

**Official Transcript of Proceedings**  
**NUCLEAR REGULATORY COMMISSION**

Title: NRC HEAF Phase II Information Sharing  
Workshop

Docket Number: N/A

Location: North Bethesda, Maryland

Date: April 19, 2018

Work Order No.: NRC-3640

Pages 1-293

**NEAL R. GROSS AND CO., INC.**  
**Court Reporters and Transcribers**  
**1323 Rhode Island Avenue, N.W.**  
**Washington, D.C. 20005**  
**(202) 234-4433**

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

NUCLEAR REGULATORY COMMISSION

+ + + + +

NRC HEAF PHASE II INFORMATION SHARING WORKSHOP

+ + + + +

THURSDAY

APRIL 19, 2018

+ + + + +

The NRC HEAF Phase II Information Sharing Workshop met in the 02A14 Classroom of Three White Flint, 11601 Landsdown Street, North Bethesda, Maryland, at 8:34 a.m., Michael Cheok, Deputy Director, NRR, presiding.

STAFF PRESENT

MICHAEL CHEOK, Director, Division of Risk Analysis, Office of Nuclear Reactor Regulation

THOMAS AIRD, General Engineer, Division of Risk Analysis

THOMAS BOYCE, Branch Chief, Regulatory Guidance and Generic Issues Branch

ROBERT DALEY, Branch Chief, Region III

STANLEY GARDOCKI, Program Manager, Regulatory Guidance and Generic Issues Branch

1       NICHOLAS MELLY, Fire Protection Engineer,  
2               Office of Nuclear Regulatory Research  
3       KENN MILLER, Office of Nuclear Regulatory  
4               Research  
5       MARK HENRY SALLEY, Branch Chief, Fire and  
6               External Hazards Branch  
7       DAVID STROUP, Project Manager, Office of  
8               Nuclear Regulatory Research  
9       GABRIEL TAYLOR, Senior Fire Protection  
10              Engineer, Office of Nuclear Regulatory  
11              Research  
12       MICHAEL WEBER, Director, Office of Nuclear  
13              Regulatory Research  
14  
15       ALSO PRESENT  
16       JENS ALKEMPER, FM Global  
17       SCOTT BAREHAM, NIST  
18       JANA BERGMAN, Curtiss-Wright  
19       ROBERT CAVEDO, Exelon  
20       FRANK CIELO, KEMA Laboratories  
21       MARK EARLEY, NFPA  
22       KENNETH FLEISCHER, EPRI  
23       DANIEL FUNK, Jenson Hughes  
24       FRANCISCO JOGLAR, Jenson Hughes  
25       CASEY LEJA, Exelon

1 ASHLEY LINDEMAN, EPRI  
2 DAVID LOCHBAUM  
3 SHANNON LOVVORN, TVA  
4 MATTHEW MERRIMAN, Appendix R Solutions  
5 ALICE MUNA  
6 FRANCESCO PELLIZZARI, EPM  
7 ROD PLETZ, AEP  
8 SUJIT PURUSHOTHAMAN, FM Global  
9 ANTHONY PUTORTI, NIST  
10 ROBERT RHODES, Duke Energy  
11 BRENDA SIMRIL, TVA  
12 THOMAS SHUDAK, NPPD  
13 STEPHEN TURNER, Independent Consultant  
14 BAS VERHOEVEN, KEMA Laboratories  
15 BETH WETZEL, TVA  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

AGENDA

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

NRC Request for Test Parameter Ranges &  
Equipment Selection . . . . . 7

Review of Phase II Draft Test Plan &  
Comments Received . . . . . 227

Public Comment Period . . . . . 288

Adjournment . . . . . 293

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

(8:34 a.m.)

1  
2  
3 MR. SALLEY: Okay, good morning. We'll  
4 get started here with Day 2. I take it, I trust  
5 everyone rested well last night, watch my Penguins  
6 beat up on Nick's Flyers. Played well. That was a  
7 very enjoyable hockey game.

8 So, let's get started today. We had a  
9 busy day yesterday, we covered a lot of information.  
10 Again, I want to thank Mark Earley for the NFPAs  
11 presentation. A lot of that reference, there is a  
12 lot of work that Gabe is going to be doing, looking  
13 at stuff, like you, too, Nick.

14 And then Ashley in the presentation, Nick  
15 read the White Paper for everyone. I think that's  
16 very valuable, thank you.

17 And Bas, you'll give presentations to a  
18 fire protection engineer like me was very eye-opening  
19 about the electrical side. Much better handle on  
20 testing than on the body protection side but it was  
21 a great presentation. I learned a lot from it.

22 So, yesterday, like I said, it was a lot  
23 of information that we were exchanging. Day 2 on  
24 this workshop, we really want a lot of your  
25 participation and we want to have a lot of good

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 active discussion today.

2 And again, it's forming how this project  
3 moves forward. We've got a good mix of people in  
4 here with utilities, the test labs. We got the NIST  
5 folks, FM, NFPA, some of the regulators. So I really  
6 want a good discussion.

7 Last evening when we were looking at this  
8 after the meeting, Nick, Gabe and I were kind of  
9 going over it. And we looked at the agenda, and what  
10 we thought for today, to make it a little productive  
11 and maybe a little quicker, was to flip the agenda  
12 around.

13 So if you look at your agenda, what we  
14 would like to do this morning is for the NRC request  
15 for test parameters, ranges and equipment selection,  
16 we'd like to start with that.

17 And I think with a lot of that discussion  
18 we can actually answer some of the questions and  
19 things that we got on the test parameter. So, again,  
20 that's where we'd like to start, for the people on  
21 the webinar, so that they know where we're at.

22 So with that, I'm going to turn it over  
23 to Gabe, Nick and Kenn Miller and we'll get the  
24 discussion going. So, Gabe, you got it?

25 MR. TAYLOR: So, just a couple of

1 administrative things before I get started is, again,  
2 we have the court reporter transcribing the meeting  
3 so we would like you to use the microphone so that  
4 both he can capture as well as the sure phone. With  
5 the speaker right there we can pick up the audiences  
6 communications a lot better for those on the webinar.  
7 So please use the phone, introduce yourself.

8 That's the microphone. And on this one  
9 you got to get pretty close, so you don't have to  
10 kiss it but almost. So, I'll just leave this back  
11 here in the back corner.

12 It's off. You have to hold those two  
13 buttons down, it will do a countdown, three, two, one  
14 and then it will go on. So it's off right now,  
15 you're not being recorded.

16 PARTICIPANT: Not hot mic you're saying?

17 MR. TAYLOR: No hot mic, just this one.

18 (Laughter)

19 MR. TAYLOR: Okay. So, as Mark said, we  
20 want to get into the test parameters. And really  
21 that's one thing we got feedback from Phase I, is a  
22 lot of people thought that we should be doing  
23 different things than what we did.

24 Part of that was, part of the real  
25 reasons of what we did was because of what

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 international group wanted to. Given the importance  
2 of the aluminum impact, we need to have a little more  
3 control on what we're doing here on Phase II.

4 So we felt it was important to understand  
5 the parameters that we can change when we test. We  
6 get feedback from the audience on what those ranges  
7 for parameters should be, as well as the types of  
8 equipment that we should be testing.

9 So the test plan, as Nick mentioned  
10 yesterday, went out for public comment last year.  
11 And we have those comments. And we've resolved most  
12 of those comments, however, there are a few that  
13 we're looking for feedback. So he'll cover that this  
14 afternoon.

15 My point is that the test plan is still  
16 flexible, so it's not final. There is a lot of time  
17 for changes before we actually go to the testing.

18 So hopefully we get valuable feedback and  
19 make the changes and do the testing that we need to  
20 address the problem.

21 MR. MELLY: And again, we are doing this  
22 one with the OECD. And I believe we have ten-member  
23 countries who are going to be joining on.

24 So next week I will be also sharing a lot  
25 of the insights from this meeting with the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 international members to try and come to a resolution  
2 of the parameters, what we're going to be testing at,  
3 voltage current, duration, things like that.

4 MR. TAYLOR: And the NRC is the biggest  
5 player in this program so we have the biggest weight  
6 of directing the program where it needs to go.  
7 Obviously, if the country donates equipment or money,  
8 they're going to have some say.

9 But if we can influence them with a good  
10 background or a technical explanation of why it  
11 should be covered a certain way, I feel that that  
12 should make it easy on Nick when he goes and tries to  
13 negotiate the test plan and agreement on the  
14 international folks.

15 Next slide. So, what we really want to  
16 get out of this presentation, I kind of already went  
17 over it, but feedback, lots of discussions, all  
18 right. I'm not up here presenting like yesterday.  
19 We went probably over 200 slides yesterday giving you  
20 a lot of information.

21 Today we want to focus the discussion but  
22 really hear from the audience and get feedback to do  
23 what we need to do, as I mentioned earlier.

24 Understand the range of operating  
25 conditions. You know, all plants are very, aren't

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the same. There's a lot of variations out there.

2 So understanding the different parameters  
3 and configurations and the importance. So we'll look  
4 for feedback on that aspect.

5 And then also, getting into the equipment  
6 that we'll be testing. As I mentioned, there is  
7 likely going to be some equipment donation from the  
8 international participants, however, it's not going  
9 to be as extensive as it was in Phase I.

10 Right now we're looking at two countries  
11 that are going to donate equipment because they could  
12 not donate monetary funds to the program. So, all  
13 the other equipment we'll have to go out and procure.

14 So we're kind of working off a blank  
15 slate. We're looking for feedback from the audience  
16 on what equipment is typical, what aspects of the  
17 equipment are important for procurement.

18 Next slide. A few weeks ago we put out  
19 this document. And the real intent and purpose of  
20 the needs and objective of the document was to a very  
21 simplistic high level, identify what the hazard is.

22 You know, in general, common terms. As  
23 well as the second part of the document, identify  
24 parameters that we'd be interested in trying to  
25 understand the range for current, voltages,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 durations, that sort of thing.

2 So, really, the whole purpose of getting  
3 that document out there was to get the audience to  
4 look at it, look at their plants, help understand the  
5 range of equipment variations and bring that  
6 information here so we can have a thorough discussion  
7 on understanding those variations.

8 Okay, so if we look at the hazard, and I  
9 took this from a presentation that's referenced  
10 there, but it provides a general description of the  
11 arc events and the different types of effluence that  
12 comes out of it.

13 So, the things that we're interested in  
14 is obviously the thermal effects. So that's going to  
15 radiate energy out and potentially damage equipment  
16 from the thermal aspects.

17 Also, this says copper vapor but  
18 obviously aluminum vapor is the same issue. The  
19 conductor vapor that can go out much farther than the  
20 thermal aspects, as far as the damaging concern.

21 So the vapor that gets expelled from  
22 these events is going to be important to understand,  
23 both how far it can go out and the nature of that  
24 vapor. Can it cause damage or shorting to other  
25 electrical equipment that could cause functional

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 failures and then impact the ability to shut down the  
2 plant or control the plant.

3 Also, another thermal aspect is the  
4 molten metal that gets expelled from the event. So  
5 you melt the aluminum, you melt the copper, it gets  
6 thrown out, how far does it go. That's basically  
7 another ignition source besides just the thermal  
8 energy from the arc.

9 As Nick showed you yesterday from the  
10 Turkey Point and the other events, pressure can also  
11 have an effect on the plant. Breaking down barriers,  
12 opening doors.

13 So, that defeats certain fire protective  
14 barriers. So understanding that is also an important  
15 aspect. And I think there's been a lot of work done  
16 in that area, but also something that we're  
17 interested in.

18 And similar to the molten metal but also  
19 somewhat different, the shrapnel. So non-melted  
20 material that gets ejected from the event and could  
21 cause physical damage to equipment in the surrounding  
22 area.

23 So, the goals of the program, we talked  
24 yesterday when I was going through the different  
25 matters, really we have a bounding method that's in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 6850 and we wanted to see if we can refine that.  
2 Whether it's for aluminum or copper or anything else,  
3 we want to see if we can make it more realistic, more  
4 representative for the plants.

5 And then also, if we modify that base  
6 model, can we then take that model and modify it for  
7 aluminum, the effecting impacts of aluminum.

8 So that's really what we want to get out  
9 of this overall program. And the objectives that we  
10 need to complete to reach that goal are kind of  
11 listed here.

12 Some of these we won't be talking about  
13 today, but a lot of them we will. So the first  
14 bullet is really the important thing, understanding  
15 the test conditions, or making realistic test  
16 conditions based on plant configurations.

17 So understanding the electrical  
18 distribution. And we have Kenn Miller up here who is  
19 the electrical to help us along with that discussion.

20 And also understanding operating  
21 experience. A great operating experience in, because  
22 it provides valuable information. Specifically, when  
23 we talk about the duration aspects of some of these  
24 events.

25 We're going to go through some of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 parameters that we can change. And the way that  
2 we're going to go through it, is I'm basically going  
3 to take one parameter, provide some background  
4 information and have discussion. And we'll go  
5 through that, through the different parameters.

6 And at the end, because the parameters  
7 kind of play on one another, we had a general  
8 discussion of all the parameters we support. But  
9 again, it's a free for all, if you have questions  
10 just ask them as they come up.

11 On the collection and measurement, and  
12 also the developing application and measurement  
13 devices, we're not going to get into too much  
14 information on there.

15 If there are questions related to that,  
16 please bring them up. But we've been working on  
17 developing measurement devices, heat flux gauges and  
18 whatnot for quite some time.

19 There was Sandia report that got put out  
20 in 2014. I know the Japanese have been working on  
21 measurement devices and Tony Putorti and Scott from  
22 NIST have been working on that.

23 So I think we have what we need from  
24 that, but if you want to have some discussion,  
25 obviously we can it's just not going to be a focus of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the lead presentation.

2 And then the last part, some more later  
3 on, AMIs and the data and using that to improve the  
4 models and revising the models, which are outside of  
5 the actual testing program but it's an important  
6 piece to consider how we're going to use the data.

7 Next slide. So, here's some of the test  
8 parameters that I've identified for discussion today.  
9 So the important ones are duration, voltage and  
10 current.

11 And as we talked about yesterday, voltage  
12 is not necessarily the system voltage that we're  
13 going to be concerned about but the arcing voltage.  
14 And we look at that, get into other things like bus  
15 bar spacing and closure configuration, the impact,  
16 the actual arc voltage.

17 Grounding configurations and X over R  
18 ratios are also going to be important to understand  
19 for the types of available fault current that you can  
20 have in the system, as well as your DC time constant  
21 for the ACs asymmetric portion of the current  
22 profile.

23 And one thing I want to talk a little bit  
24 about also is the arc initiation phase, phase angle.  
25 So when you initiate the arc, again, on a asymmetric

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 aspect of the current profile, it may have some  
2 impacts on the pressure from these events to run the  
3 testing.

4 And then the last one I want to talk  
5 about is arc location. For testing realistic  
6 equipment, where should we initiate that arc.

7 So, should it be back in the bus bar  
8 section, should it be up by the breaker slabs or  
9 somewhere in between. And that's something where we  
10 need some, a lot of the discussion because when we  
11 get into the measurement aspect, we want to make sure  
12 that we can capture the energy coming out of the  
13 equipment. And we're going to be limited by the  
14 number of instruments that we can put out.

15 So we can't like have a slab power all  
16 over, we have to kind of position them where we think  
17 the arc is going to come out of the cabinet. So  
18 knowing the equipment and how the magnetics effect  
19 arc, travel and movement and then being able to  
20 position equipment where we can measure those, those  
21 energies, is going to be important. So we'll spend  
22 some time on that.

23 Next slide. Okay, so thermal energy.  
24 That's an important piece for the thermal aspects of  
25 the zone of influence.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           If you look at the IEEE type calculations  
2           and the NFPA tables, the calculations really rely on  
3           both arc voltage, arc current, duration as well as  
4           the heat transfer coefficient as a simplified  
5           assumption, or a simplified model to characterize the  
6           energy. So, we'll start off talking about those  
7           variable first.

8           Next slide. And also, what I've done  
9           here is taken our test matrix. And we can come back  
10          to this slide as needed.

11          But this is currently how we have it  
12          broken, broken down. This is just showing the  
13          electrical enclosures with the cabinet. Experiments  
14          that we have tested.

15          We have two spares at the bottom which we  
16          haven't decided what to do. Those could be, possible  
17          used for pressure or they could be used for  
18          additional replicates or something else.

19          And we haven't decided what to do with  
20          the spare tests right now. But basically, if you  
21          look to going toward the right material, we split it  
22          up evenly between copper and aluminum.

23          Voltages levels. We have half of them  
24          being low voltage, 480, and the other half being  
25          medium voltage. Either 4160 or 6.9.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           The 4160 are likely going to be the  
2 equipment that's donated from Korea. They've already  
3 identified what equipment, and it's right between  
4 here and the breakers. So unless they can be tested,  
5 unless the enclosure is rated for a higher voltage,  
6 it's likely that equipment will be tested at that  
7 range. And then the rest is at 6.9.

8           Current. This is going to be a little  
9 different from what you see in the previous test  
10 plan, and I'll get into currents in some later  
11 slides, why we've selected these, but we're looking  
12 for feedback.

13           15 and 25 for low voltage and 25 and 35  
14 kA, that's thousands of amps, for medium voltage.  
15 And then the durations range from anywhere from two,  
16 four, eight seconds for the enclosures. One, three  
17 and five are actually for the bus bars.

18           Gaps. You can see that column is empty,  
19 so we'll have some discussion there because, from  
20 what I found, there is no standard that says this is  
21 what the gap should be for low voltage or medium  
22 voltage, it's basically up to the manufacturer to  
23 design their equipment to meet the performance  
24 requirements and various standards.

25           So, if there is any information to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 support a specific gap, for the enclosures, we're  
2 more interested in learning that.

3 And then a lot of the energy, I think we  
4 want to put the energy in there before we go test  
5 them and understand what it is, but there is numerous  
6 ways to calculate that. And it's dependent on,  
7 highly dependent on what your arc voltage is. So I  
8 didn't fill that one in right now.

9 MR. MELLY: Question.

10 MR. TAYLOR: Yes.

11 MR. VERHOEVEN: Good morning, Bas  
12 Verhoeven from KEMA. I was just looking at this  
13 table and normally at low voltage panels the short  
14 circuit current are much, much higher.

15 An earlier rate of 18, 19 kiloamps,  
16 especially in the industrial area. While in the  
17 medium voltage, the currents are a little bit lower  
18 in the value that is here.

19 So how come you don't have higher short  
20 circuit currents at low voltage amps?

21 MR. TAYLOR: So, I can get into that, but  
22 if we can go forward a few slides, the current will  
23 be done.

24 Okay. So, back up a little bit. All  
25 right, go, okay, go forward. All right, so on 5.4,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we don't have all the plants information that we need  
2 to identify what the arcing, all the fault currents  
3 are. You know, that's going to be specifically  
4 classified as a need to, system needs and whatnot.

5 But what we do have is some information  
6 on transformer powers, impedance to the transformer  
7 and the system voltage. So you can do an impendent  
8 bus type calculation, which is what I have done here  
9 for some of the plant.

10 Do you see the sample is pretty small?  
11 Only 18 for low voltage. Basically, what I did is,  
12 for plants that I could find that information, I took  
13 one or two buses and ran that calculation. And then  
14 this is just a composite.

15 So, with a low sample number, I wouldn't  
16 say this is highly representative but it's the best  
17 that I can do to come up with kind of understanding  
18 where the fault currents are.

19 So what, on the low voltage side what  
20 this is showing is just a histogram of, the blue  
21 would be your voltage fault current and then the  
22 orange would be your arcing fault current, based on  
23 the calculation IEEE 1584.

24 So based on the orange arcing fault  
25 current, we picked basically a mean value of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 14.5. So that's where we got 15, and then 25 was  
2 somewhat higher.

3 Obviously, the way that I did it, I  
4 didn't include any motor contributions or anything  
5 else. And that's implicit, but it's what I had to  
6 work with.

7 So, you are seeing some multiple currents  
8 that are much higher. But typically, when you go  
9 from medium voltage to low voltage, at least from the  
10 plants that I saw limited by the power of those  
11 transformers being, maybe on the high end, 2 megavolt  
12 amps, ratings of those transformers.

13 I don't know what the experience is here  
14 but typically that's current on the higher end of  
15 those transformers.

16 MR. MELLY: And that's exactly the type  
17 of information that we were looking to collect is,  
18 with plant experience, what are your fault current  
19 levels for these low voltage pieces of equipment,  
20 medium voltage pieces of equipment.

21 MR. VERHOEVEN: Yes. Also, to give a  
22 comment. When we test the buses that we get from  
23 KEMA, and we test low voltage circuit breakers,  
24 normally the current value is, for normal circuit  
25 breaker testing, are in the values of 60 kiloamps,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 18, sometimes even 100 to 30 kA for industrial  
2 circuit breakers.

3 And I can't imagine that this is an  
4 industrial implication.

5 MR. FUNK: I guess my input would be,  
6 this is probably not unrealistic. And I do agree  
7 most 480 volt systems, or even 600 volt systems, the  
8 standard rating would typically be 42 kA, 65 and 85.  
9 That would be a tide test.

10 But nuclear plants are a somewhat unique  
11 from a broad perspective of all industry in that  
12 they're medium voltage to low voltage step down  
13 transformers tend to be small. Typically ranging  
14 from 750 kVA to 1.5 MVA. It's pretty normal.

15 So, I think that maybe explains the  
16 difference that you're looking at it.

17 PARTICIPANT: Okay.

18 MR. FUNK: Which means the gear typically  
19 will be subjected to fault currents. Hopefully,  
20 considerably below their rating.

21 Maybe Shannon or some other utility folks  
22 can weigh in on that.

23 MR. TAYLOR: Yes, I can speak to --

24 MR. FUNK: There will of course be  
25 exceptions, but I think Gabe's approach is not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 unrealistic.

2 PARTICIPANT: Yes.

3 MR. FUNK: Yes, let's go over here real  
4 quick. Shannon Lovvorn from TVA.

5 MR. LOVVORN: Yes, Shannon Lovvorn, TVA.  
6 I would agree that the median looks about right to  
7 me. Our low voltage fault currents range around the  
8 16,000 amps or maybe some 18 or some lower.

9 The switchgear is typically feed off of  
10 like a 1000 kVA transformer for us. So that's, I  
11 think for us, I think you're in the right range.

12 MR. MILLER: I guess the other factor  
13 that can affect that too is, I'm thinking about the  
14 plant I was at, I think our 480 volt system was  
15 solidly grounded as opposed to the 4 kV and 13 kV.  
16 So that can tend to drive the fault currents up on  
17 the lower voltages. And I can't remember what our  
18 numbers were but --

19 MR. LOVVORN: Yes, we're on, our 480  
20 volts are delta ungrounded.

21 MR. MILLER: Ungrounded, okay.

22 MR. FLEISCHER: Ken Fleischer from EPRI.  
23 So, since I anticipated a workshop, I brought several  
24 nuclear utility diagrams and I've already spot check,  
25 I've seen 750 kVA up to about 1.5 MPA. We can --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MILLER: For transformer size?

2 MR. FLEISCHER: For transformers for a 4  
3 kVA to a 480.

4 MR. MILLER: Yes.

5 MR. FLEISCHER: I can continue to look at  
6 them and we can maybe adjust those number ranges but  
7 that seems to be right spot on with what Dan Funk was  
8 just saying.

9 But, I did bring drawings so that we can,  
10 if we need to fact check something that may be  
11 available on a one line, just let me know and I can  
12 do that here.

13 MR. TAYLOR: Okay, thank you. While  
14 we're here, let's just go to the next slide to show  
15 the medium voltage.

16 And I did it for 4160 because if you look  
17 at the times, I mean, that's about 85 percent,  
18 somewhere around there, have 40, or excuse me, 4160  
19 volt gear. And maybe about only a third of the  
20 plants have 6.9 kV here.

21 So 4160 is much more common in plants for  
22 medium voltage on distribution. So I put it up that  
23 way just to see if there's any difference between the  
24 two.

25 Again, the sample size is not that great

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 but similar to what I did for the low voltage. And  
2 just a histogram showing voltage fault and arcing  
3 fault.

4 One thing that is different here is that  
5 you saw a much bigger shift from voltage to arcing  
6 fault in the low voltage. And that's primarily  
7 contributed to the IEEE method.

8 There is a calculation for low voltage  
9 and a calculation for medium voltage. And that  
10 approach is based on a statistical analysis, or a  
11 regression analysis, of the data that they had to  
12 develop those models.

13 So, because this is a histogram, you're  
14 still getting a reduction from your voltage to your  
15 arcing fault, but it's not enough, at least for this  
16 case, to make it drop bins. And my bins are 10,000  
17 amp width for the bins.

18 So you can see I didn't put the mean and  
19 median for the voltage and the arcing fault. And you  
20 see the arcing fault currents does reduce but not by  
21 as much as you saw in the low voltage.

22 The low voltage is almost half of the,  
23 the arcing fault current was almost one half of the  
24 voltage fault current.

25 So, again, not that many samples. I took

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 one, maybe two buses, two buses. And I took two if  
2 I saw a difference in the power rating of the  
3 different transformers, whether it was a startup or  
4 a rad or whatever the transformer was.

5 Typically there wasn't too much  
6 difference. So in those cases I only take one  
7 sample. But that's for the 4160.

8 Next slide. This is for 6.9 kV. So  
9 again, slightly higher but not by really that much.  
10 Right around 30 kA on the mean. And there is some  
11 change here, just it jumped in when you went from  
12 voltage to arcing.

13 So, when we looked at what we wanted to  
14 test for this, 25 and 35 is what we picked. We  
15 wanted 25 to be, we wanted one point on the medium  
16 voltage to be in line with one point on the low  
17 voltage side.

18 So 25 is the common voltage between the  
19 two, or common term, sorry, 25 kA current between the  
20 two. And then we picked one higher, which is 35 in  
21 this case.

22 Again, this doesn't take into account  
23 motor contributions but, again, it is a non-  
24 conservative assumption but then, again, it doesn't  
25 take into your opinions on your source. Which is the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 opposite.

2 So, another factor of the real system  
3 response, somewhat undetermined. It really depends  
4 on what motors you have running, what your system in  
5 HEAF test for your power source.

6 Where is the handheld? Sorry about that.

7 But with the information that I had  
8 available, this is at least one way we can get a  
9 basis or at least a discussion here and get feedback  
10 from that.

11 So I know it looks like Kenn is looking  
12 through some diagrams, if you guys want to look  
13 around while I kind of go back and talk about that,  
14 at least you know now where we're coming from on the  
15 current problem.

16 So if there's not any questions, I'm  
17 going to go back to where I left off. We'll hit this  
18 again.

19 (Off microphone comment)

20 MR. TAYLOR: Nick, can you go back?

21 MR. MELLY: Back to --

22 MR. TAYLOR: Wherever I left off. I  
23 guess the HEAF plan --

24 MR. MELLY: Here, yes.

25 MR. TAYLOR: Yes. So again, 1525 low

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 voltage, 2535 for medium voltage. And then the  
2 durations, we need to spend some time talking about  
3 this. Some of the limits are based on what available  
4 energies from KEMA and other ones are based on OpE  
5 for these types of events.

6 Obviously, if the breakers work that's a  
7 sign your talking cycles and not seconds. And if  
8 they worked on designed you wouldn't have the HEAF.

9 And there's also been a lot of research  
10 done from NFPA and IEEE and others, on the shorter  
11 end. So it's another reason why we're focused on the  
12 longer durations. We have slides on that as well.

13 One thing before we go, EPRI's report on  
14 review, the testing in the OpE, as well as the other  
15 report on the mean, it did identify that there is not  
16 that many events in low voltage, and right now we  
17 have it split 50/50 between medium and low voltage.

18 So I think one thing that's up for  
19 discussion is, should we reduce the focus on low  
20 voltage and still run some test on low voltage but  
21 expand the number of tests that we do at medium  
22 voltage since it seems, from the information that  
23 we've been reviewing that there is more medium  
24 voltage type events occurring in the plant that have  
25 a safety significance, or a potential safety

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 significance.

2 So, I want to just think about it right  
3 now, but I want to come back to that because, as I  
4 said, this is fluid, we can make changes now. But  
5 once we get an agreement signed with the  
6 international group, we're then limited to what we  
7 can change.

8 Because the test plan actually goes into  
9 the agreement and it gets signed. And to make  
10 changes to that, from then you have to get all the  
11 countries agreement.

12 MR. MELLY: Seventy-five percent of the  
13 project group.

14 MR. TAYLOR: Okay. You got to get 75  
15 percent of the project group to agree to that change.

16 So, right now the majority of the testing  
17 is in that project. There are some, actually, Nick,  
18 can you go to the website? Pull up the website with  
19 your test plan.

20 MR. MELLY: Which website do we have it  
21 on?

22 MR. TAYLOR: Just go to, it's already  
23 pulled up unless you closed it.

24 MR. MELLY: Here we go.

25 MR. TAYLOR: So, the test matrix that I

1 showed, it just takes Nick's test plan and puts it in  
2 this form. But you can see the blue and the orange,  
3 the blue cases are what's going to be sponsored with  
4 the international group, and the orange cases are the  
5 ones that the NRC are going to have to fill in on  
6 their own. Just from a financial standpoint.

7 We couldn't get enough interests for  
8 contributions for an international group to cover  
9 everything. And because, as Nick mentioned  
10 yesterday, aluminum is more of a U.S. interest than  
11 most international countries, they elected not to  
12 focus on aluminum as much.

13 So, I guess, just for your awareness,  
14 that's where this came from. And we do have a little  
15 more flexibility on some of the tests. You can go  
16 back.

17 MR. DALEY: Hey, Gabe?

18 MR. TAYLOR: Yes.

19 MR. DALEY: I just got to ask a question,  
20 maybe it's premature, but where are you seeing the  
21 aluminum? Where are we seeing that?

22 Are we seeing it in both 480 and 4160 or  
23 are we seeing it primarily in one application as  
24 opposed to another and are we seeing it in newer  
25 plants via older plants?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And the reason I'm asking is, because the  
2 separation issues that older plants are much  
3 different than newer plants, so I'm really kind of  
4 curious what you want to look at, from both an  
5 aluminum and a copper.

6           MR. MELLY:    So I can take a shot at  
7 answering that.   Based on the NEI survey, we can't  
8 tell whether it is in older plants or newer plants  
9 because the plants were anonymous.   Just numbered as  
10 they were given to us.

11          MR. DALEY:    Okay.

12          MR. MELLY:    However, in terms of the  
13 pieces of equipment that we've seen in them, it's all  
14 over the board.   I was expecting to see it more in  
15 the low voltage equipment based on the OpE that we've  
16 seen, however, it was in many pieces of medium  
17 voltage equipment.

18                 And in many plants, it's used primarily  
19 as the enclosure material for the bus ducts  
20 throughout the entire plant.

21                 So, from the NEI server that we did  
22 receive, we saw more aluminum than we expected.  
23 However, only 52 plants were involved in that survey.

24                 MR. MILLER:   Did they break it down like  
25 aluminum used as bus work versus just enclosures or

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 --

2 MR. MELLY: Yes, they did. For, in terms  
3 of the bus ducts that they used, they gave us whether  
4 it was the conductor material within the bus duct or  
5 the housing.

6 In terms of the electrical cabinets, if  
7 aluminum was involved in any piece with the closure,  
8 conduct or for the cradle units themselves, that was  
9 also included.

10 But in terms of vintage of plant, we  
11 don't have that information. No.

12 MR. DALEY: Yes. I'm just trying to  
13 think, I'm really getting ahead of ourselves, but I'm  
14 trying to think, where is this going to go, right,  
15 and the effects on different plants when you got  
16 certain plants that have separation for all the 4160,  
17 really good separation.

18 Some plants have minimal, you will have  
19 40, you might have 4160 switchgears separated by  
20 rooms by you might have some of the other division  
21 kind of roaming through that. And then there is some  
22 of them where you got 4160 that are in the same room  
23 and you're separated by distance, right?

24 MR. MELLY: Yes.

25 MR. DALEY: So you're really dealing with

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 three different factions there. So, in the 4160, I  
2 mean, to me it's just a clearly, from a fault  
3 perspective in how the fault is going to affect  
4 things, it seems to be the, it seems to be more  
5 important.

6 And the other thing, now this conductive  
7 property, the conductive vapor in that, that would  
8 probably just be talked a little bit more about  
9 because that could affect everything.

10 MR. MELLY: And, Bob, I think we may be  
11 giving you a call when we start the pilot plant  
12 discussion for the selection of plants when we get to  
13 that stage, because these are the exact things that  
14 may come up in that discussion of how we select which  
15 plants we're going to try to evaluate the risk impact  
16 of this, where is this going.

17 MR. DALEY: Covering a broad spectrum of  
18 types.

19 MR. MELLY: Yes.

20 MR. TAYLOR: While I have it up here,  
21 also on the bus duct testing, the majority of it is  
22 aluminum. So you can see the NRC is picking up a lot  
23 of that cost. So feedback on that has been very  
24 important for us to make sure that we get the right  
25 bus ducts configuration and whatnot.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And so we have, Slide 8 will into this,  
2           but right now, for your awareness is, we're breaking  
3           it down by bus material and by enclosure material.  
4           So copper bus fuel enclosure, copper bus aluminum  
5           enclosure, aluminum bus steel enclosure and then  
6           aluminum bus and aluminum enclosure.

7           So, I think we feel that those are up in  
8           the plans, but obviously if there's one of those  
9           cases isn't it, we would want to test it. So  
10          feedback when we get to those slides, on that aspect  
11          and the importance of the testing matrix.

12          Can you go to Slide 10? So, what I just  
13          showed turned into a table form. We had a couple  
14          spares that we could do. You know, possibly do a  
15          longer duration. Again, it's flexible.

16          But everything at 4160, no changes in the  
17          current. So that could be something that we could  
18          change, we could use multiple currents. And it's  
19          just a variation of bus and duct material.

20          Again, gap spacing, I don't have any of  
21          that information. So I'm not sure there are  
22          standards out there that says it should be five, 17  
23          years apart, whatever it is. So feedback on that.

24          Design specs. Again, it's solely  
25          representative of --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MELLY: And the one thing that we  
2 also need to discuss when we're talking about the bus  
3 ducts, is whether the conductive material is  
4 insulated or not insulated. That can have effect on  
5 where they place the arc and how we place the arc.

6 Because we are dealing with a limited  
7 segment of bus ducts that we can put in the test  
8 enclosure itself, we need to be able to determine how  
9 to hold the arc in place. If it has the insulated  
10 material on the conductors themselves, we've seen in  
11 testing that has been done for the Cooper event that  
12 we can hold the arc in place.

13 However, if there is no conductive,  
14 there's no insulation material, we may be just  
15 creating a rail gun and having all of the energy go  
16 out directly one end of the arc travel down towards  
17 the end of the bus.

18 So that's why the test plan currently had  
19 a hard break in the conductive material to try and  
20 hold the arc in place. However, we'd like to know  
21 whether your plants have the insulated material on  
22 the outside, inside the plant and kind of get a feel  
23 for how that is across the fleet.

24 MR. TAYLOR: And no bus bars have been  
25 procured yet so we're open on what the configuration

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is. Question from Mark Salley?

2 MR. SALLEY: Yes. This is a good place  
3 as any to jump in here, but going back to this  
4 original testing we did with the internationals and  
5 the GENESIS on how this all came together, we knew  
6 one of the biggest expenses was going to be procure  
7 nuclear grade equipment to basically destroy it in  
8 the testing.

9 And when we had the original agreement  
10 with the countries, the concept that we went in with  
11 was, hey, find a plant in your country where they're  
12 putting in some new switchgear, they're upgrading,  
13 updating something, get that old equipment. It's  
14 going to be scrapped anyhow, so let us use it for the  
15 testing and that will be a whole cost saver.

16 So that's why you saw a lot of that  
17 equipment in there, for example, Korea were the first  
18 ones that were on it, and those original cabinets we  
19 did were from Korea.

20 Again, Gabe and I through Zion Solutions  
21 were able to procure the duct that was tested, the  
22 bus duct from Zion.

23 But when I, I guess the plea or the  
24 question I'm throwing out here is, we have some  
25 plants that will be going into decommissioning, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 as you guys are doing upgrades to the plant, we'd be  
2 open to say equipment donations that you could or if  
3 you'd want to put into this program. So, again, keep  
4 that in, we can work through EPRI, and equipment that  
5 you would maybe be doing an upgrade, would be  
6 scrapped out, could be used or for plant safety  
7 commission, we'd welcome that equipment.

8 MR. TAYLOR: Thanks, Mark.

9 MR. SHUDAK: Tom Shudak with NPPD. So  
10 the comment I keep hearing coming up is, what we have  
11 as our plan configuration, will it be one that has  
12 insulated aluminum buses.

13 So, we really don't know what's out  
14 there. We have an anonymous survey out there. You  
15 keep bringing up the point, we need to know that  
16 information, not all plants are represented here in  
17 this room.

18 Is there another effort to gather that  
19 information from industry to make sure we get the  
20 testing right, as far as that configuration?

21 MR. TAYLOR: I will let Mark Salley  
22 answer that question.

23 MR. SALLEY: You know, as far as going  
24 through that information, we've kind of backed off  
25 there. And we would look to NEI, as we did with the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 original one. Or to EPRI or EPRI and NEI together  
2 working in that.

3 So, again, that's where we would look for  
4 that to come from.

5 MR. TAYLOR: And not that it's that  
6 important, but process wise, what process these could  
7 be used to get that information. And really, I don't  
8 think where we're suited by, I'm not sure that we get  
9 the support to go out and issue a 50, for a type  
10 letter or a temporary TI for the inspectors to go out  
11 and look for it.

12 So we're really trying to leverage EPRI  
13 or NEI to help us understand what's out there.

14 MR. SALLEY: And again, that's the  
15 purpose of today's meeting and having your attendance  
16 here, is to learn what's out there and what we should  
17 be testing. So, again, that's a big part of today.

18 We've done similar things with cables.  
19 If you remember years ago, looking at cables, what  
20 was the typical thermoset cable out there. We did  
21 the biggest bang for the industry, our data, and it  
22 was raw asbestos fire wall III. I think that was in  
23 like 80 percent of the plants.

24 So, again, those were the things we  
25 learned so that our research is applicable. So,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 again, that's a key point of you all being here at  
2 this meeting here today is to help us guide how we do  
3 this testing.

4 MR. TAYLOR: And I guess the other option  
5 would have been a bulletin but, you know, those are,  
6 take at least a year. And then trying to keep this  
7 within the GI program being timely response is also  
8 something that we're trying to work with.

9 Question in the back with TVA.

10 MS. WETZEL: So when do you anticipate  
11 the agreement to be signed and the test to be locked  
12 in where we can't provide input?

13 MR. MELLY: The agreement right now is  
14 currently held up with lawyers. There is some  
15 viability issues in signing with that many countries  
16 and the NRC internal ability to accept testing,  
17 liability and indemnification clauses within an  
18 agreement.

19 We were hoping to have the agreement  
20 fully signed in hand towards the end of summer.  
21 August time period. That is when the test plan will  
22 be included on it.

23 Small changes can be made but they will  
24 need to be discussed with the entire group. And  
25 small changes I consider to be, if we decide to put

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 insulation on the bus bar materials.

2 After, if we receive more information, we  
3 would have a meeting with the international members.  
4 And it's a very collaborative working group that we  
5 have established for this testing program.

6 We usually do not run into any  
7 controversial issues where we can't breach consensus  
8 agreement. So I don't see it as a huge stopping  
9 point to make changes as we move forward.

10 Like we say, I mean, testing, we have the  
11 spares in there because we're bound to have other  
12 cases where we just see something we do not expect.  
13 So, I don't think it's going to be a hard stop.

14 That said, we still are under an  
15 agreement. But the end of August is what we're  
16 shooting for to have the agreements signed by the  
17 member countries.

18 MR. TAYLOR: Okay, thanks, Nick. Can we  
19 go to the next slide then.

20 Okay, so for the first parameter, one of  
21 the most important, in my mind, well, arc holders is  
22 very important too, but one of the also more  
23 difficult ones to predict from the HEAF standpoint,  
24 is the arc duration.

25 So, one thing that we wanted to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 understand was, your clearing times for your  
2 protection systems. And if you look at the needs and  
3 objectives document that went out, we tried to break  
4 that down to understand what was more current for a  
5 typical case and then when you're needing a breaker  
6 or your protective equipment fails to clear on the  
7 first clearance protector, device point.

8           Such that the fault would travel upstream  
9 and then you have a second protective device to clear  
10 and what the clearing times for that are. For both  
11 voltage fault as well as arcing type conditions. So  
12 that's one aspect of the duration that we're  
13 interested in.

14           The other aspect that might have more  
15 weight is actually the operating experience that  
16 we've seen. The IN has information on the aluminum  
17 events. And I think there has been presentations  
18 that have discussed the duration of other events in  
19 the duration.

20           So, because those are really, those types  
21 of events are really what the frequency is being  
22 contributed to for the Bin 16 type events, we're  
23 looking into a lot more on that.

24           But we wanted to understand if the  
25 systems worked as designed, what are those starting

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 times for voltage and arcing fault currents.

2 So next slide. Just to reinstate what  
3 we're planning on right now, and this is flexible,  
4 low voltage four and eight seconds, medium voltage  
5 two and four seconds. We can go longer on the low  
6 voltage because of the system, the energy that we  
7 have at KEMA.

8 And then the bus bar is one, three, four,  
9 potentially up to five seconds at medium voltage.  
10 But most of the majority is medium voltage bus bar.  
11 Testing right now is one to three seconds in  
12 duration.

13 So, some information --

14 MR. MILLER: We have a question.

15 MR. LEJA: Thank you. So, one thing that  
16 comes to my mind is, if you go back a slide, for the  
17 480 volts, or low voltage switchgear, we're saying  
18 four and eight seconds. And I can't think of where  
19 the eight seconds come from.

20 The only incident that comes to my mind  
21 is Fort Calhoun. And that situation you had a bad  
22 design, so misaligned status.

23 And also, you had zone select interface  
24 jumpers that were not being disabled. So you lost  
25 all protection in the incident.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Other than that, I've never seen a  
2           coordination diagram where you would actually have  
3           eight seconds before the second level protection  
4           would pick it up. So maybe two, three seconds, maybe  
5           even four seconds at some plants. I haven't seen it.

6           But eight seconds seems very excessive.  
7           And I don't think anybody really supports it. So for  
8           the realism scenario that we try and represent, I  
9           really don't think it's representative.

10           And in any statistical analysis, when you  
11           have an event like Fort Calhoun where it's so off the  
12           wall, you know, everything else is four to eight  
13           seconds, maybe 12 seconds and you have an event  
14           that's 42 seconds, you were to remove it because it's  
15           anomaly, right?

16           So I'm thinking, if we're trying to be  
17           real and trying to really represent what's out there,  
18           I don't think there's anything there that supports  
19           eight seconds. And that's just my opinion but I  
20           don't know how anybody else feels about it. Thank  
21           you.

22           MR. FUNK: Yes, along that similar that  
23           Gabe gave, we've talked about this, and Nick and I  
24           too, that for a properly designing system, we really  
25           wouldn't anticipate exceeding the two second range

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 even with your backup protection under most  
2 conditions. But again it is, as he just mentioned,  
3 statistically based because there is no way to know  
4 exactly what the fault current is.

5 And so, coordination folks work under the  
6 concept of a range of available currents. You get  
7 your voltage for your theoretical max all the way  
8 down to an overload condition and we're just not good  
9 enough to predict exactly what's going to happen for  
10 every scenario.

11 So, what strikes me with the testing  
12 that's been done so far is it's performed on a basis  
13 that your primary and secondary protection will  
14 either fail the function properly or were improperly  
15 designed to begin with, based on normal  
16 considerations.

17 Is there any value in performing some  
18 tests that, number one, is through primary protection  
19 work property or the primary protection failed and  
20 the secondary protection was relied upon?

21 In other words, you would limit the  
22 duration approximately two seconds. I mean, you  
23 could work a range on that but that kind of concept.

24 Or is there, the problem with that is,  
25 well, you don't get necessarily great results as far

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 as maximum information gained on equipment suffering  
2 catastrophic failure, I agree with that. And with  
3 limited equipment, you want to maximize that.

4 I think that my concern, to sum it up is,  
5 every test we've run and projection for future  
6 testing is we assume loss of both primary and  
7 secondary protection, which has happened. I'm not  
8 going to say it hasn't, but it's just the unusual  
9 case versus the normal case.

10 MR. TAYLOR: Kenn had a question --

11 MR. MELLY: Before we get there I wanted  
12 to touch on the eight seconds question. We do have  
13 international experience where we do have one low  
14 voltage event that occurred in Germany that lasted  
15 the 8.5 seconds.

16 We do understand that these are anomaly  
17 events but the frequency is fairly low on these  
18 events, which brings you into the model. We're  
19 looking for more information on that event in  
20 particular.

21 And we do know that the low voltage  
22 events, we've been discussing it is, they are rare  
23 because you have to defeat so many levels of  
24 protection to get one of these long events. So we  
25 see that in the frequency in that when we had done

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the split for the low voltage versus medium voltage  
2 equipment, you see more of these higher arcing faults  
3 in the medium voltage because you don't have to fail  
4 these many levels of protection.

5 One of the reasons for testing at the  
6 eight second range for the low voltage equipment, is  
7 because it does give us the larger energy profile.  
8 We've seen in the operating history for Robinson, for  
9 instance, we have had the ten second to 11 second  
10 range of duration for that medium voltage case.

11 And we cannot replicate that at the KEMA  
12 facility. We're limited by the duration that we can  
13 go for medium voltage 3.5, four seconds, kind of  
14 stretching our generator there.

15 So there were several reasons why we went  
16 to eight seconds, but that's why we're here today.  
17 We want to discuss the selective values and take note  
18 of, we do understand that eight seconds may be fairly  
19 excessive for the low voltage cases, however, we have  
20 seen these off the wall events in operating history.

21 MR. DALEY: Do you want me to, I'm going  
22 to put on my regulatory hat here to respond to, Dan.  
23 I think you're right, Dan, I think we have to, yes,  
24 you have to be realistic with it.

25 I just look at this whole encompassing

1 thing and I see where the major effects on it. You  
2 know, we go back to one of the first slide  
3 presentations we had and it talked about fire  
4 protection and it talked about single failure, right?

5 Okay, but you're talking, when you talk  
6 about those two things you're talking two different  
7 events, right? Fire protection you don't assume that  
8 something is just going to fail.

9 So, I think the idea that doing a  
10 realistic, some type of realistic arcing failure for  
11 fire events seems to make a lot of sense, because in  
12 the end, I think that's where it will be from a  
13 regulatory perspective.

14 Now, the single failure, you assume a  
15 single failure so having something, having a fault,  
16 this type of fault with a breaker, or at the breaker,  
17 is kind of, it's kind of an all-encompassing event so  
18 then you get into the situation, okay, I can go this  
19 long with it and how does that effect other  
20 divisions, right, if there --

21 And like I said, I'll go back to what I  
22 was saying earlier, you're dealing with a lot of  
23 older plants in that regard because, later vintage  
24 plants. I'm a BWR guy so I think BWR-5, BWR-6 just  
25 ain't, you're not going to get there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So, that's kind of my thought. So, I  
2 agree with you, Dan, I think you should have a lot  
3 more realistic ones but you should probably put some  
4 bigger ones in there too.

5           And for the conductive stuff, for when we  
6 actually get to the point where we do the conductive  
7 cloud, the cloud of death --

8           (Laughter)

9           MR. DALEY: -- then we probably need some  
10 longer durations in there.

11          MR. SALLEY: Yes, Dan, and if I could  
12 just put one thing up, we have the fire forum last  
13 week where I gave a presentation on this and a couple  
14 guys grabbed me afterwards and said, hey, could you  
15 just bring one thing up in the meeting, and I said  
16 sure.

17          And one of the things they told me, or  
18 they thought was a vulnerability to look at, is when  
19 they're switching over to standby generators, that  
20 that would be a time when we could see these longer  
21 durations. They just asked that I bring that up, so.

22          Again, I don't know if it is or not, but  
23 that was something I thought about.

24          MR. FLEISCHER: Ken Fleischer with EPRI.  
25 So, there is a technical explanation, theoretically,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 as to how you can get to eight seconds and beyond.

2 It's governed in more of our White  
3 Papers, and none of the OE, there is not sufficient  
4 data in the OE to confirm any of these events  
5 occurred.

6 But, with the available fault current in  
7 a three-phased voltage fault with protection being an  
8 instantaneous element and an overload element, you  
9 should trip instantaneously.

10 Now, if you get to the point with an  
11 arcing fault and the current is below the  
12 instantaneous setting, now the instantaneous setting  
13 cannot see that so a couple things can happen. Now  
14 you have to start writing up the time curve until you  
15 hit your inverse, overload element.

16 Which could take anywhere from one second  
17 up to 15 minutes, depending on where you arrive that  
18 curve. Similarly, even if that breaker failed, your  
19 next upstream breaker, that current, again, cannot be  
20 seen by the short-term instantaneous, or short-time  
21 delay or short-time delay element, again, waiting for  
22 a thermal element to pick it up.

23 And so that's why I can see these occur.  
24 However, the OE just doesn't have the sufficient data  
25 to confirm it so that's why these were that long.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But I do still support that we should  
2 really scrub our OE, understand the best we can and  
3 develop realistic tests.

4           MR. LEJA: So, just a response to that.  
5 It is true that it could take from one to 15 seconds  
6 depending on where you are in the thermal region.

7           But, again, for sake of realism, I looked  
8 at coordination plots with the fault currents that  
9 they're simulating and I couldn't get there. I  
10 couldn't get to four seconds. I'm saying, yes, you  
11 could get from one to 15 seconds.

12           So yes, you could get there in one to 15  
13 seconds, however, the fault currents that we're  
14 simulating is just not realistic. So, again, it's  
15 the realism scenario, you know.

16           MR. FLEISCHER: Yes, and I agree.

17           MR. LEJA: And another thing about Fort  
18 Calhoun is, if we take that into consideration and  
19 say, you know, this piece of equipment was mis-  
20 designed and this install and we're testing it  
21 because it could happen, then what's stopping us from  
22 taking the protection in the turbine and having the  
23 turbine explode and say, hey, this could happen as  
24 well. So I don't want to go that far.

25           I think we will get a lot more out of it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 if we had it at two and four seconds. The reason I  
2 am saying two seconds is because that's kind of what  
3 the gear is rated for so I think we'll get agreement  
4 and people will be very interested in those results.

5 And also, also because if you look at  
6 relay coordination, I was actually looking at that  
7 last night as well, could we get there, could,  
8 because normally when we do relay coordination you  
9 just want to, you just want to have things  
10 coordinated, you don't really worry about this arc  
11 fault arc kind of stuff.

12 But if I was worried about it and  
13 somebody gave me a project and told me to redo the  
14 relay so that we do get down to some reasonable  
15 amount of separation.

16 So let's say we want to get down to those  
17 two seconds, we could get there. If you're talking  
18 about higher than that, I mean, get down to like  
19 three seconds I mean, I don't know if it's going to  
20 happen, so, I think we could get down to two seconds  
21 and that's why I think it would make more sense to do  
22 it at two and four seconds versus four and eight.

23 Because I'm having issues articulating  
24 myself but maybe I'll get better. Thank you.

25 MR. TAYLOR: Any other comments to our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 conversation, but do we have a response or --

2 MR. MELLY: It was a suggestion we go to  
3 two to four because the currents that would be  
4 associated with having a fault that sticks in for  
5 that longer duration, 15 seconds, are not the fault  
6 currents that we are proposing for our test program,  
7 they're the ones that are riding more like the Fort  
8 Calhoun and the 5 kA range.

9 MR. TAYLOR: Okay. So basically from  
10 your coordination curves you looked at, for these  
11 durations, this is what the fault current would have  
12 to be to get that duration. Is that kind of  
13 summarizing what I missed?

14 MR. MELLY: At the fault current that you  
15 are receiving you wouldn't --

16 MR. LEJA: The duration would be much  
17 shorter and much less.

18 MR. TAYLOR: It would be much less of  
19 course. Which would be much less than four seconds.  
20 Which is not realistic compared to what, I don't  
21 know.

22 MR. FUNK: Yes, I would agree with that  
23 but I do, the equipment, I think there is some force  
24 to suggest that testing between one and two seconds  
25 also has value, which would assume loss of your

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 primary trip function which, in a lot of cases would  
2 be differential trips which are measured in a few  
3 cycles and they're reliant on maybe a less sensitive  
4 or a current relay back for something along those  
5 lines.

6 So I think that adds to this realism that  
7 I know that I have been looking for. One to two  
8 second range I think stays within the rating of the  
9 equipment and it provides maybe a realistic data  
10 point.

11 These other cases we're talking about are  
12 the created events. So, not to belabor the point,  
13 but I think there is value in seeing what we would  
14 expect to happen. What's more closer to the median  
15 than the extremes. Thanks.

16 MR. MELLY: I think the, well, the reason  
17 that the one to two seconds were even lower, the .5  
18 seconds that's recommended in the guide or the metal  
19 clad switchgear.

20 And the reason that's not showing up in  
21 the current test program is because those events are  
22 not what I would consider to be part of this higher  
23 in the arc fault damage zone bin.

24 MR. FUNK: Okay.

25 MR. MELLY: These are the ones that are

1 going to go into Bin 15, where you just have the  
2 internal cabinet damage creating an internal fire  
3 rather than breaching the cabinet and have externals  
4 under the influence of damage.

5 MR. FUNK: They won't be a HEAF.

6 MR. MELLY: They won't be considered a  
7 HEAF and that's not going, that's what I do not  
8 intend to be in the HEAF frequency bin.

9 So that's more in line with what happened  
10 at Turkey Point where you have the 32 second, or 32  
11 cycle event, .5 second event.

12 Also, the Cooper event was right on the  
13 threshold. That was a one second event. And these  
14 are the events that they're questionable, they're not  
15 HEAF events because you do have damage but you don't  
16 have the type of damage that we're looking to get  
17 towards modeling.

18 If I had endless amounts of resources, I  
19 would love to put in the one to two second range so  
20 we have those events as well.

21 However, we're talking about the  
22 destruction of a piece of equipment, extreme  
23 refurbishment, a full day in the test lab and the  
24 full apparatus of test equipment and measurement.  
25 Which is why we were focusing more to get what we see

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 in line with the Bin 16 bin.

2 MR. LEJA: And I agree with that. I  
3 agree .1 second, .5 second testing would be a waste  
4 of your money. IEEE C37.20 says, .1 seconds to one  
5 second.

6 MR. MELLY: Yes.

7 MR. LEJA: But I still find value in two  
8 seconds.

9 MR. MELLY: Right.

10 MR. LEJA: Because I haven't really seen  
11 much tests at two seconds, because that's what we  
12 expect gear to be rated for. So that's why I see  
13 value in that.

14 MR. FUNK: I understand, Nick. And,  
15 again, I understand the tradeoff of "a waste of test"  
16 because you don't expect to see the substantial  
17 results.

18 Be aware though that that's out of line  
19 with the frequency calculations right now. That's  
20 the misalignment I see.

21 Because they're all included. Even those  
22 events that would now be your, a Category 1 or even  
23 a Cat 2 that you've defined in this meeting.

24 So we would need, or my recommendation  
25 then is, okay, kind of a new baseline we're working

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 from here so let's go re-scrub the events and get the  
2 frequencies that are in alignment the way we're  
3 defining this testing.

4 MR. MELLY: That's exactly what we plan  
5 on doing with the collaborative work with EPRI on the  
6 HEAF program.

7 MR. TAYLOR: Yes. That's one of the  
8 reasons why we're working tightly with NFPA and  
9 everyone here to try and come up with the definitions  
10 because, you know, I think five, six years ago there  
11 was talks about, well, let's define a MEF and let's  
12 define a LEF. Or a low and a medium and then high.

13 So trying to take a definition that, with  
14 the categories that we've proposed right now, you  
15 know, Cat 1, well, that wouldn't be included in the  
16 HEAF. It may not even be included in 15.

17 Cat 2, maybe it's 15, maybe it's  
18 somewhere else. And a Cat 3, really what we're  
19 interested in here is the high energy arc fault type  
20 bin.

21 So, trying to work with, to formalize  
22 those and then, as the comment was, tie it into  
23 frequency, make sure everything is consistent in the  
24 PRA model.

25 Okay, so what I hear, two to four seconds

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 seems, was one proposal out there. Is there any  
2 other feedback on the duration from the group? Okay.

3 MR. PLETZ: Hi, Rod Pletz from American  
4 Electric Power.

5 I don't have a good electrical  
6 background, my background is classical fire  
7 protection. And what I'm used to seeing is during a  
8 typical fire curve you'll get to a peak HEAF release  
9 rate and that will be sustained at some point and  
10 then it will drop off.

11 When we're looking at the duration of  
12 these HEAFs, is there a point where we're going to  
13 see that energy level peak out and then the duration  
14 of this event we're just going to see more product  
15 thrown against the wall, basically, and should we  
16 limit our duration to when we're going to hit that  
17 peak energy release rate?

18 MR. TAYLOR: Okay, so I'll go ahead and  
19 try and take a stab at that response. Yes, I think  
20 for most of the testing that we've done, and what we  
21 see, it's pretty constant, the energy release rate.

22 The one caveat being the aluminum. If  
23 you look at the test, was 23 the finish equipment?

24 MR. MELLY: Yes.

25 MR. TAYLOR: If you look at Test 23 and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you look at the timeline, you had the initiation of  
2 the arc up to about, right around one second. And  
3 the energy seemed to be pretty constant through  
4 there.

5 And then right around one second you had  
6 a large increase of what's going to be expelled and  
7 the energy that's coming out of that event.

8 We haven't got down to what caused that,  
9 was it because you got up to a certain temperature,  
10 did something change internally in the cabinet that  
11 caused that additional energy release. But that is  
12 one case, that I'm at least aware of, where the  
13 energy wasn't constant and you had a change during  
14 the event.

15 I don't know if, Nick, had anything else  
16 on that.

17 MR. MELLY: In terms of the energy  
18 release electrically, if you want to talk about the  
19 transformer breakdown where right now at KEMA we have  
20 the energy to look at the current constant throughout  
21 the event. Whereas in the plant you have the degree  
22 --

23 MR. TAYLOR: If you're cutting from a  
24 generator?

25 MR. MELLY: Yes.

1 MR. TAYLOR: Okay. So I guess the point  
2 that Nick brings up, if you look on your medium  
3 voltage bores and you're being feed from a generator  
4 during unit aux, typically if you don't clear that  
5 fault, as the EPRI document, you can back feed from  
6 the generator into the fault and the generator will  
7 wind down.

8 Versus how we test the KEMA where we  
9 basically have a constant current for the entire  
10 duration that we need. So you don't have the decay  
11 of the current.

12 I don't know if KEMA has anything else on  
13 their setup. Or Tony.

14 MR. MILLER: Yes, question.

15 MR. PUTORTI: Yes, the other change that  
16 we saw during the experiments, as far as the ZOI and  
17 the threat to surrounding equipment was, if you went  
18 long enough to breach the exterior of the switchgear  
19 then there was a change in what we would see as the  
20 threat to the surrounding equipment. So that would  
21 be one point in time where there was a change.

22 MR. VERHOEVEN: Bas Verhoeven from KEMA  
23 Laboratories. With regards to the current that we  
24 make during the test, we normally arrange our systems  
25 in such a way that we have a super expectation on the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 short circuit generator. That means it will not, it  
2 will maintain the steady state current.

3 In normal power networks, they say the  
4 feeding power is sufficient to have a constant short  
5 circuit current. That's why we can make it.

6 If you would like to see decaying current  
7 to reasons, just ask because we can do it. We can  
8 set the machines in such a way with the citation that  
9 the current can decay.

10 And also, the voltage level, let's say  
11 that is for the ignition of the arc after has  
12 occurred. And also, the current value. That's all  
13 part of means we can handle. So don't be too limited  
14 in your design of what you would like to see tested,  
15 we can make quite a bit. In terms of current values,  
16 the supporting voltage and the expectation occurs.

17 And also the borings where we switch on,  
18 in design way with regards to the DC offset. So  
19 don't bother too much with our capabilities, we can  
20 adapt according to your needs. So let that be your  
21 primary goal.

22 MR. FLEISCHER: Ken Fleischer from EPRI.  
23 Then I would like to emphasize that that's something  
24 we consider, and I can see Gabe putting it on the  
25 board.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   Because the difference between an  
2 infinite bus feeding a fault and a decaying voltage  
3 from a generator where its exciter switchgear breaker  
4 has been open is a tremendous difference. Yes, the  
5 arc is sustained, yes, damage is occurring, but I  
6 anticipate that the actual energy, totally energy at  
7 the end of the extinguishment of the arc, will be  
8 significantly different and the damage should be  
9 different.

10                   So, that's a capability that we should  
11 consider.

12                   MR. TAYLOR: Okay, I think, as far as the  
13 NRC world, we're open to making those changes but  
14 again, to make a realistic from representative.

15                   However, the question is, okay, how  
16 should we set it up, how should we have the equipment  
17 be, setup to model the plants.

18                   MR. MELLY: And that will go in for  
19 medium voltage rate.

20                   MR. TAYLOR: For that case, yes.

21                   MR. FLEISCHER: Yes, it would be for  
22 medium voltage, you wouldn't see it at the 480.

23                   To emphasize, think about this. Ashley  
24 has talked to me a little bit about this for some  
25 other aspects of the testing, but remember, the gear

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that you probably are going to get is going to have  
2 multiple cubicles.

3 And as I've seen in the other tests that  
4 I have reviewed, the entire switchgear is not  
5 entirely damaged, there are other cubicles that can  
6 be used. So one of the options would be, is to do a  
7 decay test and set that configuration up for a decay  
8 test and then setup an undamaged cubicle for the more  
9 infinite bus test.

10 So that might be how you can arrange your  
11 test configurations on one piece of switchgear with  
12 multiple cabinets, as long as they're not destroyed  
13 for one of the tests.

14 MR. MELLY: Yes. And in the first series  
15 of tests that we did we did try to utilize as many  
16 cubicles as possible during the test phase.

17 So for instance, we had cabinets donated  
18 from Japan which had multiple cubicle units. And we  
19 essentially worked backwards through that cubicle  
20 doing, I believe four tests per cubicle trying to  
21 maximize the testing within the same compartment,  
22 varying the parameters.

23 So we are looking to potentially do that.  
24 It really comes down to what equipment we buy, how  
25 much it needs to be refurbished and how quickly we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 can accomplish that.

2 MR. TAYLOR: Yes, and the other thing  
3 that the German regulator is interested in is  
4 prorogations to adjacent cabinets. So if we do get  
5 damage, we're limited to use of that second cabinet.

6 I think it's a valuable comment of  
7 comparison. So that's something that we should  
8 consider.

9 MR. MELLY: That also brings into  
10 question, so, one of the goals for this test program  
11 is to really limit variable so that we can have a  
12 consistent data collection process.

13 So by changing the cubicles, we need to  
14 change the arrangement of the instrumentation. And  
15 that brings into play trying to predict where the  
16 affluent is going to release from the cabinet. Which  
17 in testing is difficult.

18 MR. LOVVORN: Shannon Lovvorn, TVA. I  
19 guess somewhat of I hear in the feedback is, we're  
20 talking about a lot of different permutations here  
21 of, some of us are wanting to take a realistic case  
22 and then I think the NRC is somewhat interested in  
23 the failure case where the device does work as  
24 expected.

25 Even in Kenn's definitions of a HEAF

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 yesterday was suggesting that there is an adequate  
2 design or some sort of failure that contributes to  
3 the event.

4 And so, I guess I'm okay with  
5 understanding that phenomenon and how much damage  
6 that can be, but we also need to be looking at, there  
7 is a lower probability of that and putting a  
8 probability number on to that kind of failure, if  
9 we're going to take that larger damage.

10 So, I guess, that's why the duration  
11 discussion seemed pretty difficult because we all  
12 kind of had a different mindset of what's realistic  
13 and what we're trying to accomplish. I think there  
14 is different permutations of what you can consider.

15 One is that your system acts as design.  
16 I mean, I shouldn't have a HEAF really but if there  
17 is some sort of failure then hopefully there is some  
18 sort of probability that we can put on to that.

19 Because, the presentations last week in  
20 the fire forum, we all know that fire risk is  
21 dominating the risk picture. And part of that is  
22 because of over conservatism in the, what I'll call  
23 the immaturity of these models. So, we just need to  
24 be thinking about that.

25 MR. MELLY: So I'm going to, let me grab

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that one real quick is that right now we currently,  
2 this ties in with the definitions, the frequency in  
3 all these pieces.

4 As the current Bin 16 frequency, or where  
5 we want it to go, I believe that every one of these  
6 events here, where you see these longer duration  
7 HEAFs, the ones where we would consider these  
8 damaging events with the zone of influence, every  
9 single one of these did have a protection level  
10 breakdown allowing it to occur.

11 So that reliability of the component, the  
12 failure of the component, will inherently be captured  
13 by the frequency of the events that we use for the  
14 input to the model. And that's currently the way  
15 that we're trying to handle it rather than going the  
16 approach of putting the reliability number somewhere  
17 within the equation itself.

18 MR. TAYLOR: I think that's a good  
19 comment and breakers and tracking devices are highly  
20 reliable. And so we were thinking along the same  
21 lines but then to get that conditional probability of  
22 becoming a HEAF becomes typical.

23 So I think what Nick said, it seems  
24 reasonable that if we can have a good definition of  
25 what these events are we can develop a frequency from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the fire events to characterize the frequency and  
2 then the data from this just characterize the hazard  
3 that we have kind of continuity.

4 MR. MELLY: And from the OpE I think I  
5 only, I can only off the top of my head remember one  
6 single event in an ISO phase where there wasn't  
7 levels of breakdown where there still was huge damage  
8 states. But primarily, every single case that we've  
9 seen in the HEAF bin did have failures of protective  
10 levels.

11 MR. MILLER: And we did want to have an  
12 understanding of the extent of damage when we do have  
13 a HEAF like that.

14 MR. MELLY: Yes.

15 MR. MILLER: And we know there's been  
16 failures and it's a lower probability, right.

17 MR. MELLY: Yes.

18 MR. MILLER: So part of this is  
19 understanding that sort of influence of that high  
20 energy event rate.

21 MR. MELLY: Yes.

22 MR. VERHOEVEN: Bas Verhoeven from KEMA.  
23 The topic that has not been mentioned so far, at  
24 least not to my knowledge is, is that if you have an  
25 arc in a cabinet, and let's say the cabinet remains

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 closed and it stays within that box, at some point of  
2 time it will burst somewhat out. The doors will open  
3 or it burns through the cycles. That means that the  
4 arc and the flash will go into different segments.

5 Is there thoughts being discussed of  
6 having the cubicle also inside the space, the volume,  
7 that is mimicking the, let's say the control room of  
8 the switchgear or is that just an open space where  
9 basically the fumes can go out because it will be a  
10 secondary buildup of pressure if that's a confined  
11 area?

12 MR. MILLER: Like with the one event  
13 where the fire door, the fire barrier door was  
14 breached, I guess that's what you're referring to?

15 MR. VERHOEVEN: Yes.

16 MR. MELLY: So we haven't discussed that  
17 right now because that is one of the goals is to  
18 understand the pressure.

19 So, the current test plan has us  
20 measuring the pressure of just the internal enclosure  
21 itself. And we have been discussing ways to try and  
22 extrapolate what the room pressure increase would be  
23 from that pressure reading. We don't have a good  
24 handle on whether that's going to be possible or not.

25 During the discussions we have had with

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 KEMA, as well as in the PIRT, there was the  
2 possibility of creating a mock room around the  
3 electrical enclosure and measuring the pressure rise  
4 of that room so that we can extent it to plant  
5 specific room designs so you know your, what the  
6 pressure rise in that room would be so it can  
7 challenge fire doors.

8 Another challenge there is fire doors  
9 typically aren't pressure rated, so making that  
10 connection is another effort. It's something that we  
11 are considering putting in limited number of tests so  
12 we can get a room pressure rise increase. Again,  
13 that's going to be up for discussion within the next  
14 weeks.

15 MR. TAYLOR: Yes, I think it comes down  
16 to the balance point of what's worth the cost on the  
17 effort on the NRC side versus how big of an impact it  
18 makes on the safety side.

19 MR. MELLY: Right.

20 MR. TAYLOR: So we haven't come up with  
21 a decision. We have been thinking about, I know  
22 Steve Turner has some information he shared and is  
23 available, and the literature on different ways that  
24 they tried to model pressures. So there might be  
25 some analytical approaches to model it but I'm not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 sure of how much are those, approaches are.

2 Do you want to add anything?

3 MR. TURNER: They are hard to do. At the  
4 minimum, it's very cheap to do. At least stick one  
5 microphone out at 15 feet and one microphone out at  
6 20 feet and you get data, the acoustics are all  
7 terribly off, but you get some idea if you can see  
8 that in some results from a February 2017 test that  
9 we did. We got that data.

10 MR. MELLY: Yes.

11 MR. TURNER: So, just those microphones  
12 are cheap.

13 MR. MELLY: And we're also similarly  
14 starting that from scratch on the pressure  
15 measurements because during our first attempt, in the  
16 first test series when we measured the pressure, we  
17 had a lot of interference, electrically, to our  
18 measurement devices, so we weren't really relying or  
19 we can't rely on the pressure measurements from our  
20 first series to try and extrapolate.

21 And that's why in the OECD report you see  
22 that we've reported the pressure on the same graphic  
23 that we did for the electrical energy. And you see  
24 a direct comparison, or spikes in the pressure  
25 readouts, both on, the power turns on and when it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 turns off.

2 Which we would not expect when we turn it  
3 off. That huge jump and spike that we were getting  
4 in the pressure readings if it was just based on the  
5 pressure itself.

6 So we were getting interference. And a  
7 lot of that actually has been reduced from testing  
8 that we've seen from Steve and the Japanese.

9 KEMA, in their facility, had moved from  
10 a fiber optic measurement device which has given much  
11 cleaner results. And I think that it's true pressure  
12 reading that they received in their later testing.

13 So, that's one thing to keep in mind if  
14 you have reviewed the pressure that we have collected  
15 from the first series.

16 MR. TAYLOR: So, from what I hear, I  
17 think getting back on topic, we're talking about  
18 duration right now. I heard a proposal to change low  
19 voltage to the four seconds. I didn't, does that  
20 seem reasonable for the group? So I think that's one  
21 change we should make.

22 The other thing is, I didn't get much  
23 traction on the proposal to try to do the lower  
24 duration event, to have a second or whatnot. Is  
25 there any more discussion we wanted to have on that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 aspect?

2 MR. FLEISCHER: For the low gear?

3 MR. TAYLOR: Yes. For the low voltage.  
4 Or even medium voltage.

5 MR. FLEISCHER: I have some input on  
6 that. In a way, this is still on topic but bear with  
7 me.

8 One of the comments that I was, had  
9 offered up, and I think it's in the EPRI comment is  
10 that, probably the first thing we should do before we  
11 take off with all this testing, right, is to  
12 demonstrate that the gear that we're going to use, we  
13 understand its capability and its ratings and that we  
14 go ahead and take on the compartments which should  
15 not damage anything else and you shouldn't worry  
16 about, propagation of the arc outside its cubicle is  
17 to do a full standard C37.27.7 test.

18 The right size arc wire, the duration of  
19 only half a second protective device being used to  
20 limit the fault and all that and do a standard test  
21 in conformance with that IEEE standard, and then just  
22 say this gear has been certified suitable for use for  
23 this exploratory type testing. And so therefore  
24 that's my traction for the .56 seconds.

25 Yes, I do believe we should do it, but it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 would be part of the certification that the  
2 switchgear is healthy to continue with the testing.

3 MR. MELLY: I'll take that one. We may  
4 be able to do that for the low voltage cases.

5 For the medium voltage cases, we will not  
6 be able to do that because of the current contract  
7 that we have with KEMA, that will be essentially  
8 doubling every medium voltage test that we have.  
9 Which is expensive.

10 So based on our current restrictions and  
11 budget that we have moving forward, I don't know if  
12 we have the money to do a full another 16 or 32  
13 tests.

14 MR. FLEISCHER: We're going to have that  
15 many switchgear components? I was think of  
16 certifying one as one design.

17 MR. MELLY: Yes. We may be able to do it  
18 if we buy one standard design for the other tests.  
19 For the donated pieces of equipment, I do not know if  
20 we can do one for them.

21 MR. TAYLOR: Yes, so donated equipment,  
22 we don't know exactly what we're getting from  
23 Germany, but from Korea we're getting 5 kV Magna-  
24 Blast with the protocol track and breakers and gear.

25 MR. MELLY: Also, I don't think, for the,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 are you discussing the metal clad switchgear standard  
2 with the, where we're not going to be ejecting the  
3 hot gas out the front with the cotton waste stabs and  
4 things like that?

5 MR. FLEISCHER: I'm trying to digest the  
6 question. I'm just thinking of the IEEE C37.20.7  
7 test for metal class switchgear. Yes, it would be  
8 the medium rolls.

9 MR. MELLY: That's the guide on arc  
10 resistance?

11 MR. FLEISCHER: That's the guide on the  
12 arc resistance certification.

13 MR. MILLER: Yes, with the cotton.

14 MR. FLEISCHER: Yes, those are cotton  
15 targets, I do remember that.

16 MR. MILLER: That's right.

17 MR. MELLY: And if it failed that test,  
18 what would we consider?

19 MR. FLEISCHER: Well, that would be bad  
20 now wouldn't it.

21 MR. MILLER: What's the purpose of that  
22 though? We're basically confirming that the  
23 equipment was built to the original, per that --

24 MR. FLEISCHER: Right.

25 MR. MILLER: -- out there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FLEISCHER: And so, as we learned  
2 from Bas yesterday, only 25 percent of those, if you  
3 don't test them, you don't know. It might not work.

4 What's the purpose of the test? The  
5 purpose of the test is to demonstrate to us, and our  
6 stakeholders and the utilities, this test going  
7 forward is using gear that was sufficiently designed  
8 and rated, and verified rated, to be able to, for the  
9 test going forward.

10 MR. MILLER: But wouldn't that apply to  
11 ever piece of gear that we are, going to do the test?  
12 Do we need to do that for all?

13 MR. FLEISCHER: No, I don't know if we  
14 need to do it for all of them, but I do understand  
15 now the challenge. If we have different pieces of  
16 gear and it's a mixed bag, I understand the  
17 complexity and the cost impact.

18 I guess I was a little more idealistic  
19 that we would procure, until today I didn't know, but  
20 when I was thinking these comments through, I figured  
21 we were going to design and procure maybe a GE Magna-  
22 Blast switchgear breakers for all of the medium  
23 voltage tests. And you would just take one of those  
24 switchgear and verify that it was arc resistant for  
25 the IEEE standard.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   MR. MELLY:    But I'm also more worried  
2                   that if I did that, let's say I reached out and I  
3                   said, this is the most common piece of equipment that  
4                   is in 20 plants and I'm going to go do the test.  And  
5                   then I run the certification at KEMA and I come back,  
6                   this is not, it didn't pass the test.  Is there  
7                   implication for those 25?

8                   MR. FLEISCHER:  Well, that's a good push  
9                   back.

10                   (Laughter)

11                   MR. FLEISCHER:  The thing is though, is  
12                   that then we'd have to look to see if it's a  
13                   production issue versus a design.

14                   MR. MELLY:  It could open a can of worms  
15                   though if we --

16                   MR. FLEISCHER:  It would.

17                   (Off microphone comment)

18                   MR. MILLER:  Can I speak?  But that's not  
19                   the purpose of this testing either, we're not trying  
20                   to certify the equipment that's built per the IEEE  
21                   C37 standard, meets the standard, we're looking at  
22                   stuff beyond that.

23                   MR. FLEISCHER:  So is --

24                   MR. MILLER:  So I'm still not seeing the  
25                   purpose of what, of doing what you're saying.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Because that's not the purpose of the testing.

2 MR. MELLY: It's the baseline.

3 MR. FLEISCHER: Kenn, correct, it's not  
4 the purpose of the test. What it does is it verifies  
5 that the equipment we have chosen to do the test  
6 would have survived a standard arc fault at .5  
7 seconds or less. That's all.

8 Just that the piece of equipment we've  
9 chosen is robust enough so that the results we get  
10 know that under ideal conditions of all protective  
11 device sparking, it was okay, now we're taking this  
12 beyond its rating --

13 MR. MILLER: So at baseline --

14 MR. FLEISCHER: It's a baseline.

15 MR. MILLER: -- this test.

16 MR. MELLY: Do the plants have that  
17 certification right now certification right now on  
18 pieces of equipment that are installed?

19 MR. FLEISCHER: I don't know. I don't  
20 think they all have it.

21 MR. MILLER: Well --

22 MR. FLEISCHER: It's a guide, right?  
23 IEEE's are a guide, so this is voluntary.

24 MR. MILLER: Kenn, I mean, when plants buy  
25 equipment per a spec, they get a certain indication

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that it meets the requirements of the spec. well, it  
2 is.

3 I mean, that's the whole purpose of  
4 buying something per our spec. You get a certificate  
5 of performance.

6 MR. CIELO: Yes, you might get a  
7 certificate of conformance or you might get a COC.  
8 You're not going to get what Bas was describing  
9 yesterday.

10 Which is a certification from an  
11 independent test lab that it met 100 percent of the  
12 requirements of whatever the standard is. Which is  
13 a full type test, which is an independent test.

14 Which means that the manufacturer submits  
15 that piece of equipment, in our case, to our test  
16 lab. Our test engineer and our test team verify the  
17 device to the drawings.

18 They actually do a physical verification  
19 against the drawings and then they run it 100 percent  
20 to the requirements of the standard without any input  
21 from the manufacturer. It's to the standard.

22 We pick the circuits, we pick, you know,  
23 in accordance with the standard, all the voltages,  
24 the amperages, all those test parameters, every piece  
25 of equipment that we use in our test labs is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 verifiable backed NIST, in the U.S. anyway, because  
2 of our ISO 170.25 certification.

3 So we can vouch for every piece of  
4 equipment that we use to measure all of the, the  
5 results basically. And so when it passes 100 percent  
6 in accordance with the standard, then a lab like KEMA  
7 Laboratories would issue a certificate. But that's  
8 not necessarily what you're getting when you get a  
9 COC.

10 MR. FLEISCHER: On the interest of time  
11 I was going to try and get it back to Gabe here. So  
12 my thoughts are, why don't we just put it as a  
13 parking lot, a breakout session if you will, as a  
14 consideration.

15 And if it's viable or there is a way to  
16 make it work, that would be great. But it's  
17 essentially, it's a baseline.

18 The other thing to your question, I now  
19 know what you're asking. When you do a purchase spec  
20 for a piece of switchgear, you're going to put in the  
21 design standards.

22 MR. MILLER: Yes.

23 MR. FLEISCHER: Right.

24 MR. MILLER: This is all the standards  
25 that they're testing against.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FLEISCHER: Right. But you may not

2 --

3 MR. MILLER: They're putting, GE is going  
4 to say this breaker will meet those requirements.

5 MR. FLEISCHER: Right. But you may not  
6 put this testing standard in. In other words, you're  
7 only going to get what you put in your specification.

8 So I think the answer to your question  
9 is, probably a lot of the early nuke designs probably  
10 weren't aware of this testing and probably didn't  
11 have this done. So their certification search is to  
12 a design standard as opposed to a testing guide.

13 MR. MILLER: Yes. So, to me, I would  
14 attribute this to an assumption on our part with the  
15 beginning of the testing. Otherwise we're talking  
16 about a lot more testing and scope increase of what  
17 we're doing.

18 MR. FLEISCHER: Yes, okay.

19 MR. DALEY: I got this microphone about  
20 20 minutes ago so this will probably sound like a non  
21 sequitur at this time.

22 I just got to keep on going back. I see  
23 this, we got to know what the end of this is and  
24 what, keep the end in mind of what we're looking at  
25 and look at it in terms of, I'm just thinking right

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 now. I'm thinking your design basis event and then  
2 your external events.

3 So you got your design basis single  
4 failure type thing which has specific events,  
5 specific portions of this could potentially affect  
6 that. And then you got your 805 portion which is a  
7 totally different animal.

8 You're dealing with probabilities. I  
9 mean, some of the same things in deterministic, and  
10 the Appendix R plants are going to be similar but  
11 you're dealing with probabilities too so you're  
12 looking at that.

13 And then you got the deterministic  
14 plants, the Appendix R plants, which would be some of  
15 the things that you're looking at in 805 as a subset  
16 of that.

17 And then the last thing, and I haven't  
18 given a lot of thought to this is, is you got the  
19 seismic type event where you got, where you would  
20 almost half to be dealing with a non-1E bus that's in  
21 proximity to your Class 1E buses. Which is not that,  
22 that's not that uncommon particularly with older  
23 plants.

24 So, anyway, I just think you got to have  
25 the end in mind.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. CHEOK: So, this is Mike Cheok. A  
2 quick comment. And you know I am always interested  
3 in everything I just heard.

4 So the beauty of risk analysis is you do  
5 couple all the consequences with the frequency. So  
6 when you do PRAs you have large, medium and small  
7 LOCAs. Loss of coolant accidents.

8 And each one of these things come with a  
9 frequency. And for the large LOCA you have a much  
10 smaller frequency.

11 Enough even for a loss of offsite power  
12 so you have different durations, how long you lose  
13 your offsite power. And obviously, the longer you  
14 lose offsite power the smaller the frequency.

15 And you know, the other extreme is  
16 seismic PRAs. You know, you do the different hazard  
17 curves, you have the smaller earthquakes all the way  
18 to the large earthquakes and obviously the frequency  
19 curves would be, you have a lot smaller frequencies  
20 for the large earthquakes.

21 So I think the discussion here is a very  
22 good discussion and the results, I think one thing we  
23 have to be very careful about is when we're  
24 discussing tests and results and when we have the  
25 results that we want to display, let's say for a four

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 second duration or even a eight second duration, we  
2 always have to couple that with a frequency. We  
3 cannot just go out and tell people the zone of  
4 influence is X without saying this was a very  
5 infrequent event that is coupled with several  
6 different failures and probably with a frequency of  
7 ten to the minus eight or whatever.

8 So I think we all have to keep the  
9 consequences on the damage states where the  
10 frequencies in our test and in our communications of  
11 results and things like that.

12 MR. SALLEY: It's a good point, and I'll  
13 give it back to Gabe, but you say, Bob, with the  
14 earthquakes. Look how we do earthquakes, right.

15 We have our design basis earthquake,  
16 which is what we expect to see in the plant, and we  
17 do that and then we have our safe shutdown  
18 earthquake. If you want to draw a parallel to this  
19 with the short durations, what we expect to see with  
20 the equipment and when it does work, that safe  
21 shutdown earthquake is what the HEAF is.

22 So, again, going back to the definitions  
23 I think is going to be key. Here you go, Gabe.

24 MR. TAYLOR: I think this is a great  
25 discussion, exactly what we want.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MELLY: Yes.

2 MR. TAYLOR: So, next slide.

3 MR. TURNER: I got one more comment on  
4 the --

5 MR. TAYLOR: Steve Turner.

6 MR. TURNER: As far as talking about half  
7 second duration and one second duration, I think one  
8 of the things we're missing in this presentation is  
9 we look at our Phase I test, there is a huge data  
10 bank of half second tests out there that's in the  
11 IEEE and FDRA flash tests.

12 There have been hundreds and hundreds of  
13 tests at half a second and one second. The weakness  
14 it has is it barely touched on them. But I would  
15 recommend that you guys go back and grab the IEEE  
16 papers and write that up in some way to convince  
17 these people that at least it will cover half a  
18 second and one second is kind of covered and we're  
19 just going to focus on this new bin for the really  
20 bad stuff.

21 And as far as going back and doing the  
22 test and saying, look, it passed, my view on those  
23 tests have always been, and you saw it in his video  
24 yesterday, the first one of those I ever saw that  
25 passed I said, geez, if that's a success I'd hate to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 see a failure. Because it still looks pretty  
2 dramatic.

3 Those flames can still come out and stuff  
4 can still get lost. And so, it's just not a very  
5 appealing thing to say, look, this passed the test.

6 And the other thing is, the thought may  
7 be that if you do that easy test first you can do a  
8 test in it again, you probably can't. It's going to  
9 damage it enough, you won't hit it again.

10 MR. MELLY: And again, one of the videos  
11 we saw yesterday was a pass of the test because it  
12 didn't come out the front facing where the personnel  
13 would be, which is how that test is designed.  
14 However, for our zone of influence, I'm still worried  
15 about the back and the top and where the cables are.

16 So, running that standard test, if it's  
17 to a cabinet design to have a detachment plate or  
18 something along those lines, I'm still going to be  
19 worried about my cables, my other equipment and  
20 things like that.

21 While I do still care about personnel,  
22 it's generally not in the PRA calculation.

23 MR. TAYLOR: Okay, the next slide. And  
24 I think I've gone through this enough but the longer  
25 versions ties into our energy and the thermal aspects

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of that.

2 Obviously, that type of modeling is going  
3 to be different from expelling the molten materials,  
4 the shrapnel, the pressure, things we also need to  
5 consider.

6 But I think that's what a large scale  
7 testing, how good we can capture that through  
8 document it via video as well, on thing I didn't  
9 mention yesterday is, in the first series of tests  
10 we're going to bring up Sandia's, the plan is to  
11 bring out Sandia's video equipment and they can  
12 actually track particles and run them into their  
13 computer and they can get you miles per hour, where  
14 it's going, what it's bouncing off of. So we want to  
15 give that a shot and see if that works. That might  
16 help us on a non-thermal aspect.

17 Again, to characterize better the ZOI.

18 MR. MELLY: I think we've covered this  
19 part.

20 (Laughter)

21 MR. TAYLOR: Yes, we've heard a lot of  
22 discussion, maybe I should have showed this on the  
23 second slide.

24 (Laughter)

25 MR. TAYLOR: But if there is anything

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 else, we want to talk about duration right now,  
2 please, please do bring it up. If not, we will go on  
3 to the next topic. Unless we need a break.

4 MR. SALLEY: Yes, why don't we take a  
5 break, Gabe, 15 minutes. Okay.

6 MR. TAYLOR: All right. So, let me just  
7 check the webinar real quick before we break. And it  
8 shows no questions coming in.

9 MR. SALLEY: Any more out here?

10 MR. TAYLOR: It doesn't look like we have  
11 any questions on the webinar, so let's go ahead and  
12 take a break for 15 minutes and we'll come back at --

13 MR. SALLEY: 10:30.

14 MR. TAYLOR: -- 10:30. So almost a 20  
15 minute break. 10:30 we'll be back.

16 (Whereupon, the above-entitled matter  
17 went off the record at 10:11 a.m. and resumed at  
18 10:32 a.m.)

19 MR. SALLEY: All right. How do we turn  
20 this on? Okay, so we will pick it back up and,  
21 again, thank you, this is kind of what we envisioned,  
22 organized chaos.

23 I mean the discussion is great, you know,  
24 we want this input. Also we're reaching out to our  
25 folks on the webinar, you know, you all are part of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 this, too, so we got young Tom there on it, so please  
2 feel free to type any of your questions in and bring  
3 it in, so we want the people on the webinar to be a  
4 part of this process, too.

5 So with that, Gabe, let's go until 12  
6 o'clock.

7 MR. TAYLOR: All right.

8 MR. SALLEY: At 12 o'clock we'll take  
9 lunch because the discussion is going to be a good  
10 break point and we'll pick it back up.

11 MR. TAYLOR: Okay. So the next parameter  
12 is voltage. Obviously, we are looking at low voltage  
13 as 480, the most common in U.S. plants although there  
14 is some 600s out there.

15 And then medium voltage, 6.9 is a lot  
16 more common in European plants, so, you know, there  
17 is a big push from the group to go at 6.9. Also,  
18 some of the later U.S. plants were putting in 6.9  
19 safety buses, but there is a lot of variation.

20 6.9, as I mentioned earlier, about half  
21 of the plants in the U.S. have it, right around a  
22 half. 4160 is much more common in U.S. plants.

23 So if the plant is medium voltage, 6.9,  
24 they test it at that, however, if donated equipment  
25 doesn't go there we'll go to 4160, but, again, it's

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 another topic for discussion.

2 If we want to do something 4160 or some  
3 other 7.2, 12, 13kV, that is up for discussion, but  
4 that would be something that Nick would have to take  
5 back and negotiate with the international, so just a  
6 little background on where we are with that.

7 I have some slides that might help the  
8 discussion along, so we can go to the next slide. So  
9 we talked about this a little bit yesterday, but what  
10 I did is I went back to the Phase I that the NRC ran,  
11 those test results, and the orange is the system  
12 voltage, so it was either 480 that we ran for the low  
13 voltage or, it's a little hard to see, but we ran  
14 6.9, 7.2, one 4160, and then two 10kV tests in Phase  
15 I.

16 So the orange is showing the system  
17 voltage and the blue is showing the arcing voltage,  
18 so the voltage collapse during the arc, and you can  
19 see, although we have some variation between 4160 and  
20 the 6 or 7, 6.9 or 7kV, and even 10, the arc voltage  
21 doesn't change too much, too dramatically.

22 And some of the reasons behind that could  
23 be the bus bar spacing has an impact on what the arc  
24 voltage is. So just to make that clear, when you are  
25 looking at energies it's not the system voltage that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you're concerned with it's the arc voltage that goes  
2 into the energy calculation.

3 Next slide. So just another way to look  
4 at this. What I am comparing is in the blue is our  
5 arc voltage and the orange is basically the distance  
6 between our buses in the gear.

7 So based on that trying to see if it  
8 tracked, and in general it tracks, but, again, there  
9 is some variation that doesn't align with, you know,  
10 a correlation on just distance between the buses.

11 Next slide. So there are some methods  
12 out there to predict what your arc voltage is based  
13 on your spacing. So this method here, without  
14 getting into too much detail, comes from the CIGRE  
15 document.

16 And basically based on your spacing it  
17 predicts a voltage per unit distance, or voltage in  
18 this case, kilovolts per centimeter. So the gray is  
19 basically that model and the orange is our medium  
20 voltage test and the blue is our low voltage test.

21 So if you look at the medium, you know,  
22 the medium, the general tendencies that the model  
23 tracks and however there is some spread for, more so  
24 for low voltage than medium voltage, and on the  
25 medium voltage side it tends to over predict the arc

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 voltage compared to what we are seeing in the  
2 testing.

3 Next slide. This is showing the same  
4 information but now instead of distance, what I  
5 showed in two slides back, I am showing what the  
6 CIGRE document would calculate as your arc voltage,  
7 comparing it to blue, which is what we actually  
8 measure the arc voltage.

9 And so it is an important parameter, but  
10 just because you have a certain systems voltage  
11 doesn't mean you are going to get a certain arc  
12 voltage.

13 I think distance does have impact, but  
14 there is some scatter there. So being able to  
15 predict that is a complication that we are going to  
16 run into.

17 Next slide. Okay, so that's really what  
18 I had on voltage for background discussion. So as  
19 far as our testing, you know, I want to hear, get  
20 some feedback on, you know, is 480 reasonable, and  
21 then the approach for 6.9kV for the medium voltage  
22 gear.

23 Are there other aspects of the testing,  
24 the system lineup, the power supply that we are using  
25 at KEMA that comes in and impact the arc voltage.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So I want to go ahead and open it up to  
2           the room if there is any feedback on the voltage for  
3           the test.

4           MR. FUNK:    Gabe, yesterday you and I  
5           briefly discussed, you know, fully being able to  
6           characterize the supply system.    Can we get the  
7           characteristics for the KEMA generators so we can  
8           actually do a model with those, an impedance model,  
9           and that way we can predict voltages, the degradation  
10          in voltages with the new software that's out there?  
11          It's pretty easy to do.

12          So if that is available it would be of  
13          interest I think for some of us to get access to  
14          that, maybe just build it into the test plan.

15          MR. CIELO:  Yes, this is Frank.  When you  
16          say "characteristics," I mean it's not just a  
17          generator, it's everything in between, too, right?  
18          I mean because we can --

19          MR. FUNK:  Yes, absolutely.

20          MR. CIELO:  And that would be for the  
21          entire lab?  I mean I am not sure what you are  
22          asking.

23          MR. FUNK:  Not really.  You know, in the  
24          electrical world when we model this we model the  
25          generation or the source and that's usually done with

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the transient and the sub-transient reactants, cable  
2 length, and standard distances between the phases.

3 It's not very difficult to do. So you  
4 black box it and you should be able to characterize  
5 it for us. You need the transformation.

6 MR. VERHOEVEN: Bas Verhoeven from KEMA.  
7 It will be very difficult because our generators are  
8 not normal generators.

9 MR. FUNK: That's why I am asking, I  
10 understand that.

11 MR. VERHOEVEN: And like I said earlier  
12 that we have a way with our excitation to counteract.  
13 But I don't really see the point of adding that into  
14 a model because most of the times the network is a  
15 very strong source with a certain impedance, of  
16 course, and that is basically the reference that you  
17 can calculate and that we make sure that our  
18 generators will mimic exactly that part, that's why  
19 we have that excitation.

20 The only part is when you were referring  
21 to that you have let's say being fed by the generator  
22 itself, that then drops down the frequency. That's  
23 something different. But for average short circuit  
24 calculations the system voltage are basically the  
25 impedance, in that case, the maximum short circuit

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 value, and that's what we can adapt for strong  
2 networks, low networks, with very high DC offset or  
3 small DC offset.

4 MR. FUNK: Yes, I partially agree with  
5 you but maybe not completely. When we do a model you  
6 have a starting point, be it an infinite bus or a  
7 generator, once again the model of the generator,  
8 those standard parameters you would use, and I  
9 understand that your generator is different, so doing  
10 so in a conventional manner is maybe not as  
11 realistic.

12 But as a starting point the black box  
13 needs to be the voltage or typically an MVA available  
14 from the system and an X to R ratio which when  
15 married up within the in-house part of the  
16 configuration cables, et cetera, which we should be  
17 able to characterize, that's what gets you the, as  
18 Gabe had on his screen, the voltage, the X to R  
19 ratios, and the current.

20 And with those three parameters then you  
21 can move forward with an electrical analysis, so  
22 characterizing that shouldn't be completely  
23 impossible.

24 I mean if you are going to offset it with  
25 your equipment then you know what you are offsetting.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 So, again, to do a short circuit model, to look at  
2 all the different quantities that are of interest,  
3 being able to characterize the generation source I  
4 feel is important.

5 It's not absolutely critical, but it  
6 would sure help when we went to pair up past events  
7 with test results as we try to define what categories  
8 things are in and using a predicted model, the  
9 software out there, eCAP, EasyPower, there's a  
10 million of them, they all work the same way and they  
11 are all sort circuit calculations conducted in  
12 accordance with IEEE.

13 So I guess that's where I leave this that  
14 we want to be able to replicate IEEE modeling to  
15 correlate the test results to what we have seen in  
16 our past events and without that information from the  
17 test then we cannot do that.

18 MR. VERHOEVEN: Yes, well maybe we have  
19 to take this offline a little bit, this discussion.

20 MR. TURNER: Let me try one quick one.  
21 We measured the generator voltage and then we  
22 measured the test object voltage, so we get a pretty  
23 good idea of what the I squared R losses are from the  
24 generator to the test object.

25 That's something, we get those white

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 forms to go along with things. We generally just  
2 report the test object voltage, but I think maybe  
3 with those two things you ought to be able to come up  
4 with some sort of -- it would be the black box but  
5 just based on the voltage you're dropping the I  
6 squared R losses.

7 We lose about 50 percent sometimes of the  
8 power just in I squared R losses from the generator  
9 out to the test object.

10 MALE PARTICIPANT: Would that give it to  
11 you?

12 MR. FUNK: No, probably not.

13 MALE PARTICIPANT: No?

14 MR. FUNK: The I squared R losses -- I  
15 understand the I squared R losses. What we are  
16 looking for is to characterize the impedance of the  
17 system because that's what drives for the medium  
18 voltage and high voltage AC systems, the entire  
19 analysis and also the functioning to some degree of  
20 the protective relays.

21 I agree, let's not get bogged down in  
22 some detailed discussion here, but it's something  
23 that I think we would want to pursue a little further  
24 offline. Thanks.

25 MR. VERHOEVEN: Like I said we can do

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 quite a bit with our generators in terms of settings.  
2 Basically it's the situation in your system, how it  
3 is, what is the impedance there, short circuit  
4 impedance, and the transients and sub-transients that  
5 we see, offsets and so forth.

6 MR. FUNK: Right.

7 MR. VERHOEVEN: So basically that's the  
8 value that you should use in your calculations of the  
9 short circuit in your system and those values we use  
10 to set our machines so that we mimic your situation.

11 So it's basically the other way around I  
12 would say. It's your system designs or dictates what  
13 is happening and in case it results in a short  
14 circuit code and duration depending on the voltage,  
15 and let's say for the test itself we set our machines  
16 in a such a way that it will represent that situation  
17 because we have impedances to that we can play around  
18 with the DC offsets.

19 MR. FUNK: I understand. You're saying  
20 let's reverse engineer the black box and you can do  
21 that. I think that's reasonable. I think that's  
22 reasonable. Please understand I am trying to foresee  
23 where ultimately the utilities are going to be. They  
24 are going to have to try to make their case based on  
25 your test results which aren't precisely what their

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 system has.

2 So the closer we can draw that lane, the  
3 stronger argument, technical basis, they'll have for  
4 applying the results however this may work out. I  
5 hope that makes sense.

6 MR. TAYLOR: Okay. So on voltage 6.9kV  
7 is there any discussion or proposed changes from that  
8 approach for medium voltage?

9 (No response)

10 MR. TAYLOR: Anything from the webinar?

11 (No response)

12 MR. TAYLOR: Okay, what about 480, we're  
13 comfortable with testing at voltage? I see heads nod  
14 yes, so -- and one thumbs up, okay.

15 MR. MELLY: And this is one difference  
16 that we had. In the version that went out in June  
17 the medium voltage was designated as 4160 with the  
18 international interest more on 6.9.

19 We have moved it to that and we felt  
20 comfortable doing it because when we looked at the  
21 first series of tests between our 4160 and 6.9 the  
22 actual arc voltage did not differ very much between  
23 those two ranges.

24 MR. TAYLOR: Okay. So I'm not hearing  
25 anything, so we'll get to the next topic, current.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 You've already -- Back up. All right, so this is our  
2 test ranges at the rate pressure 15/25 for low  
3 voltage, 25/35,000 amps for medium voltage. Go to  
4 the next slide.

5 MR. MELLY: Can we, just so -- We did  
6 show already we have the end values of how many  
7 plants we have collected this information from.

8 As we have said previously we don't have  
9 a very good avenue to go out and actually request  
10 additional information, so this is an area where we'd  
11 be looking for more information to kind of enhance  
12 our histograms and the analysis that we have here.

13 It would have to be done through EPRI,  
14 NEI, a voluntary, or any plant in the room, or other  
15 information to enhance our dataset to make sure these  
16 values are appropriate.

17 MR. TAYLOR: Yes, and on that, you know,  
18 I have one question for the utilities, I am not that  
19 familiar, although I have been at plants where I have  
20 seen the arc flash labels on the equipment saying  
21 this is the category of PP and this is the energy  
22 from this equipment.

23 Has the utilities gone out and done arc  
24 flash studies for their equipment that you are aware  
25 of?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. LOVVORN: Yes.

2 MR. TAYLOR: Shannon is saying yes.  
3 Anybody else? Okay, so there are some plants that  
4 have gone out there. That might be a reasonable area  
5 to look to see if you could open those analysis up  
6 and see where the currents are going out, because to  
7 do that you are going to come up with a voltage fault  
8 and you're also going to follow the IEEE, assuming  
9 you follow the IEEE guidance to do those analyses  
10 you'd have the arcing fault current.

11 You know, one thing that differ there  
12 though is the duration they are assuming the  
13 protection works. So that might not be as  
14 applicable, but, you know, that might be a useful  
15 source of information to help confirm or deny where  
16 we are sitting there.

17 And if there is even databases available  
18 for your equipment maybe that is something that may  
19 work with EPRI or NEI or whoever to at least compare  
20 with what we were working off of to make sure we are  
21 in the ballpark.

22 You know, we want to be, again, a  
23 realistic representative and the more information the  
24 better we can be at achieving that. So that's a  
25 request.

1 I don't know if there is any formal way  
2 we can follow up on it, Mark, but, you know, again,  
3 please feel free to contact myself or Nick if you do  
4 go back and look at that and say, oh, my gosh, we're  
5 10,000 amps too high or too low or whatever.

6 MR. MELLY: And we can send out a meeting  
7 summary after this to the participants with almost  
8 the request action item below list and things like  
9 that. Tony has a question.

10 MR. PUTORTI: Since you are making that  
11 request and following on the previous discussion does  
12 it make sense to ask for a sample circuit that might  
13 be appropriate for low voltage and medium voltage and  
14 then provide that to keep the match up for the  
15 experiments?

16 MR. TAYLOR: So as far as the  
17 characteristics for the sample circuit --

18 (Simultaneous speaking)

19 MR. PUTORTI: Something that is  
20 representative of the plants.

21 MR. TAYLOR: Okay. I mean we could make  
22 that request. I think it would be worthwhile, you  
23 know, knowing there is a lot of variability.

24 But I think what where we are looking at  
25 and based on some of the EPRI stuff is the medium

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 voltage boards coming right off of the step down  
2 transformer from the generator and then offset load  
3 extender right below your load extender, your regular  
4 load extender.

5 The other thing, too, that we haven't  
6 really got into, Mark brought it up, is your easels  
7 for the safety-related boards, you know, if there are  
8 any voting concerns there that tension could cause a  
9 longer duration type event.

10 Again, that's on duration, but, you know,  
11 that would be the other area where there might be  
12 some interest to get the circuit characteristics  
13 there to support this testing.

14 So I wouldn't -- That's I good point, I  
15 wouldn't make that offer. When we get those  
16 characteristics from the plants then we can make sure  
17 that the test generator is set up to mimic those.

18 MR. SALLEY: Gabe, we have a question on  
19 the webinar by the way.

20 MR. TAYLOR: Okay. Let's let Kenneth  
21 Fleischer from EPRI --

22 MR. FLEISCHER: Ken Fleischer from EPRI.  
23 This just hit me so it's more of a brainstorm comment  
24 on standby EDG. It's a worthwhile comment, but we  
25 talked about realism here and I don't think any of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the OE we saw there was a diesel that was on the  
2 system and it is so infrequently on the system that  
3 I am wondering if it should just screen out from a  
4 probabilistic standpoint.

5 It's a thought. Keep it on the board for  
6 now, but that's just a thought I had on the standby  
7 diesel.

8 MR. TAYLOR: Okay, thanks. Tom, on the  
9 webinar?

10 MR. AIRD: This question is from David  
11 Lochbaum. The question is with NRC seeking voluntary  
12 info from industry how will the NRC ensure any info  
13 provided is representative of overall industry and  
14 not a non-representative best case?

15 MR. TAYLOR: So I think to respond to  
16 that we'd have to work with some of the experts at  
17 the NRC to run it by the electrical group. I am not,  
18 I wouldn't consider myself to be one of those  
19 experts.

20 But we're working with either in research  
21 with Kenn's group or even out in the regions with the  
22 inspectors that have the background and have the  
23 experience to confirm the information that we are  
24 receiving would be probably the most reasonable  
25 approach to addressing that concern.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I don't know if Mark or Nick has anything  
2 else that --

3 (Simultaneous speaking)

4 MR. MILLER: Now I would assume if we're  
5 going like through NEI and EPRI they would be doing  
6 that for us, too, right? I mean they would  
7 filtering, or checking data for us, also.

8 MR. SALLEY: Yes, I think you covered it.  
9 And, Shannon, I was just thinking of Kent Bryan at  
10 TVA when he would solve these types of problems the  
11 word he would also use was garden variety and I think  
12 that's kind of what we are looking for is that, you  
13 know, middle of the road garden variety thing.

14 Again, I'll fall back to request this  
15 Firewall III cable. We knew from all the questions  
16 we asked when we looked at that when we were testing  
17 that cable that was getting pretty much 80 percent of  
18 the plans for the thermoset.

19 So, again, we'd be looking for that same  
20 type of input and, again, the steel line, would be  
21 that garden variety circuit that we have been looking  
22 for.

23 MR. MELLY: Yes, and to reiterate what  
24 Mark said is that we will be getting that garden  
25 variety but that's also why we are testing at the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 current ranges that we have selected so that there is  
2 the potential when the model does come out it will  
3 have this, the dynamic zone of influence where you  
4 can use what's applicable to your plant-specific  
5 lineup with the research that we are conducting so  
6 that you can create a plant-specific modeling state.

7 We can't cover it all in our test  
8 program, that's why we would like to be right in the  
9 middle of the road with a range so that it can be  
10 applicable generically.

11 MR. TAYLOR: Okay, so good feedback on  
12 that. Thanks for the question. We can go to the  
13 next couple of slides. I have already gone over how  
14 I develop these and what we are basing it off of,  
15 but, again, any additional information to help  
16 support that by all means please provide that to me  
17 and Nick.

18 And, you know, we'd probably have to have  
19 a discussion whether we can have a follow-on go-to  
20 meeting or a webinar just to when we receive that  
21 information and further discussions moving forward to  
22 kind of remain the collaborative environment and to  
23 make sure that we are understand the information that  
24 we are getting and that we are using it appropriately  
25 to modify the test plan moving forward.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So that's just a thought that came into  
2 my mind. I don't know if the group thinks that this  
3 reasonable to have a call in the future, but I think  
4 it would help us out.

5           Next slide. Okay, so let's go back one.  
6 Any additional discussion on fault currents, where we  
7 are currently at in the information we have at hand,  
8 so it's 15K and 25K for low voltage, 25 and 35 for  
9 medium. Anything to add from the audience here?

10           MR. MELLY: Is there anything on the  
11 webinar?

12           MR. TAYLOR: Okay.

13           MR. MELLY: Okay.

14           MR. TAYLOR: So that's what we'll go with  
15 for the time being until we have any information to  
16 go otherwise. So the next question is on the system  
17 connections and to the generator they can configure  
18 and either be Y or delta connected.

19           Most of the testing that we did in Phase  
20 I was delta. However, there can be wye connections  
21 made at KEMA, so as far as the plants and the uses  
22 here, you know, which one do you think, or what  
23 combination of the two do you think would be  
24 appropriate, and that's something that we haven't  
25 specified yet in our test plan.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Obviously, there is a lot of transformers  
2           that are delta, wye, primary, secondary, vice versa,  
3           so looking at where the faults are is there any  
4           opinion on one over the other, one configuration over  
5           the other?

6           MR. MELLY:   And just as a note from the  
7           testing in Phase I, the ground it seemed to use was  
8           primarily related to the test, the limited test we  
9           did in wye connection was because we were testing at  
10          a high voltage for a long duration and the generator  
11          and the setpoints we were looking for were more  
12          easily obtained using the wye configuration.

13          MR. LOVVORN:  If I can just say that, you  
14          know, for those that are frustrated that the Y would  
15          be representative of the medium voltage connection  
16          and the delta would be representative of a low  
17          voltage connection.

18          So if I was going to pick for my plant  
19          I'd say wye on the medium and delta on the low, but  
20          I don't know if that's representative of the  
21          industry.

22          MR. MILLER:  Another plant I was at it  
23          was wye for both.

24          MR. FLEISCHER:  Kenn Fleischer from EPRI.  
25          I can go back through my drawings, but if I recall at

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 medium voltage there is both, there is a lot of  
2 combinations of delta and wye.

3 So to get down into low voltage I see a  
4 more commonly grounded wye. There are a few systems,  
5 I know of one plant that is delta, and there is I  
6 think maybe a few others, but I would think that  
7 unless we can assure ourselves that there is no  
8 difference in the arc performance or damage between  
9 a wye and a delta I think we should test both  
10 configurations, particularly at the medium voltage  
11 level.

12 The low voltage level, unless I find a  
13 greater preponderance of delta systems in the U.S.  
14 nuclear power plants maybe we can just limit it to a  
15 grounded wye, and when I say "grounded" that may also  
16 have some impedance.

17 MR. MELLY: And one thing to note is that  
18 when we did have the, hold the PIRT this was one of  
19 the lower importance rankings to the eventual damage  
20 states.

21 We didn't see it as being a very high  
22 factor in any of the tests that we ran as the  
23 eventual damage state, so it is a lower ranking for  
24 the PIRT and I think on what I am hearing is I think  
25 we agree that it's going to be a lower importance in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 here.

2 MR. MILLER: It's more about the amount  
3 of all current.

4 MR. TAYLOR: Yes. So just to reiterate  
5 I think maybe that might be a secondary or even  
6 tertiary parameter and to make sure that the KEMA  
7 equipment can be set up to achieve our durations and  
8 our currents and then see, you know, whether we can  
9 support wye or delta for those.

10 And if we can't get a combination of  
11 both, we should attempt to do it to provide the  
12 comparison, but, again, it's not a, from what I am  
13 hearing it's not a primary important parameter.

14 MR. CIELO: Yes, this is Frank from KEMA.  
15 Yes, once you decide on what you want to do then it's  
16 a matter of, then we'll take that and we'll see how  
17 we need to configure the lab to be able to do that  
18 and we'll tell you if we can or cannot achieve it and  
19 then you'll be able to judge from there.

20 MR. MELLY: Yes.

21 MR. TAYLOR: Okay. So we can go to the  
22 next slide then I think. So moving on for the wye  
23 connections and grounding, what I saw was just the  
24 reactive or ungrounded, you know, what's the  
25 preference, and maybe I'll start out with KEMA, you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 know, what's your capabilities for grounding the  
2 system, the power generation system?

3 MR. CIELO: I would want to have some of  
4 our facility people be able to answer that question,  
5 but, again, I think also I'll just reiterate what I  
6 just said.

7 I think the way we work is you will come  
8 to us and say this is what we are trying to  
9 accomplish, this is what we need to do. We'll work  
10 with you with given the limitations of our equipment  
11 and the lab and so forth and we'll tell you what we  
12 can and cannot do.

13 So there is so many different  
14 possibilities here, so many different configurations  
15 that we could use, and, you know, at this point we  
16 don't see any limit.

17 The biggest thing that we are worried  
18 about is the thermal effect on our generators because  
19 we're not going to put that, you know, mocking up the  
20 test cell is one thing --

21 MR. MELLY: Yes.

22 MR. CIELO: -- doing anything to our  
23 generators is a completely different story. That's  
24 a completely different story.

25 MR. MELLY: Yes.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Okay. So from the audience  
2 I think we have a comment in the back. That would be  
3 Robert Rhodes from Duke.

4 MR. RHODES: Yes, this is Robert Rhodes  
5 from Duke, or Bob. Harris has, and I'm a Harris  
6 person so I am plant person, not a testing person or  
7 a theoretical person, we've got wye and it's high  
8 resistance grounding which limits your fault current.

9 We had the high energy fault on the ISO  
10 phase and the output was just exactly what was  
11 expected by or explained by KEMA. It went out, we  
12 had faults on the ISO phase, it blew the main  
13 transformer, it fed back because it's a high  
14 resistance ground with a grounding transformer, did  
15 the same thing on that grounding transformer and blew  
16 that out.

17 The bus stayed intact except for the  
18 piece that got ripped down through the neutral  
19 grounding transformer because the vehicle or the  
20 enclosure got destroyed.

21 So that resistance -- And I believe there  
22 is a lot of resist of grounding schemes in the  
23 industry that would tend to limit your ground fault  
24 and change your whole characteristic on a solidly  
25 grounded system and your results are going to be all

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 different.

2 And I would warn the testing people  
3 because when they did this on our ISO phase it fed  
4 back into the generator and we blew out our hydrogen  
5 seal, so I would be very concerned about your  
6 equipment because I don't want to damage your  
7 equipment.

8 It didn't hurt us very long but we had to  
9 replace our hydrogen seals, but there you are.

10 MR. LEJA: While the microphone is here.  
11 I can't speak for the entire fleet, but for the sites  
12 I am comfortable with or know well, usually on a  
13 medium voltage you always have a grounding  
14 transformer or a resistive, a ground resistor, on the  
15 low voltage it would usually just be solid ground.

16 But I have seen that throughout, not just  
17 Exelon.

18 MR. DALEY: Yes, I was just going to say  
19 that I think Duke, the Duke plants are a little  
20 different. I agree, they do have a high resistor and  
21 I think that will affect how these events carry on.

22 But I don't know that that's very -- I  
23 mean for the plants that I have seen it is not clear  
24 to me that that's the trend in the industry.

25 I think you see some type of resistive

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 grounding or you see some solid grounding out there,  
2 I think that's more prevalent than a high resistance  
3 ground like you guys have, but that's just from the  
4 plants that I have seen.

5 MR. FLEISCHER: Ken Fleischer from EPRI.  
6 Yes, there's going to be all kinds of grounding  
7 schemes, but also HEAFs can also be initiated phase  
8 to phase which then takes that out of the picture.

9 So I'll see if I can do a little bit of  
10 work and maybe kind of get a representative of what  
11 I am seeing through the various U.S. nuclear power  
12 plants trying to bin that up for info, but, again, I  
13 think that if we look at a HEAF from phase to phase  
14 the grounding schemes will take us, that will not be  
15 too much of a big factor.

16 MR. MELLY: And we are initiating phase  
17 to phase in every case.

18 MR. FLEISCHER: Right.

19 MR. RHODES: One more comment. This is,  
20 again, Bob Rhodes from Duke. One other thing I have  
21 noticed through the years is when you see the high  
22 energy arc faults the arc faults tend to find or seek  
23 out the weak points in the system and the weak points  
24 in the system may be the bus bars but more likely  
25 they are transformers, bolted connections, things

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 like that that go and the test seems to be ignoring  
2 all of that.

3 So I would at least look at that impact  
4 and see how you see it, because if you look at the  
5 Robinson fault it was the cable over the bus that was  
6 completely destroyed and the conduit that was steel,  
7 you just had a gap in the conduit, it's not there  
8 anymore.

9 So the weak point, wherever that point  
10 is, not necessarily a bus bar being the weak point.

11 MR. TAYLOR: Anyone have anything on the  
12 transformers?

13 MR. MELLY: Transformers were Mark's  
14 planned phase --

15 (Simultaneous speaking)

16 MR. TAYLOR: Yes, I think right now we've  
17 kind of excluded that from the scope of this work.  
18 I think internationals, Germany, in particular, is  
19 interested in that.

20 MR. MELLY: Yes, there has been several  
21 discussions of testing transformers at the higher  
22 voltages. It's a little bit outside of our scope  
23 right now, we're just trying to limit it to what was  
24 currently, what we saw as more dominant risk from the  
25 OpE that we have looked at, it being the bus, or the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 electrical enclosures themselves as the initiating  
2 points.

3 MR. TAYLOR: Okay, so go ahead and --

4 MR. AIRD: Gabe, there is another  
5 question from the webinar.

6 MR. TAYLOR: Sure.

7 MR. AIRD: This one is from Preston  
8 Cooper. He says from the original arc flash 1584  
9 equations the grounding is basically broken into  
10 effectively and non-effectively grounded systems.

11 Are we wanting a more detailed view to  
12 the effects of grounding?

13 MR. TAYLOR: I'm not sure if we have come  
14 to a decision on that. I kind of threw it out there  
15 to add the, you know, realism to the event, but,  
16 again, I think it comes down to realism from your  
17 plants and what type of fault currents you can get  
18 and duration.

19 And from what I am hearing from KEMA they  
20 can basically configure their system to meet those  
21 parameters and for, you know, ground, phase to phase,  
22 as EPRI brought up, you know, the grounding is  
23 probably not as big of an impact.

24 So from that discussion, you know, I am  
25 kind of concluding that we're probably not going to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 evaluate the grounding versus non-grounding in the  
2 test parameter, but on, you know, the representative  
3 side, but that's really what the discussion was  
4 focused on.

5 MR. MELLY: And another additional factor  
6 to keep in mind as you look at the test matrixes that  
7 we have developed and how we are focusing a lot of  
8 the discussion here today is that you see us trying  
9 to limit our test variables and have direct  
10 comparisons between tests so we can draw one-to-one  
11 comparisons.

12 With such a limited number of tests as  
13 well as the difficulty in collecting data, especially  
14 the measurement of the heat flux, the slugs, ensuring  
15 that we are within the line of affluent, or the plume  
16 of the arc itself, we are trying to ensure that we  
17 can have comparable results which is why we are  
18 trying to do replicate testing, limit the number of  
19 variables.

20 So if we can through discussion or  
21 consensus deem that one parameter is less likely to  
22 have an impact it's of benefit to exclude it from the  
23 test scope.

24 MR. TAYLOR: All right. Any other  
25 feedback on that one? Ken?

1 MR. FLEISCHER: Yes, actually I'm getting  
2 this idea from you, Nick. I think the brainstorming  
3 whiteboard we got going on here is good.

4 I think at some point what we may want to  
5 do is bin these into what the priorities are, which  
6 are the most important, what's your absolutely must-  
7 do's for the test to get meaningful results, and  
8 which are the secondary and tertiary level items that  
9 if we can do we will and if we can't we don't. I  
10 think we should probably bin this at some point.

11 MR. TAYLOR: That's a good suggestion.  
12 I think I agree. Let's get through this and then see  
13 where that takes us and if we have to come back over  
14 lunch you can come back to this to do the binning,  
15 that's fine, but we still need an hour or two to get  
16 through Nick's test plan and comment resolution.

17 MR. MELLY: We may be able to handle that  
18 during the test plan discussion, because right now we  
19 have a large slot to discuss the comments that were  
20 received on the test plan and we're kind of knocking  
21 them down one-by-one as we're going around this  
22 discussion right now.

23 So I see us -- Right now we're moving at  
24 a good pace.

25 MR. TAYLOR: Yes, I think this is the

1 most important part of this whole workshop so I would  
2 like to spend a lot of time working on this  
3 discussion.

4 MR. MELLY: Yes. And the binning I think  
5 we can do during lunch.

6 MR. LEJA: So this is kind of going on a  
7 tangent I guess, and I'm not PRA person, but I can  
8 understand the fact of frequency for like the  
9 frequency level PRAs.

10 So for these medium voltage systems you  
11 do your tasks how you do your task phase to phase,  
12 but when you develop your frequencies I think that  
13 should be one of the things you guys kind of consider  
14 as this resister systems if it's phase-to-ground  
15 fault it's going to limit the current and typically  
16 that's how most faults start, it's phased to ground  
17 and then it flashes over.

18 Not to say it's not going to flash over  
19 if you have that resister ground, but it's probably  
20 something that you should keep in mind when you  
21 develop your frequencies for PRA.

22 So it's less likely that it will be a --  
23 it'll be phase to phase fault if you have that  
24 grounding resister or grounding transformer. I am  
25 amenable to hear which is typical. I believe it's

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 difficult.

2 MR. MELLY: I agree and I think that's  
3 something that we need to keep in mind when we do the  
4 re-review of the OpE for the binning and the  
5 frequency as to how much information can we get on  
6 the events that have occurred, type of grounding of  
7 the system, the duration, the current.

8 For a lot of these the information that  
9 we have is coming from the LERs which typically focus  
10 on the plant response rather than the electrical  
11 characteristics of the event itself.

12 I know that now that these events are  
13 happening if we can go out and collect as much  
14 information, for instance the Cooper event, Turkey  
15 Point, the Robinson, we have a wealth of information  
16 on what actually occurred, specific information on  
17 the duration, the current, the voltage, the  
18 configuration, if we can go back and collect that  
19 through the OpE of the previous, of the past events  
20 it would really help in nailing down the frequency  
21 and nailing down the OpE and how it correlates to  
22 what we're trying to do.

23 MR. TAYLOR: Yes, and I agree with that  
24 discussion. Just to clarify though, you're basically  
25 saying that if you have a high resist of grounded

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 system the arc would stay phase to ground and it  
2 wouldn't flash over, was that the --

3 MALE PARTICIPANT: I think it was less of  
4 a chance.

5 MR. TAYLOR: Less of a chance.

6 MALE PARTICIPANT: But it probably will  
7 flash over.

8 MR. MILLER: This is Kenn Miller. Less  
9 of a chance of the initial line to ground fault.

10 (Simultaneous speaking)

11 MR. TAYLOR: Becoming a phase to phase  
12 fault is that --

13 (Simultaneous speaking)

14 MR. TAYLOR: Okay. Okay, I just wanted  
15 to be clear on that. But, yes, I think that is  
16 something that we can look into. Next slide. Nick?

17 MR. MELLY: Oh, sorry.

18 MR. TAYLOR: You know, one thing that I  
19 think is important, and I have mentioned this  
20 multiple times already, you know, today is where do  
21 we put that arcing wire to start the arc.

22 It has an impact on, you know, where it  
23 will transition if it will move, or, also more  
24 importantly, we need to collect data external to the  
25 equipment to characterize what type of thermal source

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is coming out from the event as well as our  
2 photography and videography to capture where any of  
3 the molten material is going and the vapor, the  
4 conductive cloud, cloud of death, whatever you want  
5 to call it.

6 So if you look at the guide, the IEEE  
7 guide, it tells you basically put it as far away from  
8 your incoming power source as possible, so that's one  
9 way.

10 I think a lot of the reasoning behind  
11 that, and I don't have it, so, you know, the  
12 background behind is that basically the magnetics  
13 that was going to push the arc away from the source.

14 So we have various locations where we put  
15 in Phase I, and this is actually a diagram out of the  
16 Phase I test report. In the back section of the  
17 cabinets we could always put it somewhere on the bus  
18 bar, so we could put it on the horizontal or the  
19 vertical bus bars.

20 Next slide. And this is was in a low  
21 voltage piece of the gear, or we can put it on where  
22 the stabs are on the front of the gear to initiate  
23 the arc.

24 So those are kind of the locations. I  
25 think there has been some OpE for where you have bus

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 cables coming in to the back of the gear, there has  
2 been some failures there, and, obviously, you see  
3 failures at the stabs where the gear goes into.

4 So, you know, those are two places we  
5 want to focus in on, but also the bus bars in the  
6 back there has been some OpE on failures there,  
7 right?

8 MR. MELLY: Yes. Yes, and there is some  
9 challenges associated with both. So if we went with  
10 the approach putting it into the arc location of the  
11 front of the cabinet, which we did in a few cases in  
12 the first test series essentially the breaker  
13 misalignment, the stab misalignment going in and  
14 things like that, we can initiate the arc in the  
15 front of the compartment except the instrumentation  
16 becomes somewhat of a challenge in that orientation  
17 because the door will swing open, sometimes throw the  
18 door and our equipment stands, which would be located  
19 directly in front it, will take the brunt of the  
20 impact of potentially the door swinging open and  
21 knocking them out, whereas in the back of the cabinet  
22 or the sides of the cabinet we have less of a risk of  
23 impinging on our instrumentation stands.

24 So I know Tony has been giving this a lot  
25 of thought as to how to collect repeatable datasets

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and this was a challenge for if we do the front.

2 MR. PUTORTI: In Phase I if you take a  
3 look at the experiments we used on the equipment that  
4 was donated by Japan we were actually able to have  
5 the same HEAF result four times.

6 We placed the arc wire on both of the  
7 connections in the rear of a switch gear which was on  
8 the secondaries of the breakers where the voltage  
9 connection was between a bus bar and the cables that  
10 would be exiting to the load and we were able to, the  
11 HEAF exited right out the back in all four of those  
12 that we did.

13 So that was an example of a scenario that  
14 we favored because it would allow us to know exactly  
15 and hopefully be able to repeat again where the HEAF  
16 products would exit the enclosure and we would be  
17 able to put our instrumentation there to characterize  
18 it well.

19 MR. MELLY: Yes. In the front  
20 compartments there was a lot of, it was a little  
21 chaotic, either the door blew open and the energy  
22 came out the front or we would breach internally  
23 compartment-to-compartment or the exterior wall and  
24 it was somewhat of a guessing game as to the location  
25 of the arc agenda.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FUNK: One quick comment, and I'll  
2 put Mr. Earley on the spot on this a little bit, but  
3 I believe in the most recent issuance of IEEE 1584  
4 they found a definite distinction between the energy  
5 that was emitted from an arc created on a vertical  
6 section versus a horizontal section and they have  
7 changed some of their guidance based on that.

8 So that, again, I apologize I'm not as  
9 familiar with that as I should be and maybe I'll,  
10 again, put Mr. Earley on the spot to comment on that,  
11 whether that should be considered for our testing.

12 MR. EARLEY: Yes, that is true that the  
13 results from the vertical and horizontal test did  
14 yield some different results.

15 MR. FUNK: Thank you.

16 MR. TAYLOR: So any other feedback on  
17 that or is -- I mean in the vertical orientation was  
18 it more severe than the horizontal or -- I don't even  
19 know.

20 MR. EARLEY: I believe that the vertical  
21 was more severe.

22 MR. TAYLOR: So that would be, you know,  
23 something we would need to consider. Is there any  
24 other feedback on where we should initiate the arc?

25 You know, one additional comment was that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 when we did do the finish piece of equipment we put  
2 the --

3 MR. MELLY: This wasn't there.

4 MR. TAYLOR: No, this has been --

5 MR. MELLY: No, that's our --

6 MR. TAYLOR: You had the incoming power  
7 supply from KEMA coming here, we put the arc down  
8 here.

9 MR. MELLY: Right in the center.

10 MR. TAYLOR: Oh, in the center?

11 MR. MELLY: Yes.

12 MR. TAYLOR: Somewhere in here on the  
13 gear, so for that cubicle let's say, and all three  
14 phases tied together initiated the event and it  
15 quickly promulgated up into the back part of the  
16 gear.

17 MR. MELLY: So it promulgated from the  
18 front of the switch gear towards where you had more  
19 aluminum material and the horizontal bus bars and  
20 then you see the entire, from the video you saw the  
21 ejector coming out the side following the magnetic  
22 path.

23 But, again, that was -- We initiated the  
24 arc in the front cubicle and it promulgated up to the  
25 top.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FLEISCHER: Ken Fleischer from EPRI.  
2 Yes, I like this more detail and thoughtful  
3 discussion where you put the arc.

4 I can't remember which report, or test  
5 report I read where some of the arc initiation was  
6 just not in accordance with any operating experience  
7 we have, removing the 24 inches of arc chute to try  
8 and get an arc to work was just in my mind not  
9 realistic.

10 So what I recommend we do is not place an  
11 arc somewhere where it is just not conceivable that  
12 we can even initiate an arc there, if that makes  
13 sense.

14 MR. MILLER: Keep the original  
15 configuration of the equipment.

16 MR. FLEISCHER: Right, right. Yes, I  
17 understand we have to cut a little bit into an  
18 existing gap that's in the insulation between maybe  
19 a bolted connection to get a good wrap of the wire,  
20 but not go into a part that's already got insulation.

21 It's kind of like I think the discussion  
22 about the non-safe bus, is it insulated bus or is  
23 not. You're not going to initiate an arc where the  
24 insulation is covering the buses.

25 MR. MELLY: Right. For our series of

1 testing what we plan to do for the Phase II, we did  
2 not alter the cabinets in any way besides removing  
3 the initial insulation at the arc connection point.

4 The only thing that we had that was a  
5 little strange in the initiation of one of our tests  
6 was in Tests 4, 5, 6 and 7 the Korean cabinet donated  
7 equipment we had a lot of difficulty in maintaining  
8 the arc itself, or initiating the arc where we had  
9 extinguishment immediately a few milliseconds after  
10 the test.

11 So Test 7 we have coined the Frankenstein  
12 test because you'll see bolts in there just as trying  
13 to have enough material to vaporize initially to  
14 maintain the arc.

15 That was the first series of tests that  
16 we ran and it was a very trial and error. It did not  
17 quite work and we have learned a lot more as we have  
18 moved forward.

19 MR. FLEISCHER: Actually, I'm glad you  
20 reminded me of that. And I am okay with  
21 experimentation, so maybe one thing we can do is if  
22 we decide to a test that is what I call experimental  
23 or exploratory and it's not expected in real life  
24 let's make sure we just very clearly state that in  
25 the final test report so that in the future the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 utilities can say, hey, this was not representative,  
2 this was an exploratory test.

3 MR. TAYLOR: I definitely agree.

4 MR. MELLY: Yes, we agree.

5 MR. FLEISCHER: The other thing we can do  
6 is, and if you say you're going to get to this later  
7 we will, but I also, I'm having a hard time getting  
8 my head around the size of the arcing wire using for  
9 medium voltage.

10 MR. TAYLOR: I was just talking to Ken  
11 about that.

12 MR. MELLY: Yes.

13 MR. TAYLOR: So if you look at guide, the  
14 IEEE C-37.20.7, it has two different wire sizes in  
15 there. I believe it's six and 24 --

16 MR. MELLY: Ten and --

17 MALE PARTICIPANT: Twenty-four is the  
18 medium voltage and ten for the low voltage.

19 MR. MELLY: Ten K strand.

20 MR. TAYLOR: Okay, ten for the low  
21 voltage and 24 for medium.

22 MR. MELLY: And the ten is K strand wire.

23 MR. TAYLOR: And the ten is K strand wire  
24 meaning that it has a lot more small strands to make  
25 up that ten gauge conductor.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So, you know, moving forward we want to  
2 understand, all right, the arcing wire is only there  
3 to create the conductivity in the plasma and really  
4 all we need is enough material to get the arc to  
5 initiate and then maintain it to allow the event to  
6 occur for the duration.

7           So Kenn Miller actually reached out to  
8 IEEE to understand what's the basis, what's the  
9 reason behind the different sizes, and we haven't  
10 gotten a -- They forward it on to their committee.

11           Maybe some of the individuals here on  
12 that can try to get some basis, but if there is  
13 anybody in the room that has some information, you  
14 know, we're interested to learn more on that.

15           MALE PARTICIPANT:     Do you have any  
16 background on that?

17           MR. FLEISCHER:   No. I can go back to the  
18 standards and see if I recognize anybody, but what I  
19 offer up is that I am not saying take exception but  
20 it would say, hey, we're going to initiate an arc for  
21 IEEE C37.20.7 and then we use a different wire size,  
22 I would just say if we're going to use a different  
23 wire size and a different wire type let's just  
24 outright say that it's going to be a deviation from  
25 the standard or not.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Yes, I'll take a look, Kenn. I will go  
2 look into the standard, who's on the standard board,  
3 and see if I recognize anybody from my past non-  
4 nuclear IEEE life. There might be someone on there  
5 I know.

6           MR. MELLY: Yes. And when we did look  
7 into it we noticed that there was a specific callout  
8 as to why they used the ten gauge K stranded wire to  
9 initiate the arc in low voltage because they had a  
10 greater success of maintaining the arc for the  
11 duration, the desired duration, and there was no  
12 explanation as the reduction in the wire size for the  
13 medium voltage.

14           I assume it's just because it's much  
15 easier at holding the arc in, but because we did see  
16 that explanation as for the holding for the desired  
17 duration our initial thought was we went with that  
18 for all the tests because that was one of our main  
19 parameters of interest.

20           MR. TAYLOR: And that's in the 2017  
21 edition of that standard. They put that in in an  
22 annex.

23           MR. MELLY: Yes.

24           MR. TAYLOR: So I think moving forward,  
25 and Nick and I have talked about this a little bit,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is that we plan on using what the standard, or guide,  
2 I guess, says to use for either medium or low voltage  
3 but we still want to hear back from that standard  
4 committee to see what the basis or logic is.

5 MR. FLEISCHER: Yes, and I'll try and  
6 look see if I can find something.

7 MR. MELLY: Yes.

8 MR. TAYLOR: We appreciate that.

9 MR. FLEISCHER: I'll get with you by  
10 either way.

11 MR. MILLER: Yes, I've sent an email to  
12 the chair working for them but I haven't heard back.

13 MR. TAYLOR: Okay, so go ahead and the  
14 next slide, Nick. Another picture I have taken out  
15 of the press report, again, trying to get the same  
16 thing, where do put the arcing wire.

17 This is just a medium voltage piece of  
18 the gear, so you have the bus cables coming in the  
19 back making connections to the bus bars within the  
20 enclosure in the middle section and then you'll have,  
21 this is a medium voltage, you'll have two sets of  
22 breakers in this case up front.

23 So we could potentially put the arcing  
24 wire right at the bus connection, the bus cable  
25 connections to the gear, we could make shorting in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the bus section of the gear in the middle region, or  
2 we could make the arc connection in where the stabs  
3 are, where the breakers are located.

4 So those are possibilities. We are  
5 looking for feedback and --

6 MR. MELLY: And this is the test that  
7 Tony was talking about. We had very good success of  
8 getting similar arc conditions when we initiated it  
9 in the rear of the compartment than we did when we  
10 tested it in the front cubicle.

11 MR. TAYLOR: And I know I am probably  
12 stealing a little bit of Nick's thunder here, but  
13 moving forward we do plan on including breakers in  
14 the enclosures.

15 They may not be functioning and we might  
16 not have them racked in but they are at least there  
17 for their mass and thermal characteristics --

18 (Simultaneous speaking)

19 MR. MELLY: Yes, that was one of the  
20 resounding comments we received from internationally,  
21 NEI, EPRI, is that the picture that was depicted in  
22 the test plan did not have an actual breaker unit in  
23 it.

24 We have changed it so it does and we do  
25 plan on putting non-functional breakers in so we have

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the thermal mass, the fire load potential, as well as  
2 the pressure influence.

3 MR. TAYLOR: And breakers are the most  
4 expensive piece, so the non-functional piece is  
5 important. If we can get something that is the right  
6 size to put in there we will.

7 Obviously if we can get a one-to-one  
8 match that's what we'll use, but we just have to  
9 watch on the budget side because if we're going to  
10 have to spend, I don't know, X number of dollars on  
11 the gear and then we got to spend ten or 20 times  
12 that just to get breakers, you know, it's going to  
13 limit the amount of test that we can do.

14 MR. MELLY: Which is another reason why  
15 we planned on not testing at the breaker unit itself  
16 so we don't have to buy repetitive pieces of breaker  
17 equipment.

18 MR. PUTORTI: Tony Putorti from NIST.  
19 And in Phase I these enclosures and cabinets did have  
20 breakers.

21 MR. TAYLOR: Okay, next slide. So this  
22 is just the same piece of gear, just the schematic of  
23 it, so, again, in this case that's where they put the  
24 arcing wire.

25 Is there any feedback from the group of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 proposed or suggested locations that initiate the  
2 arc?

3 (No response)

4 MR. TAYLOR: Okay. On the webinar, Tom,  
5 do we have anything?

6 (No response)

7 MR. TAYLOR: All right. Again, if you go  
8 back home and something comes in your mind please  
9 email us on that, otherwise I think you know those  
10 are the three locations that we were interested in.

11 OpE shows that events are occurring there  
12 and we'll probably pick, we probably won't just do  
13 one, but, you know, maybe two and possibly three,  
14 but, again, we want to weigh, you know, how  
15 repetitive we can get the, I'll call it effluent, the  
16 energy coming out for our measurement gauges. Next  
17 slide, Nick.

18 MR. MELLY: One more point there is that  
19 some of the parallel work that is being done by Japan  
20 as well as their testing agency CRIEPI, which is the  
21 parallel of EPRI in the U.S., they are doing a lot of  
22 testing as well to look at the energy levels to limit  
23 the amount of energy and they are doing predominantly  
24 most of their testing in the breaker cubicle itself  
25 or very close to the breaker cubicle because they are

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 more interested in the threshold amount of energy  
2 that is initiating an ensuing fire which they are  
3 using as one of their damage states.

4 So by initiating at the breaker unit  
5 itself you have a higher chance of starting the fire  
6 in that breaker unit which is why they are doing the  
7 testing there.

8 So we had been working with the  
9 international community and we are going to try and  
10 leverage some of their testing experience through the  
11 use of IAs and other avenues so there is data that we  
12 might be able to obtain from that arc location given  
13 their test series.

14 MR. TAYLOR: All right, next thing is bus  
15 bar spacing and I show you that it is important for  
16 arc voltage, or it's one of the parameters that  
17 influences arc voltage.

18 The standards don't specify, at least I  
19 am not aware of any, and typically spacing that I  
20 have found is IEEE has some tables in 1584 that gives  
21 you either a range or a single point value for  
22 different types of equipment for bus bars.

23 So from that, you know, six inches, four  
24 inches, or one inch about for the different types of  
25 classes of gear. And then I also found a White Paper

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 from one of the, one company that had some  
2 information as well. It was similar to what was in  
3 1584 but it was, you know, typical bus bar spacing.

4 So I think it's really going to depend on  
5 what type of gear that we choose will depict on what  
6 the spacing is, but if there is any opinions in the  
7 room of, you know, this is the type of spacing we  
8 have in the plans or we bought this gear because of  
9 this rating we'd be interested in knowing that now or  
10 moving forward such that we can procure our gear that  
11 was representative.

12 MR. MELLY: The other important aspect of  
13 the spacing itself is that the way that we have set  
14 up the test plan that we'd want to compare the copper  
15 results versus the aluminum result, the spacing can  
16 be different based on the sizing that you need,  
17 copper versus aluminum, we don't want to do a this  
18 exact same size copper versus the exact same size  
19 aluminum because they are going to be differing in  
20 the field.

21 We want to potentially buy equipment that  
22 is spec'd out for either material and there will be  
23 slight differences in the spacing, depending on what  
24 material you are using.

25 MR. LEJA: So I understand, you're going

1 to be limited to the spacing based on the kind of  
2 gear you're able to get, but I would probably just  
3 note it in the report and maybe reference that table  
4 and just say based on, you know, this is standard,  
5 and here's what we tested, just so people have a  
6 comparison and could maybe have done something that  
7 might have skewed the results a little bit.

8 MR. TAYLOR: Okay. I think that's very  
9 reasonable. Okay. Not hearing anything, nothing  
10 from the webinar, we'll go to the next slide then.  
11 All right. Bus insulation. We can test bus bars  
12 with insulation or without. I think there's been  
13 some recent event where they had insulated buses in  
14 their bus duct. But not only bus duct, even in the  
15 gear, do you guys experience insulation on the buses  
16 or is it typically non-insulated or a bare bus or bus  
17 bars? So that's the kind of feedback that we're  
18 looking for because, again, we have prepared  
19 equipment, we could go either way or we can get a  
20 cross-section of insulated or non-insulated.

21 MR. FLEISCHER: One plan I'm intimately  
22 familiar with, the non-seg bus, it is insulated.  
23 It's that Norrell type insulation. But the fault  
24 that they had was another one of these maintenance  
25 errors. Apparently, they had done an inspection, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 where the bus goes horizontal and then goes to a 90-  
2 degree with bolted connections, they forgot to put  
3 the boot back on. So that was exposed, and that was  
4 where the arc occurred. So, therefore, my one  
5 experience with an arc on that would be an exposed  
6 area of an insulated bus.

7 MR. TAYLOR: Okay. I think if we just  
8 add on, I think if we did test insulated buses, we  
9 could either test it where a connection is where  
10 there's an insulation and there's a boot. You might  
11 have to get the arc to stabilize. But also I think  
12 there was recent testing done where they removed  
13 insulation within the bus bar and caused a three  
14 phase there, so that's another approach we could  
15 take. And with the insulation removed, I think it  
16 helps stabilize the arc so it doesn't, you know,  
17 shoot down the bus bar. And that's one of the  
18 reasons why Nick put in the test plan for the  
19 uninsulated cases we have a cap so that the arc  
20 didn't just shoot down to the end. I think there are  
21 some cases where the arcs are stabilized and haven't  
22 moved that far.

23 But, again, from a testing perspective  
24 and to setup the instruments, we kind of have to make  
25 some modifications to make sure we can get the arc

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 where we want it.

2 MR. MELLY: Right. Because if you  
3 remember the video that we showed of the bus duct  
4 that we did test, you saw this just plume just  
5 shooting out looking like a rocket engine. And if  
6 we're trying to refine the current model for bus  
7 ducts, it's this cone in a downward direction and we  
8 see in the modeling, as well as the OpE, is from  
9 these events where the bus ducts hung overhead.  
10 That's why the gap break was there because if we  
11 didn't put that we were worried it was just going to,  
12 the arc was going to migrate and move all the damage  
13 downwards.

14 We have learned a lot from the Cooper  
15 testing that was done. And they were able to  
16 stabilize the arc and center the cubicle or center  
17 the enclosure and get much more damage consistent  
18 with what you would see in the FAQ method, so we are  
19 trying to move forward in that respect.

20 MR. DALEY: Ours were variable.

21 MR. TAYLOR: That one comment was  
22 utilities would have bare conductors.

23 MR. MELLY: Does it matter whether it's  
24 an external or internal? Like for the Cooper tests,  
25 the Cooper bus duct was outside versus a lot of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 bus ducts that we're worried about postulating for 60  
2 to 50 are internal.

3 MR. TAYLOR: Okay. Not hearing any  
4 feedback, it might be reasonable, I'll put this on  
5 the table, to test some bus bar, bus bar  
6 configurations with insulation and another segment  
7 without and then have a comparison. So does that  
8 seem reasonable to the group? I'm seeing some yes,  
9 some yes nods in the yes direction. All right. So  
10 that might be something we want to change then, Nick.

11 MR. MELLY: Okay.

12 MR. TAYLOR: While I'm writing this, what  
13 about, for test bus ducts, what about gear? Is there  
14 configurations out there in the plants that have a  
15 lot of insulations on the bus section of the gear, or  
16 are they mostly uninsulated?

17 MR. MELLY: If you go back to this  
18 picture of the Japanese equipment, this was insulated  
19 bus bar material internal to the cabin. When we did  
20 initiate the arc, we removed, roughly, an inch of  
21 insulation around and connected the arc and wire at  
22 that location. Tony.

23 MR. PUTORTI: So there were a couple of  
24 experiments on these enclosures where we did remove  
25 the insulation when it was in, let's say, a middle

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 compartment.

2 MR. MELLY: Yes.

3 MR. PUTORTI: When we did the four on the  
4 rear, the bolted connection was uninsulated, so we  
5 put the arc wire on the uninsulated portion.

6 MR. TAYLOR: Okay. I'm just looking at  
7 time and I think we got enough time to get through  
8 this. Was there any other feedback on insulation  
9 characteristics? All right. Not hearing any, if you  
10 do find that the gear is insulated or commonly  
11 insulated, please let us know. I think we have a  
12 path forward for the bus ducts.

13 Okay. The next couple of slides are  
14 looking into the pressure influences. So where the  
15 thermal is more of the energy, from the pressure it's  
16 more the arc power. Some of the literature we've  
17 looked into emphasize the DC time constant has a big  
18 role in how the pressure effects from the event occur  
19 or propagate. Asymmetric current to a point has some  
20 impact, but also looking at the volume of your  
21 enclosures and your openings, given a door opened or  
22 just the ventilation, also have an impact on pressure  
23 because you need some type of containment to get  
24 pressure obviously.

25 So, you know, I think, Dan, you had a lot

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of feedback on the asymmetric nature of these time  
2 currents or these current profiles and looking at the  
3 DC time constant and the asymmetric nature of these  
4 profiles. Is there any influence or interest in  
5 exploring those aspects of these events from a  
6 pressure standpoint?

7 MR. FUNK: I guess we could. You have  
8 characterized it well so we at least know exactly  
9 what we've got. To be honest, the testing is pretty  
10 benign in this regard to the offsets and the time  
11 constants are really low, and you don't include any  
12 feedback from motor contributions, etcetera,  
13 etcetera. So I guess that's my feeling on that  
14 particular part of this.

15 MR. TAYLOR: Okay. Anybody else have a  
16 --

17 MR. FLEISCHER: Just help me understand,  
18 DC time constant, are you saying DC offset which is  
19 part of the asymmetrical current? Okay.

20 MR. TAYLOR: Yes, I think it's the same.  
21 No, I think I'm referring to the CIGRE report, 602,  
22 and they identified that the time constants, how fast  
23 you decay.

24 MR. FLEISCHER: Right. So it's a DC  
25 offset. It's the standard asymmetric half cycle to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the first --

2 MR. TAYLOR: The decay --

3 MR. FLEISCHER: Yes, okay, all right.

4 I'm used to it referred to as DC offset, but CIGRE  
5 may call it different, but it's the same thing.

6 That's all I needed to know. Thanks.

7 MR. TAYLOR: Is there anything on the  
8 webinar or in the room on that? It seems like it's  
9 not a high priority. All right. Just quickly on the  
10 equipment, a few things I want to go over on the next  
11 slide with Germany is planning. They're still  
12 working with their utilities. Korea already has  
13 lineup of what they want to provide us. All their  
14 equipment will be procured or donated, so if there's  
15 any plants out there that are upgrading or modifying  
16 their plant and then it gets representative  
17 equipment, you know, feel free to contact Nick or I.  
18 We can see if we can help arrange for that donation  
19 of equipment and get it into our storage facility up  
20 in Pennsylvania before that.

21 MR. FLEISCHER: Kenneth Fleischer from  
22 EPRI again. If it's going to be really impactful to  
23 do that based on the testing we talked about, we want  
24 to make sure that all the donated equipment, we get  
25 the vendor manuals, as Kenn Miller and I talked

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 about, to get the vendor manuals, the factory test  
2 reports, everything that's related to that equipment  
3 so that we have something to at least review to make  
4 sure that what we got is what we got.

5 MR. MELLY: Yes, we're going to reach out  
6 and get as much information as possible about the  
7 donated equipment. There have been challenges in the  
8 past, either language barrier or vintage of procuring  
9 that information from country to country. We're  
10 going to, I think with this round of equipment that's  
11 going to be donated, it's going to be much easier to  
12 obtain that.

13 MR. MILLER: This is Kenn Miller. I  
14 know, too, when we were getting stuff from the Zion  
15 plants, you know, that plant was already down and  
16 being demolished and we couldn't get much  
17 information.

18 MR. TAYLOR: Yes, a lot of the  
19 documentation has been removed for, you know, non-  
20 safety or non-required to maintain. I want to put  
21 that out there because that can save us a lot of  
22 expenses and, if you save us expenses on that aspect,  
23 that means we can potentially do more tests or more  
24 analysis or more in other areas. So I want to put  
25 that out there, but I think, you know, Kenn's comment

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 on being, you know, getting equipment that's very  
2 similar so we have some repetition is also something  
3 we have to weigh. And, you know, if we go out and  
4 procure equipment, I think that's what we tried to do  
5 is try to pick out we want this manufacture, this  
6 model number, we want X number of those types of  
7 equipment. We'll probably be going to basically  
8 salvages equipment or refurbished, as that's what  
9 we've done in the past.

10 MR. MELLY: There are potentials to have  
11 challenges with proprietary information, as well, in  
12 publishing those vendor manuals and things like that.

13 MR. FLEISCHER: Yes, I guess my point is  
14 it would be a shame on us not to ask at least.

15 MR. TAYLOR: All right. Next slide. So  
16 real quick, without getting into too much detail,  
17 Korea is on the left. I guess they're 5 kV rated  
18 breakers. We're not sure of the gears rating, but  
19 we're assuming it's also rated to 5 kV. As for the  
20 vendor manuals, we got a generic manual from them  
21 that's not specific to this set of what they have  
22 procured here, so I think Nick has asked them a  
23 couple of times to get more detailed information on  
24 that. But we know we have -- is it two or four?

25 MR. MELLY: Four.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Four sections of switch  
2 gear, so four cabinets and four breakers. These are  
3 the vertically racked-in medium-voltage breakers from  
4 Korea.

5 And then on Germany I'm not, we met with  
6 them a few weeks ago. They just switched plans with  
7 what utility was donating, so they didn't have all  
8 the information available yet. But right now I think  
9 they're donating four low-voltage switch gear  
10 sections and four medium voltage.

11 MR. MELLY: Yes, with the knowledge that  
12 this plant is shut down. The difficulty in getting  
13 equipment out is that the entire plant is dark, and  
14 they said there's rats everywhere. So they're trying  
15 to get a company to get out the equipment now.

16 MR. TAYLOR: Nick, do you know if these  
17 are air breakers, docking breakers --

18 MR. MELLY: I do not know.

19 MR. TAYLOR: Okay. So that's the only  
20 information we have to collect, but in these two  
21 countries they could not donate money, so this was  
22 the alternative to include their participation. And  
23 both have worked with us in past projects, so it was  
24 valuable to continue that collaboration.

25 All right. So this is something to think

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 about, but, if we go procure equipment, what is  
2 representative, what's realistic, and what should we  
3 go out and -- and this isn't a complete list. This  
4 is just things that I've run into in the past. You  
5 know, you have the Gs, Allis Chalmers, the  
6 Westinghouse IT ADDs, other manufacturers obviously.  
7 But, you know, if I wanted, today, to go out and  
8 procure 30 pieces of gear or 30 sections of gear to  
9 do these tests or however many we need, where should  
10 I focus in on? What's representative of the plants?

11 So do we have comments on that right now,  
12 or we can wait until after lunch to give you guys  
13 time to think about it. I think it's very important  
14 for us, when we go for a procurement, to get the  
15 right equipment.

16 MR. MILLER: This is Kenn Miller. I'm  
17 familiar with the GE Magna-Blast and Westinghouse VS  
18 switch gear.

19 MR. TAYLOR: All right. And then on low  
20 voltage, my list was, there's going to be a lot more.  
21 But the common ones I've run into is, again, the  
22 Westinghouse, GE's. There's going to be other ones.  
23 Next slide.

24 MR. FLEISCHER: The previous one, the GE  
25 Magna Blast and Westinghouse were the most common for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the fleet that I represented.

2 MR. TAYLOR: Magna or Megne?

3 MR. FLEISCHER: Well, actually, GE Magna  
4 Blast.

5 MR. TAYLOR: Magna?

6 MR. FLEISCHER: Yes.

7 MR. TAYLOR: All right. Next slide then,  
8 please. All right. And then the other thing that's  
9 important, you know, we talked about it a little bit  
10 today is you have the arc, you have your source term  
11 from the arc, but then to damage things outside the  
12 cabinet you need to get through the cabinet. And  
13 looking into enclosure thicknesses for the burn-  
14 through times, you know, what's typical? And I  
15 think, from the information we had yesterday, it  
16 seems like they're changing to make the minimum  
17 requirements to meet certain standards.

18 The only thing I could really find out  
19 there on material thickness was from the IEEE  
20 standards, and it's the C37.20.1 and also C37.20.2,  
21 so 20.1 is low voltage and 20.2 is medium voltage,  
22 and they have the same information on the minimum  
23 steel thickness of the enclosures being 1.9  
24 millimeters thick for the enclosure and then  
25 partitions between the primary circuits would be 3

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 millimeters. So that's the minimum that's specified  
2 in that standard. I don't know what's out there in  
3 the plants.

4 So feedback on that would be, I think,  
5 important because one of the reasons why is the  
6 finish test that we did, we didn't have a complete  
7 lineup of gear and all we had was a section. And  
8 where the arc occurs, the partition seemed to be very  
9 thin. I don't know if you have a measurement of  
10 that. It wasn't representative of what we see in a  
11 lot of the other equipment.

12 MR. MELLY: We did not have a measurement  
13 of the thickness of the partition at that point, and  
14 it was a thinner material, as it was going to be  
15 buttoned up to another section. Additionally,  
16 something that gave us another indication was that we  
17 did use a thicker steel material to button up where  
18 the incoming power supply would have gone, and we've  
19 also vaporized that. But it was a question mark in  
20 our minds as to what was the importance of the  
21 various thicknesses for the external cabinet walls,  
22 given that we saw an immediate breach and larger  
23 damage state from this equipment. So it's something  
24 that we're going to be focusing in on, and we want to  
25 really get feedback on what's out there because we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 know it could be across the board.

2 MR. TAYLOR: We're getting close to lunch  
3 here so not much discussion. So another thing, you  
4 know, maybe after lunch we can come back and hit on  
5 it. But we'd like to at least, you know, be  
6 representative in this circumstance because it does  
7 have an impact on the energy that can get out of the  
8 enclosure.

9 And ventilation, again, we might be bound  
10 by what the manufacturer used for the equipment that  
11 we procure, but it does have an impact on pressure  
12 and we want to be representative. So any feedback on  
13 ventilation, we'd be interested to learn more on that  
14 if there are a lot of variations or if we should  
15 just, you know, with the equipment we select, use  
16 what's provided. Obviously, I don't think we should  
17 be out there modifying the enclosures to meet a  
18 certain ventilation but we want to have some feedback  
19 on that.

20 And the last thing before we break is on  
21 bus duct. We've just spent a lot of time on the  
22 enclosures, and I think that's where a lot of our  
23 testing is, but, from the informal survey that went  
24 out, it seems like there's a lot of bus ducts with  
25 aluminum on them. So I already talked about the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 configurations that we planned on doing, the bus  
2 versus enclosure configurations, so we're looking for  
3 feedback on that, as well as what is your bus bar  
4 configurations, square bus bars like we tested in the  
5 previous program, testimony six, rectangular,  
6 circular, or what's your bus bar configurations? I  
7 don't think we're getting into ISO phase buses, so  
8 we'd be looking more on the medium-voltage bus bars  
9 and not the ISO phase going down to your main  
10 transformer. And then the rating or the size of  
11 those buses.

12 So I think now we're almost close to  
13 breaking here. Those are the things maybe we go pig  
14 out during lunch, come back and have this discussion,  
15 unless anybody wants to bring something up right now.  
16 So we'll have the gear we should be procuring,  
17 enclosure thicknesses, bus duct configurations, and  
18 come back after lunch and have a discussion on that.  
19 And then we'll get into Nick's test plan response.

20 MR. SALLEY: Okay. So before we break  
21 for lunch, are we losing anybody this afternoon?  
22 Bob, Shannon, Greg. Well, thank you guys for  
23 attending. I really appreciate it. We'll soldier on  
24 without you after lunch, but we appreciate you being  
25 here.

1           Before we go, though, Frank and I were  
2 talking, there was a number of questions about the  
3 facility generator. Dan, you had a lot of questions  
4 about it. And one of the suggestions and actually an  
5 offer that Frank and Bas are making here, if we  
6 wanted to do a day trip or an afternoon to KEMA to  
7 see the facility, if you think that would help, we  
8 could potentially set something up. Ashley, I work  
9 through EPRI with you and Victoria, with NEI and  
10 Mark, if any of your folks think it would be  
11 worthwhile seeing it, if you could briefly get back  
12 to me. Frank would be gracious enough to set a field  
13 trip up and we could go and you could see the  
14 facility, see what they're doing. If you think that  
15 would be of value, how about getting back to me and  
16 letting me know from there?

17           MR. CIELO: We'd answer any questions  
18 that you have, show you anything, you know, have our  
19 facility people there and our test people available.  
20 Yes, I mean, it's not that we don't want to provide  
21 the information. We can provide the information, but  
22 we want you to be able to put it in a context of the  
23 lab and how the lab actually works and how we  
24 actually function. So we would, you know, we would  
25 absolutely like to, if you guys -- NRC is going to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 spend all this money, taxpayer money, and you're  
2 going to invest all this time and this effort and  
3 it's that important, I mean, I think you'd really  
4 want, I would think you'd want to see the lab and  
5 you'd want to see what the lab is capable of doing  
6 and how it functions and to meet some of the people  
7 that are actually doing the testing. So that's an  
8 open invitation, and I'll leave it up to Mark to let  
9 us know when that is and we'll work it out.

10 MR. SALLEY: All right. Mark, for the  
11 NFPA folks, if it's of value on that, and we'll talk  
12 to Victoria for NEI and see if there's value. We do  
13 this trip a lot. It's a day trip. It takes what?  
14 Three and a half hours from here? It's right up by  
15 our Region I office outside of King of Prussia and  
16 can do it in an afternoon. So we'll put that out.

17 So with that, it's almost 12:00. Let's  
18 break for lunch and be back here by 1:15 downstairs  
19 and let's pick it back up at 1:30 in the afternoon.

20 (Whereupon, the above-entitled matter  
21 went off the record at 11:55 a.m. and resumed at 1:28  
22 p.m.)

23 MR. MELLY: Okay. Starting up, we wanted  
24 to discuss, as we're going to get started again --

25 MR. SALLEY: Before we get started, the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 discussion we were having was pretty good, so we're  
2 not going to try to stick too much to the agenda now.  
3 I think it's more important to get the information  
4 exchange. We want to get that, Gabe, we got a couple  
5 of tables up here that, hopefully, when we rank some  
6 of these and bin some of these, we'll be able to take  
7 that away and we'll include that with this meeting in  
8 some of the information as we move forward.

9           Also, in the same idea of that, as we  
10 look at it, we had a thought over lunch that, you  
11 know, this is similar to what the week-long PIRT  
12 exercise did, and we have that result and we got that  
13 report published. So when we're done with that, Nick  
14 is going to pull out the PIRT and, just for  
15 curiosity's sake, this is what the internationals  
16 have been working on, we'd like to see how this group  
17 ranks the same things as, you know, what's important,  
18 what's medium importance, low importance, and just  
19 see if we're getting alignment between what we've  
20 done a year or so ago with the PIRT versus what we're  
21 doing today. So, again, we'd like to do that this  
22 afternoon.

23           So with that, Gabe, I'll turn it over to  
24 you and pick it back up.

25           MR. TAYLOR:           From this morning's

1 discussion, I think it's important for us to go and  
2 kind of rank some of the parameters so we know what  
3 to focus in on or what's most important for the arc,  
4 arcing events, and also get into this because I  
5 understand, if you haven't had a chance to look at  
6 the PIRT report on this, to understand what they  
7 thought was important. That might help us with our  
8 ranking here.

9           Before we do that, Kenn Fleischer brought  
10 up some information. He looked at 28 plants over  
11 lunch to get information for their transformers from  
12 the unit aux. And from what he found, it's not a  
13 complete of all the plants, but it's a sample that  
14 kind of gives you a representative, hopefully a  
15 representative snapshot that a delta to Y, there's  
16 about 20 plants out of the 28 that has that  
17 configuration. Six of the plants had delta-delta,  
18 two of the plants Y-Y, and he didn't see any Y-deltas  
19 there, but that doesn't mean they don't exist, it  
20 just might not have been included in the sample.

21           So, again, just for the background and  
22 the follow on from the discussion this morning, so  
23 what that might tell us is that we maybe we need to  
24 spend more time looking at the Y configuration since  
25 there seems to be more of a population in that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 configuration versus the delta. So when we look at  
2 the split fraction of events, if we can modify the  
3 test plant to be representative of that, that might  
4 help us out. So I appreciate that information and  
5 we'll take that back as we go and change the test  
6 plant.

7 Okay. So with that, I think, Nick, can  
8 you go over quickly the PIRT results and findings  
9 from that effort?

10 MR. MELLY: Right. And what you're  
11 seeing here is the summary table. It's in Chapter 3  
12 of the PIRT, essentially trying to look at all the  
13 phenomenon on the three scenarios that were ranked  
14 during the study as to what were the most important  
15 characteristics. They have put together level 1  
16 phenomena as the highest importance, level 2 and  
17 level 3, as you go down, decreasing in importance.

18 And the report goes into specifically  
19 what all of these mean. I can quickly go over kind  
20 of what's included in the terminology there.

21 The target characterization essentially  
22 was what is the fragility of the targets that is  
23 being exposed to the HEAF effects, such as is it  
24 thermoset, is it thermoplastic, what's the cable,  
25 what is the damage state, what's seen as a very high

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 parameter to determine what the zone of influence of  
2 damage would be?

3 Moving down, we get to the arc  
4 characterization that included things such as the  
5 current voltage of the arc itself, the arc  
6 mitigation, this would be your protective systems and  
7 devices as to what that can limit the duration of the  
8 event, where am I within the lineup of my specific  
9 plant, and how important is that to determining what  
10 the zone of influence will be?

11 Also, cabinet lineup effects, this was  
12 looking at cabinet damage for damage or, sorry,  
13 whether I'm going to damage an adjacent cabinet from  
14 the zone of influence. And you can see it's missing  
15 from the first two scenarios and only included in a  
16 third because the first two scenarios did not have a  
17 lineup as part of the scenario. If you were to look  
18 in each scenario's detail, we had a lone cabinet to  
19 a cable tray to a cable tray or a lone cabinet to a  
20 both trains of equipment cabinet lineup and it varied  
21 from case to case.

22 Moving down from that, we looked at the  
23 internal ensuing fire, such as what combustible  
24 materials would be in the cabinet as to how large of  
25 a fire we're going to have in that cabinet; external,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what's outside of the cabinet, cable tray again,  
2 material came into play there; pressure effects, am  
3 I going to damage anything in the room from the  
4 pressure effects, and that was largely room  
5 dependent; the electrical configuration, a lot of  
6 factors came into that and they're explained in the  
7 report so I'm not going to dive deep into that one  
8 because it gets a little in the weeds.

9           Then when we get a little bit lower in  
10 importance, you see suppression effects, room  
11 configuration, and fire detection. Those are  
12 primarily listed as low because we didn't see them as  
13 an important factor for determining what the zone of  
14 influence would be. So for example, fire detection,  
15 these events happen so quickly that the detection is  
16 not going to play a role in determining if I have  
17 damage because, clearly, these events create so much  
18 smoke and they're happening so quickly that the  
19 detection is not going to limit the damage that we  
20 see from the initial blast.

21           Room configuration, as well. While we  
22 did see that as important, we tried to be in the  
23 mindset that the zone of influence can be used in any  
24 room configuration if you figure out, it's going to  
25 be scenario specific, which is why it's down low

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 again.

2           Suppression effects came into play  
3 because there hasn't been much work on is my  
4 sprinkler system going to be reliable given that I've  
5 had one of these events, am I going to damage the  
6 capability of my system with an event this scale?

7           So this was the perspective of the  
8 members as to how important things were. It goes  
9 into great detail in the appendices on each  
10 participant's ranking, and it goes into the  
11 scenarios. So to scenario one, you see Train A,  
12 Train B, cable tray, and this is kind of how we  
13 approach the problem. And this is really in parallel  
14 of what we were discussing earlier of binning the  
15 importance of the characteristics, and I feel like  
16 this was the stab to do just that based on the result  
17 of phase one.

18           The report also goes into detail of these  
19 higher importance events in the summary conclusion.  
20 But it's definitely something that we would like  
21 feedback on if it hasn't been something folks have  
22 looked at. It's a pretty all-encompassing report and  
23 a lot of work went into it.

24           Does anyone, it's difficult to have the  
25 discussion without understanding exactly what goes

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 into each of these categories, but does anyone see  
2 something that doesn't align with what they're  
3 thinking would be in terms of importance for  
4 determining a zone of influence?

5 MR. SALLEY: Before you go there, Nick,  
6 one other thing before you go into that is, in the  
7 PIRT exercise, this is to help us drive research. So  
8 the questions that are being asked when they're going  
9 through these scenarios is do we know how to do  
10 something? If we know how to do something, we've got  
11 a lot of experimental data. Then that shakes out  
12 because we can do it. A question will come up with  
13 phenomena, hey, this is the phenomena, now can we run  
14 the experiment, is it something that's reasonable to  
15 do that we can get information? So where does that  
16 lie in our rankings? This is where the  
17 identification and ranking table piece comes in, and  
18 so it goes back to this work that we're talking here  
19 with the experiments. What experiments can we do to  
20 get data to fill holes so that we can better do the  
21 risk analysis on? So that's kind of the underlying  
22 premise that the group was going in.

23 Now, if you wanted something that was  
24 just pie in the sky \$10 million to do it, you'd  
25 obviously washed it off the table because it was not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       achievable. So the goal was to get to achievable  
2       research to help better the problem, and that's the  
3       underlying premise that PIRT starts out.

4                   MR. MELLY: Yes, and you can see that the  
5       questions also ask here that Mark was getting to is  
6       that's the state of the knowledge of the parameter  
7       itself. So is there -- model adequacy was is there  
8       models that can handle this currently? Data  
9       availability is does the data exist to apply into a  
10      model? And the ability to collect the new data, so  
11      how easy it is to collect data on this particular  
12      parameter. It would be easy to collect the data, it  
13      would just be extremely expensive to collect the  
14      data, so that was also taken into account as the  
15      ability.

16      But this might actually be a good place to show the  
17      breakdown that was included in each of these  
18      phenomena.

19                   So this was probably the better place to  
20      go. For the electrical configuration, we're talking  
21      power supply, electrical tension coordination,  
22      internal cabinet configuration with things like the  
23      breaker configuration, cabinet compartmentalization,  
24      cabinet combustible loading, bus bar configuration.  
25      This gets to the horizontal/vertical discussion that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we were having as affecting the energy release.  
2 External cabinet. Again, ventilation, structural  
3 design, cabinet penetration. Arc characterization,  
4 arc migration, breaching the enclosure, electrical  
5 characterization, thermal effects of the arc,  
6 magnetic effects of the arc, electromagnetic  
7 interference. This one, as you can see here, low,  
8 medium, and these are the rankings of the individual  
9 members and they're compiled in that summary table  
10 you saw above.

11 A lot of them also have notes as to why  
12 some folks differed from others in their rankings.  
13 Not all of them, though. Fire protection, presence,  
14 characterization of the system. Fire suppression  
15 presence, the fire suppression effects. Pressure  
16 effects, projectile, missile damage, pressure wave,  
17 internal ensuing fire, fire ignition,  
18 characterization of the fire source, fire  
19 development. This gets into the T=0 that's currently  
20 frequently used. Smoke generation, altered  
21 ventilation effects, the ensuing fire. Very similar,  
22 smoke generation and things like that.

23 Then we get into the room configuration,  
24 that was room integrity, the room arrangement, room  
25 ventilation. Then we get back up to the summary.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But when we do our discussion here, it's  
2 going to be interesting. And we can go back to this  
3 PIRT if we think that the current in the voltage, as  
4 well as the protective systems, are the highest  
5 important parameters, we can compare with what the  
6 PIRT has ranked those on the individual parameters  
7 throughout this report.

8           And, again, this was a week-long  
9 phenomena ranking elicitation exercise with, I  
10 believe, seven countries who participated.

11           MR. PLETZ: The conductive cloud, is that  
12 included under the pressure effects?

13           MR. MELLY: That will be included, I  
14 believe it is in the arc migration. We discussed  
15 that in the arc ejecta.

16           MR. SALLEY: Nick, why don't you walk  
17 through the parameters to see, generally, how the  
18 people ranked them, if they're in similar alignment  
19 with what . . .

20           MR. MELLY: It's a little difficult to do  
21 that with the three scenarios differing.

22           MR. SHUDAK: Can I get a clarification  
23 from this morning? The medium voltage testing, are  
24 you still planning on doing it at the 4 kV and 6.9  
25 kFV, or did you say you're only going to be doing it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 at the 6.9?

2 MR. TAYLOR: So the question was, for me,  
3 voltage testing, are we going to be testing it 4.160  
4 or 6.9 kV?

5 MR. SHUDAK: Or both.

6 MR. TAYLOR: Or both. Right now, the  
7 majority of the testing will be 6.9, except for that  
8 equipment that was donated. From the specifications  
9 that they sent us, it looked like it's only rated for  
10 5 kV, so we'll test that at 4.160 if we receive it.

11 MR. SHUDAK: Okay.

12 MR. TAYLOR: But right now, the plan  
13 wasn't to test anything else at 4.160. And if you  
14 look at the arc voltage, the presentation I provided,  
15 it seemed like the system voltage didn't have much of  
16 an effect on the arc voltage. That's one of the  
17 reasons why I put that together. So I don't see, we  
18 don't have any real preference, but, right now, the  
19 plan was to go 6.9.

20 MR. SHUDAK: If you're looking at other  
21 donated equipment, if it comes from, you might get  
22 other donated equipment that would be 4 kV equipment.  
23 I'm assuming you'll test it at that?

24 MR. TAYLOR: Yes, correct. So the  
25 question was if we get other equipment donated that's

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 not rated for the higher voltages, what are we  
2 testing that? We're not going to test it beyond what  
3 it's rated for, so if we get a 4 kV or 5 kV piece of  
4 gear, we're not going to test it at 6.9 or do  
5 anything higher. We'll test it at 4.160.

6 MR. MELLY: And to answer the previous  
7 question, the gas and the cloud conduct with  
8 particulate is included in the arc characterization  
9 portion of what you saw in the above table, and that  
10 was one of the high parameters ranked for importance  
11 of determining the zone of influence. So it's one of  
12 the relatively high ones.

13 MR. FLEISCHER: Kenneth Fleischer from  
14 EPRI. The one thing I don't see in there that I  
15 noticed in the background on page eight of the phase  
16 two test plan is it said that the PIRT panel covered  
17 three distinct HEAFs, the first was an HEAF occurring  
18 in an electrical enclosure with a cable tray passing  
19 over the enclosure, but I don't see anything where  
20 the test plant gets into considering the enclosure as  
21 being a target in the zone of influence.

22 MR. MELLY: The enclosure. Do you want  
23 me to speak to --

24 MR. FLEISCHER: I'm sorry. It's the  
25 cable tray.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   MR. MELLY: The cable tray. When we get  
2 into my presentation as to how the test, the phase  
3 two will be performed, we'll get a little deeper into  
4 that. But I can speak to it briefly here is that we  
5 hadn't looked into putting a physical cable tray  
6 above the cabinet that we're going to be testing  
7 because we were going to try and focus on the ability  
8 to put instrumentation into measure the effect. By  
9 putting a physical cable tray above the cabinet, we  
10 would be limiting our ability to collect information  
11 at varying distances away from the cabinet. We were  
12 trying not to shield our instrumentation with the  
13 physical cables above the cabinet. So we're  
14 attempting to get all the information we needed which  
15 could then be applied to determining target fragility  
16 and determining whether that cable tray would be  
17 damaged or ignited in that case.

18                   We've received several comments on that  
19 on whether we would have a physical cable tray above,  
20 as well as what materials would be put into that  
21 cable tray, whether it be thermoset or thermoplastic  
22 cables. However, the current plan was to focus on  
23 collecting the heat flux data at varying distances so  
24 that it can then be applied to the target  
25 fragilities. Gabe spoke a little bit to that, but

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that would be a secondary piece to make the link-up  
2 between the data collected in phase two and the  
3 probable damage states. So that's what we had  
4 currently planned for the phase two of testing.

5 MR. TAYLOR: And just to add a little to  
6 that is that, you know, let's say we go out and want  
7 to put in, hypothetically, a test tray. Obviously,  
8 we're going to have limitations with measurement and  
9 devices, as Nick mentioned, and also what cable do we  
10 test? You know, if we test one cable, does it  
11 represent X, Y, and Z, and also, you know, you're  
12 looking at does the HEAF damage the cable from a  
13 functionality standpoint and does it ignite a cable  
14 from a fire propagation standpoint. And both the  
15 material and configurations are going to have a lot  
16 of influence on those two aspects, so it's another  
17 parameter that's just going to add a lot of  
18 variability and we can't reproduce enough tests to  
19 capture all those variations.

20 So we felt that hanging good measurements  
21 with the instruments would serve us better than  
22 trying to get a cable tray in. But, you know, if  
23 there's ways around that or if there's ways to bound  
24 things, you know, we're still open ears.

25 MR. TURNER: It's so cheap just to stick

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 on a couple of cable samples, like I used to on  
2 tests. One of my hindsight things was I should have  
3 been sticking little cable samples around all over  
4 the place and didn't. You know, you just do the  
5 resistance before and after if you want to, but it's  
6 cheap and it's quick. So tests are so expensive and  
7 so rare, in hindsight, I would have done a lot more  
8 of that if I had a chance, so you ought to think  
9 about doing that.

10 The other thing is, even though you're  
11 measuring these fluxes, the exposures are so short,  
12 I don't know how you can relate it to something, like  
13 cable ignition where we not only have to have fairly  
14 long durations of exposure, like 30 seconds, you  
15 would say here's the flux it takes at 30 seconds. We  
16 got this flux over two seconds, I don't think you're  
17 going to be able to figure out if the cable without  
18 the actual cable.

19 So it's cheap. I put cable samples up  
20 there. If you look at the IE we're working on now  
21 where I did a lot of cable sampling, I would just  
22 change that from, rather than solid metal sample  
23 holders, use expanded metals so it gets air behind it  
24 and it's got more of a chance to ignite it when it  
25 gets hot enough.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MELLY: Yes, that's a good point.

2 MR. PUTORTI: That's currently in the  
3 test plan is to put samples of cable along -- Tony  
4 Putorti, NIST. The current test plan has small  
5 samples of cable. We just have to make sure that we  
6 don't pack things so tight that we disrupt, you know,  
7 the various levels of measurements that we're trying  
8 to do and different distances.

9 MR. TAYLOR: Okay. So I guess the change  
10 then is the cable tray. All right. That is one  
11 change that we're making.

12 MR. MELLY: And this is what Tony was  
13 referring to. In the current plan, we do have cable  
14 coupons on the mock test stands that we've discussed,  
15 as opposed to the full tray. We didn't receive much  
16 feedback on the PIRT when it was published and made  
17 publicly-available. We're open to any review or any  
18 comments on differing opinions as to the importance  
19 of certain characteristics, and it is a pretty in-  
20 depth report. It's very difficult to skim over the  
21 entire thing within a few minutes of today's effort  
22 without wasting too much time but --

23 MR. TAYLOR: Yes, and the feedback  
24 doesn't have to be different. If you think there's  
25 a conclusion in here that you guys agree with, I

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 mean, that's just as valuable feedback.

2 Okay. So not hearing anything on the  
3 webinars, all right. So then, Nick, can you pull  
4 back the presentation from this morning and go up to  
5 an earlier spot where it had all the variables?  
6 Actually, let's stay here because we kind of, it was  
7 kind of getting towards lunch and we were kind of  
8 winding down.

9 So after lunch, has anybody thought of  
10 other equipment models that are common that you see  
11 out in plants? Right now, we have identified the GE  
12 Magna Blast and the Westinghouse DB-50s that I  
13 believe are common from earlier discussion.

14 MR. MILLER: Another low voltage one is  
15 ITE. It's pretty old. This would be, like, 60s or  
16 early 70s.

17 MR. MELLY: I believe that was the one  
18 that was at Fort Calhoun, as well, the ITE series.

19 MR. TAYLOR: Okay. Well, again, if you  
20 go back to your plants and you have that information,  
21 please get it to Nick or I.

22 Next slide. Keep going. Thicknesses.  
23 You know, these are minimum in the standard. I don't  
24 know when the standard had these in it versus when it  
25 didn't and when the standard came out. So given the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 vintage of the plants, I'm not sure that this was  
2 applicable at those times, but this is kind of what  
3 we're working on. I think what we do for equipment,  
4 we make sure that we're meeting these minimums. But,  
5 again, the realistic side, does anybody have any  
6 thoughts or feedback on what the actual equipment  
7 enclosure characteristics are?

8 MR. MELLY: That's a tough one off the  
9 top of your head.

10 MR. TAYLOR: Without looking.

11 MR. MELLY: But this is one where if  
12 anyone digs into this from spec sheets or things like  
13 that as to what the actual equipment thicknesses are,  
14 it would be a good comparison to what we plan on  
15 purchasing.

16 MR. TAYLOR: Enclosure ventilation. I  
17 think for this morning it's going to depend on what  
18 we procure. I'm not hearing other feedback, so I  
19 think that's kind of where we, I believe, want to  
20 comment.

21 MR. FLEISCHER: Ken Fleischer from EPRI.  
22 I was thinking earlier about what you said. You were  
23 making a distinction whether it's indoor or outdoor,  
24 right? I'm familiar with outdoor units that actually  
25 have heaters and vents, so they actually do circulate

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the heat rise through them, whereas I'm also familiar  
2 with indoor. They're more sealed. I don't know, are  
3 we, I don't think, are we considering trying to  
4 represent any outdoor bus testing?

5 MR. MELLY: We were not going to, we had  
6 not focused on that as a major parameter to look at,  
7 whether it's indoor design versus outdoor design. We  
8 are trying to stay middle of the road again. From  
9 our phase one of testing, when we did have to create  
10 a mock cabinet, we were donated breakers and we built  
11 a cabinet around it. We created typical venting at  
12 the top of the cabinet, which we've seen throughout  
13 several plants. It wasn't louvered design, but it  
14 was almost checkerboard top vent. So we're really  
15 just trying to be representative of what's out there,  
16 and we've seen a lot of cases where you just have the  
17 louvered design on the back face of the cabinet.

18 MR. FLEISCHER: Okay. My thought would  
19 be is maybe we don't put a lot of importance on the  
20 outdoor, just similar like the large transformers, I  
21 think, that were discarded because they're outside  
22 pretty much, you know, the air is like a heat sink,  
23 it's just not really to just go right into atmosphere  
24 and pretty much be attenuated. You could treat the  
25 outdoors non-safe bus the same and really consider

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what the representative types are indoors.

2 MR. MELLY: So would you say that they're  
3 representative type for indoor switch gear and medium  
4 voltage would be sealed, not vented?

5 MR. FLEISCHER: Yes, the ones I've seen  
6 are pretty much sealed, non-vented. This is non-safe  
7 bus, right, we're talking? Not enclosures. We're  
8 talking -- did I get on the wrong topic here?

9 MR. MELLY: I was talking about the  
10 enclosure, but if we're talking about ducts, yes, I  
11 would say no vent.

12 MR. FLEISCHER: All right. My mistake.  
13 But I have seen, we do have outdoor turbine decks  
14 where we do have some of that equipment outdoors, but  
15 it's non-safe.

16 MR. RHODES: This is Bob Rhodes, Duke  
17 Energy. The non-safe bus ducts that I'm familiar  
18 with at Harris Robinson, they all have a breather  
19 about the size of a quarter on the bottom of the  
20 duct. It's sealed at the top, but it's not airtight,  
21 which is one of the reasons that we assume that the  
22 smoke would get into there and cause an issue. Of  
23 course, ours all have the coating that was mentioned  
24 earlier, so they're all insulated. Norrell, yes.

25 MR. MELLY: The one we pulled from Zion

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 also had the boots, as well as the insulation on it.

2 MR. MILLER: Could we go back to the  
3 panel thickness one again? So are we asking that  
4 because we're going to be fabricating --

5 MR. MELLY: No, we do not plan on  
6 fabricating the cabinet --

7 MR. MILLER: We're just going to be  
8 testing the equipment we've got which has already got  
9 a defined enclosure, right?

10 MR. MELLY: Yes.

11 MR. TAYLOR: So I think it's getting at  
12 the phase one testing where we have the international  
13 equipment that got donated and the partitions weren't  
14 these thicknesses. So, you know, we wanted to make  
15 sure that, moving forward, we test equipment --

16 MR. MELLY: In addition, we were hoping  
17 to get some information as to when we do procure the  
18 equipment to test that it's representative of what is  
19 currently out there.

20 MR. TAYLOR: I think, along your lines we  
21 get equipment from whatever manufacturer and it meets  
22 these, then we should be okay.

23 MR. MILLER: Or I guess if it doesn't, we  
24 would just make note of that? Because, I mean, if  
25 they were bought to all the standards before these

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 took place or they changed --

2 MR. MELLY: Yes, that's a good point.  
3 And I guess it's definitely what we want to consider  
4 when we're going through a procurement.

5 And then the last one on bus ducts, was  
6 there any additional thought on the configurations,  
7 how we had it broken down in the test plan and mixed  
8 tree of tests, aluminum bus, aluminum duct, and so  
9 forth, on different configurations? Does anybody in  
10 the room say, hey, we don't have aluminum bus steel  
11 ducts or whatever their configuration is? I know we  
12 have aluminum and copper, aluminum bus bars/aluminum  
13 enclosure, copper bus bars/aluminum enclosure, I'm  
14 assuming we have copper/steel. So nobody is  
15 objecting to any of these four configurations?

16 MR. EARLEY: And while you're on this  
17 piece, I'll mention that I checked out one of the  
18 papers on this. The horizontal configuration is  
19 worse than the vertical configuration. And the  
20 horizontal configuration, the magnetic effect propels  
21 the plasma cloud outward.

22 MR. TAYLOR: Thank you. So it is more on  
23 the plasma cloud being more --

24 MR. EARLEY: Well, the incident energy is  
25 higher.

1           MR. TAYLOR: Incident energy is higher  
2 also for the horizontal configuration. Okay. And  
3 then, you know, ratings of the buses, I think that's  
4 something that I do have access to in the information  
5 we have, but if there's any feedback from the group  
6 here on we know our buses rated to 1600 amps or  
7 whatever it is, we'd like to test something that's  
8 close to what's out there. So any feedback on that?  
9 All right. So I think I can work with our electrical  
10 group and see where the population is. Nick, do you  
11 have anything else on the test parameter?

12           MR. MELLY: No, not at this time. But  
13 one thing in the test parameter that's not currently  
14 well defined is the physical arrangement of how the  
15 bus ducts will be tested. There's some pictures in  
16 there. So that's one area that we are going to be  
17 enhancing as we go forward with the test plan. It's  
18 going to be the second phase of testing, so we're  
19 most likely a year away from even beginning any bus  
20 duct tests.

21           There was a very robust design and test  
22 that was done by Cooper on their bus ducts, and it  
23 was very interesting and the results seemed to work  
24 very well with what we're trying to do. So we may be  
25 piggybacking off of tests that have already been

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 done.

2 So this is actually, what was in the test  
3 plan, we received several comments as to why there  
4 was the physical break in the bus duct that was  
5 depicted, and that was an attempt to try and keep the  
6 arc in this location because we were worried about  
7 just continuing down the magnetic path and having the  
8 arc migrate to the very end of the bus duct.

9 After seeing some of their testing, at  
10 least with insulated bus ducts, we don't know if  
11 that's going to be necessary to put that physical  
12 break in there if there's the insulation. If there's  
13 no insulation, we still don't know whether that's  
14 going to be a problem. But, again, you can see that  
15 we would have the instrument tests then located at  
16 various distances around the bus duct itself.

17 In another picture, we had a cabinet  
18 determination point, and we do not know if we are  
19 going to need that arrangement set up. So this  
20 picture here was we had it terminated again to a  
21 cabinet. We don't think that we will need that  
22 arrangement.

23 We'll go over this in a little bit more  
24 detail when I'm doing my presentation on the phase  
25 two test plan. But any thoughts on this would be --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Yes, I think from this  
2 morning's discussion, we talked about maybe splitting  
3 it up half insulated/half not or some fraction of  
4 that. And for the insulated --

5 MR. MELLY: For the insulated cases, I  
6 think, you know, we can do what was previously done  
7 by Cooper and peel the insulation off from a section  
8 where we initiate the arc and it should stabilize in  
9 that location. But for cases where we don't have the  
10 insulation, does anybody object to what we had here  
11 where we actually physically separated, had a  
12 separation along the bus and we initiate the arc  
13 obviously on the power side of the bus, and, again,  
14 it's to help maintain the arc in one location so we  
15 can get good measure, decent measurement in that  
16 location, because without that the magnetic forces  
17 should push the arc out and away from where we  
18 initiated that. And, you know, not having it  
19 confined and not having a more continuous  
20 configuration is basically just blow everything right  
21 out the end and we don't have open bus ducts in the  
22 plant. So that was kind of our approach.

23 MR. SHUDAK: This is Tom Shudak from  
24 Nebraska Public Power. Related to the Cooper testing  
25 that was done, the picture you showed there has the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 switch gear at the end. We had a lot of discussion  
2 on what we tested ours, and if you put caps on the  
3 end of them as you guys did on the Zion where you  
4 capped that end of it, we didn't feel that was  
5 realistic. And so we spent a lot of time and  
6 modeling of it to see if we needed to have caps on  
7 it.

8 So I guess if you're not going to put the  
9 cap on there, I guess we'd like to know, I'd like to  
10 know if you're going to put something on the end of  
11 those. There's lots of supports that go along the  
12 way that would slow down any pressure wave, and these  
13 things just keep going on and on, right? They're  
14 very lengthy. They don't end. So I guess if you're  
15 going to turn that one at the end of it, that's going  
16 to impact, I think, your test results.

17 MR. MELLY: And that's also, that's one  
18 good point you brought up is that, in that testing  
19 that was done, you did not have a cap on the end  
20 because you did have those supports periodically  
21 beyond where the test was initiated. We have not  
22 procured these yet, so we don't know how they're  
23 going to be physically arranged within the bus duct  
24 itself. If we do have those supports, it might not  
25 be necessary to put the cap on the end. However, if

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 it is just a continuous run without any support in  
2 the way from procurement, we may need to physically  
3 cap the end or have a termination into a cabinet.

4 MR. TAYLOR: And it doesn't necessarily  
5 have to be a cabinet that we procure. We can build  
6 a cabinet and put some ventilation on it and just  
7 terminate it into that just to kind of represent the  
8 end effect of a long run. But I think it's a good  
9 point on, you know, you have the support pieces, the  
10 support members it goes down the length of the bus,  
11 and, you know, the question I then was asked is do we  
12 include those? I think we would, depending on what  
13 we procure and what the design spec is.

14 MR. MELLY: And one other consideration  
15 is that when we had put together this test plan, one  
16 of the reasons why we had the cap in originally, as  
17 well as the reason why we had this physical  
18 termination, is we were testing in one of KEMA's test  
19 cells, it's test cell seven, which had their medium-  
20 voltage incoming power supply on the left-hand side  
21 of the cell and the low-voltage on the right-hand  
22 side of the cell, and we were very worried about  
23 damaging the adjacent power supply from that cloud  
24 that you saw in the test video.

25 We have moved all of our medium-voltage

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 tests, I believe, we moved them all to test cell nine  
2 where we don't have that concern. One of the test  
3 cell walls is completely devoid of any kind of power  
4 supply, so we'll just be able to not worry about  
5 damaging anything. And that cap did not work very  
6 long, as you can see by the video.

7 But as you can see here, I'm getting a  
8 little bit ahead of myself, but we have the varying  
9 levels of instrumentation stands so that we don't  
10 have just one static three-foot instrumentation  
11 point, so we can actually get different levels of  
12 instrumentation. And if we damage one, we'll have  
13 backups at different distances. For the Finland test  
14 that we did run on test 23, we destroyed the  
15 instrumentation tests they have, so we have very  
16 little information as to what the flux was at the  
17 three-foot zone of influence, and we had no  
18 redundancy beyond that. So while we do have other  
19 instrumentation at different points around the  
20 cabinet, it gives us very little information as to  
21 the immediate effect from that test.

22 MR. AIRD: We have a question from the  
23 webinar from David Lochbaum. His question is do the  
24 cameras provide information needed to assess the  
25 severity of the HEAF event or is their role to help

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 market the badness of HEAF events?

2 MR. TAYLOR: I can attempt to address  
3 that. So there's two types of cameras that we used  
4 in the past. There's the regular video cameras that  
5 take high speed photography video of the event. We  
6 can use that partially to look at the shrapnel and  
7 any type of metal that leaves the compartment. And  
8 then we have the thermal measurements, as well, so we  
9 have some high-speed high-arc cameras that we've been  
10 using that NIST has. I think there's some  
11 limitations with their initial camera that we used,  
12 and we've been working with his to get a camera that  
13 has a larger, what they call dynamic range, and it  
14 automatically changes the ranges, meaning it can  
15 capture different temperature ranges of the event.

16 So with that information, we can better  
17 characterize the temperature rise of different  
18 components or surfaces of the enclosure and use  
19 information that way. I don't know if NIST or Nick  
20 had anything to say.

21 MR. MELLY: The high-speed camera that we  
22 actually used, it was also possible to watch the arc  
23 migration from point to point within the cabinet in  
24 certain cases. There was some early on testing where  
25 you could actually see the initial arc strike and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 then watch the arc move to a different portion of the  
2 cabinet, and you could see it re-strike and start the  
3 arc in a different location. So that video was very  
4 helpful in watching what was occurring during these  
5 events.

6 MR. PUTORTI: Tony Putorti from NIST. So  
7 one other thing that we plan to do with these extra  
8 cameras that we've added is that not only do you get  
9 a qualitative idea of the extent of the arc ejecta  
10 but also most of these cameras are not going to be at  
11 a right angle, so it's relatively easy to go and get  
12 a quantitative view of where the arc ejecta is, what  
13 the extent is, and where it is in relation to the  
14 instruments that we have installed.

15 MR. FLEISCHER: Ken Fleischer, EPRI. I  
16 like how you set up the three-tier there so that you  
17 said before if you lose something you get the next  
18 level. Should the bias be significant, some of those  
19 coupons may fall off and onto the floor. They're  
20 going to be individually marked, so you know when you  
21 pick them off of the floor which rack they came from.  
22 Good.

23 MR. MELLY: The answer was yes to that  
24 question.

25 MR. FUNK: This is Dan Funk. A quick

1 question on --

2 MR. TAYLOR: Let's go to Dan, and then  
3 we'll come back to Stan.

4 MR. FUNK: A quick question on the test  
5 setup. We're going to force the damage to be where  
6 you started obviously. That's the intent here. And  
7 so you're going to prevent the natural phenomena that  
8 I think we all agree takes place typically to a  
9 termination point. Is the intent of this design to  
10 simulate a segmented bus duct to where you're failing  
11 at a joint or is the intent for this to apply to both  
12 segmented and non-segmented, and that's going to tie  
13 back into our current practice, which for non-  
14 segmented bus ducts, because of the magnetic effect,  
15 we postulate the HEAF event actually at the main  
16 breaker terminals and not anywhere along the path.  
17 This, depending on how the results are applied, could  
18 dramatically influence that.

19 MR. MELLY: This was more taking in mind  
20 the segmented effect, so we'd be doing it at the  
21 joint or at the bolted connection in the bus duct.  
22 For those that are occurring at the termination  
23 points, we were trying to map that to the damage of  
24 the enclosure testing, rather than the bus duct  
25 testing. So those plants which welded the bus ducts

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 rather than have the bolted connection, they would be  
2 matched to the enclosure testing results, and we're  
3 going to try and clarify that in the methodology.

4 For here, where we're actually trying to  
5 focus where it occurs, it is to try and simulate that  
6 bolted connection in that case.

7 MR. JOGLAR: So before we run the test,  
8 vision is to stay consistent with the FAQ on the zone  
9 of influence for this thing?

10 MR. MELLY: We are using that as the  
11 starting point. However, there's no way for us to  
12 locate that 37 feet above the ground.

13 MR. JOGLAR: No, no, but at least for the  
14 non-segmented ones, I think you said just put it on  
15 the breaker.

16 MR. MELLY: Yes, we're staying consistent  
17 with that because we have no OpE to make us think  
18 that anything has changed in that realm. Any other  
19 follow-up questions from the --

20 MR. GARDOCKI: Well, where are you going  
21 to go into, you've got another presentation,  
22 positions, the racks and where --

23 MR. MELLY: So the question was how many  
24 racks are we going to place. The picture on the  
25 screen right now depicts three above and three below.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Tony, do you want to take that? Right now, the  
2 current plan is to have three varying levels.

3 MR. PUTORTI: Tony Putorti from NIST. So  
4 are you referring to the bus duct here or to the  
5 enclosures?

6 MR. GARDOCKI: Test coupons. You're  
7 going to have one position?

8 MR. PUTORTI: For this particular setup?

9 MR. MELLY: So for this particular setup  
10 where you see the three racks, each rack will be  
11 depicted or placed with, this is what the proposed  
12 rack would include. So each rack would include these  
13 instrumentation pieces, so multiple coupons and the  
14 depicted instrumentation.

15 MR. PUTORTI: And so we have slugs, the  
16 classic slugs for clothing around there. Click  
17 thermometers are on there used for measuring heat  
18 flux, as well as a new tee-cap sensor that we're  
19 working on now which measures, we'll be able to  
20 measure very high heat fluxes, as well as some  
21 coupons to collect any types of materials that may  
22 coat things in the vicinity, as well as the samples  
23 of cable.

24 MR. MELLY: And, again, right now, what  
25 we're showing on the screen is for the enclosures.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Again, you see that the three test stands, again,  
2 this is not done on scale so don't think that they're  
3 all going to be that close together, but the  
4 intention is to have the varying distances of  
5 instrumentation racks that are not cluttered enough  
6 to actually impede the hot gases, so we have included  
7 instrumentation at varying distances. That was one  
8 of the questions we got that these were not  
9 consistent with the mentioned spacing that was  
10 consistent with the IEEE guide, and that was for a  
11 reason in that we're going to be designing these with  
12 minimal impedance for the hot gases coming out.

13 Any other questions before we move on?

14 MR. TAYLOR: So, you know, we still have  
15 Nick's presentation on the test plan and the counter-  
16 resolution, and we're going to get to that. But one  
17 thing that came out of this morning's discussion was  
18 should we look at the parameters and the things that  
19 we can change and kind of rank their priority?

20 So what I've done is I've put together a  
21 list here on two sheets, everything from arc  
22 location, grounding configuration, winding  
23 configuration of your transformers, the supply,  
24 whether we're going to model from their generator at  
25 decaying current or a steady-state current as we've

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 done in the past. Obviously, duration voltage and  
2 current are going to be important.

3 And on the second sheet here, you know,  
4 enclosure thickness, bus insulation, circuit  
5 characteristics, and that was, you know, providing a  
6 sample from the plant of the circuit characteristics.  
7 Bus bar, gap separation of the buses. Equipment  
8 separation. You know, older plants and newer plants  
9 have differences in designs. Is that important? DC  
10 offset or phase initiation angle, ventilation,  
11 aluminum alloy or bus material.

12 There's more. We can put them up there,  
13 but what I'd like to do is kind of go through those  
14 and rank them from a priority or importance  
15 standpoint, how important is it to our test protocol?  
16 High, medium, low. So I think that's kind of the  
17 suggestion earlier from Ken, so is it okay if we just  
18 start going through those and kind of throwing out  
19 our plans? I'm going to use a different color for  
20 the ranking.

21 So starting off on these three, I already  
22 think that they're going to be high importance. So  
23 duration, does everybody agree it's of high  
24 importance? Anybody disagree? Okay. So we'll put  
25 high for duration. Voltage, high, medium, low? All

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 right, okay. Any disagreement with high on voltage?  
2 All right. So the comment was the excitation voltage  
3 isn't going to change much. The arc voltage is what  
4 we're interested in. The batteries might be dead in  
5 that one, Ken.

6 Okay. So arc voltage, high. And then  
7 current, is that going to be high, medium, or low?  
8 High? Medium? Low? Abstentions? All right. So  
9 high on that one, too. I kind of thought that's  
10 where those would fall.

11 Arc location, you know, I put horizontal  
12 and vertical, and that was the feedback from NFPA  
13 that showed, the recent research showed that  
14 horizontal had a higher incident of energy than the  
15 vertical orientations. So that might influence where  
16 we put the arcing wire in our experiments, maybe more  
17 on the bus section of the enclosures.

18 So for arc location, how important is  
19 that to the overall HEAF event? Do I have any highs,  
20 high importance rankings? Medium? What about low?  
21 I'm getting zero feedback.

22 MR. FLEISCHER: I think it's still high.

23 MR. MELLY: I have one question on this  
24 as to, for the results that were during the NFPA  
25 testing that showed horizontal, initiation showed a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 higher energy in the plume, is that because the  
2 instrumentation was located in a horizontal direction  
3 or was it not due to the instrumentation locations?  
4 So that's what I'm trying to get at is that, if I  
5 initiated the arc in a vertical orientation, were  
6 there vertical instrumentation locations that would  
7 have still been in the plume or was the energy, were  
8 the results calculated at the front face of the  
9 cabinet because personnel were the objective of the  
10 testing?

11 MR. TAYLOR: Well, of course, that is a  
12 major objective of the testing is the personnel and  
13 how much it tends to impact them. And the plasma did  
14 move in that direction. Of course, the magnetic  
15 effect pushed it in that direction, and it also  
16 indicated that the effect was worse when the fault  
17 took place deep inside the cabinet.

18 MR. MELLY: So that's, I think, a good  
19 clarification because if we are going to be putting  
20 our instrumentation both horizontally and vertically  
21 because we're worried about both the three foot and  
22 the five foot, I think it's something to keep in mind  
23 that it might not have the same effect because we're  
24 worried about the plume and the magnetic effects in  
25 both the horizontal direction, as well as vertically.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 So it may have a lower importance than what some  
2 people have typically seen in literature for our  
3 specific case.

4 MR. TAYLOR: Yes, it may not have the  
5 effect on the overhead cable tray, whereas that was  
6 non-arcal.

7 MR. MELLY: Right. So if I can, I  
8 actually have a test --

9 MR. EARLEY: I think I know what test  
10 he's talking about, and the sensors were in the front  
11 so they were engulfed in a side plume that came out  
12 horizontally.

13 MR. MELLY: And I can show the --

14 MR. EARLEY: The vertical plume is just  
15 looking at the side and it's not engulfed.

16 MR. MELLY: And I'll show one of the  
17 tests right after the break. I can pull up where we  
18 had a test that was initiated on a vertical section  
19 of the bus bar material within the cabinet. It was  
20 our OECD NEA Test 11, and the arc was directed  
21 vertically, in the vertical orientation, but we do  
22 have test stands in the front of the cabinet, so  
23 you'll completely see that we're going to get lower  
24 results on our horizontal facing where the personnel  
25 would be versus where we're instrumenting at the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 vertical case. So that's just something to keep in  
2 mind when we're putting this ranking on.

3 Okay. So, again, for arc location, who  
4 thinks that that is of high importance? Dan.

5 MR. FUNK: I'm looking at the recommended  
6 updates to 1584, and horizontal versus vertical, they  
7 say it's about twice the impact. So I think it's  
8 probably important because if we're going to be  
9 playing with zones of influence, it's something we  
10 need to know. Maybe it can all be handled by  
11 research of what 1584 did. And you're correct. If  
12 they're relying on it for the tests, it's kind of  
13 what you would expect. But it's probably something  
14 we should know a little bit more up-front than before  
15 we spend all the money for the tests.

16 MR. TAYLOR: So we have two votes for  
17 high. Anybody else? Three. All right. Raise hands  
18 for high. Now we have three, four, five, six.  
19 Mediums? And lows? One medium. Okay. So three  
20 lows, a medium, the majority high.

21 Grounding configuration. It seemed like,  
22 because we were doing three phase, that the grounding  
23 configuration wasn't that important. So, you know,  
24 we could go and we could solidly ground it or we can  
25 higher-resistant ground it or we could leave it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 floating, right? And I think some of that has to do  
2 with the machine team, what they can best protect  
3 from overheating losses. So they left, but that's  
4 something we also have to consider.

5 But from the group that's still here, how  
6 important do we think grounding configuration is for  
7 the test that we plan to do? Do we think it's a low  
8 priority, a medium parameter priority, or high?  
9 Okay. So for high? Who think it's of high  
10 importance? We have one in the back, two. Medium?  
11 One, two, three, four, five. And low? Two. Two-  
12 five-two. Oh, I missed Nick. Two-five-three. So  
13 you're doing high, medium, low, right?

14 MR. MELLY: Yes.

15 MR. TURNER: I'll just cover, the way we  
16 do the test for Japan is we're mainly looking at  
17 energy and really high energy events. We don't care  
18 what the grounding is, as long as we get the current  
19 we ask for and the duration we ask for. And the  
20 reason we do that is KEMA is setting up with you to  
21 meet your best for 23 kiloamps. They look at the  
22 variety of circuits they can do and what combinations  
23 of things can give them a nice, steady 23 kiloamps  
24 with the duration you asked for. Sometimes, it's  
25 steadier in Y and sometimes it's steadier in delta,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and so they'll just recommend a circuit to me and I  
2 don't care whether it's Y or delta because we rarely  
3 see anything --

4 MR. MELLY: Yes, I'm with Steve. Change  
5 mine to low, so change one of the mediums to low.

6 MR. TAYLOR: I'll go back through. Dan,  
7 you had a comment?

8 MR. FUNK: Yes, I'm going to basically  
9 qualify my high. Some of what Steve said, I think  
10 the grounding configuration, where it's important is  
11 actually in frequency. If you have an ungrounded or  
12 a high-grounded system, you're likelihood of  
13 protection failure is actually, in my mind, going way  
14 down, so I think it's a frequency issue more than  
15 maybe the testing which is what you're interested in.  
16 Does that make sense?

17 MR. TURNER: Yes, and the testing at KEMA  
18 is, of course, complicated because the frequency is  
19 going to go down as the rotor slows down to give you  
20 the power. So an example, a test where you're  
21 running 40 megajoules, they might start out running  
22 them at 60 hertz on the generator, but by the time  
23 you finish the test it's running 48. It slows down  
24 that much. When you're out there in the generator  
25 hall, you just hear it grinding down.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FUNK: Yes, I'm sorry. When I say  
2 frequency, I mean probability --

3 MR. TAYLOR: Okay. So let's go ahead  
4 around the room again for the grounding  
5 configuration, importance of that parameter to the  
6 actual testing, who think it's a highly important  
7 parameter? No hand raises. All right. What about  
8 medium? Medium importance? And low? One, two,  
9 three, four, five, six, seven, so it looks like it's,  
10 for those who voted, it's low on that, Nick. We're  
11 not putting your names up here, so don't feel  
12 bashful. Please provide the feedback on this.

13 All right. Grounding configuration,  
14 delta versus Y. I think the information that Ken  
15 gave us is pretty useful for when we split up the  
16 different configurations but then, again, you know,  
17 comments we've heard, as long as we get the  
18 characteristics of the fault that we want from the  
19 laboratory, it may not be that important.

20 So for delta versus Y winding  
21 configurations, what's the belief for its important?  
22 Who thinks it's a highly important parameter for the  
23 testing? Medium? Low? So we have one medium, and  
24 one, two, three, four, five, six, seven, eight, nine,  
25 nine on the low.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           MR. FLEISCHER: I would like to ask a  
2 question on that because I think maybe you guys have  
3 experience. So the face-to-face voltage between a Y  
4 and a delta is different, but you're saying that the  
5 testing you've seen is always the arc voltage and  
6 have you seen the arc voltage similar, regardless of  
7 whether it's a Y or a delta?

8           MR. MILLER: Yes.

9           MR. FLEISCHER: They're the same?

10          MR. MILLER: Yes.

11          MR. FLEISCHER: All right. Then go ahead  
12 and change mine to low.

13          MR. TAYLOR: Okay. So that's another  
14 unanimous low, a unanimous decision on that one. All  
15 right. Another thing that we had for a variable is  
16 the supply. With KEMA super-excitation configuration  
17 at their site, we can basically do a steady-state  
18 current, which is what we've been doing in the past.  
19 However, for medium voltage with the unit conducted  
20 designs, the generators want to trip. It's going to  
21 coast down and continue to feed the fault, so you'll  
22 have a decaying current for as long as that fault is  
23 locked in.

24                        So the question here is how important is  
25 it to test the actual decay that you see in the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 plants versus the steady state that we've been doing  
2 to the testing?

3 MR. TURNER: How big is the decay before  
4 the generator can't hold it anymore? Ten percent,  
5 thirty percent?

6 MR. TAYLOR: The question is how big is  
7 the decay before the generator can't maintain the  
8 voltage.

9 MR. FLEISCHER: So I don't want to steer  
10 anybody in the wrong direction. I don't know off the  
11 top of my head. I don't want to venture to guess.  
12 I'd rather get facts. I'm going to see if I can find  
13 a digital fault record that would accurately record  
14 that type of information. I'm aware of one plant  
15 where I may have access that was a generator, it was  
16 a six-second generator fit fault. No, Turkey Point  
17 suffered a flashover of the main power transformer.  
18 Actually, the arcing fault was on the high-voltage  
19 terminals, so the main power transformer. But it  
20 would show you how the generator responded to it  
21 because remember we did a root cause.

22 I'm going to see if that -- and I  
23 remember we pulled a DFR. I'm going to see if I can  
24 find that DFR. That would then tell me what happens,  
25 but I would anticipate, again, let's walk through the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 scenario, right? You're basically, you've tripped,  
2 you got a HEAF. The plant has tripped. Part of that  
3 is a plant differential. You open the yard breaker,  
4 so you have no voltage contribution from the switch  
5 yard. You're now just with the generator with maybe  
6 like a stuck breaker. So you're going to have an  
7 immediate step change because the exciter fuel  
8 breaker is going to half open, so really it's going  
9 to be the residual magnetism of the rotor. The rotor  
10 won't even be excited. So, therefore, you're going  
11 to have an immediate step change down and then, from  
12 there, you will have a decay. And I think that's  
13 what we saw on the digital fault recorder.

14 So I did make a note to go see if I can  
15 find that. Is it 70 percent? I don't know. I can't  
16 remember.

17 But as far as going for a vote, I think  
18 right now, unless we run into a technical  
19 feasibility, I vote yes. That's a tie. Fifty  
20 percent of the plants are on off-site power, fifty  
21 percent are off the generator.

22 MR. FUNK: I'd like to second Ken's  
23 perspective. It's not, you don't run into a  
24 practical limitation because right now these unit-  
25 connected designs or that coast down are, quite

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 frankly, what's driving some of the answers we're  
2 coming up with in our database checks. So  
3 understanding that phenomena I think could be pretty  
4 important if that holds true that the unit-connected  
5 design is vulnerable.

6 MR. TAYLOR: Any other comments before we  
7 go to vote?

8 MR. TURNER: I'm thinking we're mainly  
9 trying to learn about energy and the ZOI, so I'd say  
10 if the current only drops ten percent that doesn't  
11 change the energy very much and you don't learn  
12 anything. If it changes 80 percent, you may as well  
13 have run just a duration half as much. But I don't  
14 know if KEMA can do as much as 80 percent. They can  
15 probably do probably a 30 percent drop-off.

16 MR. FUNK: That's fine, but just  
17 understanding the phenomena, I think, so we can go in  
18 with our eyes open and not closed is what's  
19 important.

20 Tests aren't ever perfect.

21 MR. MELLY: One thing to note, we do plan  
22 to make a test plan change to include this decay as  
23 part of the medium-voltage testing. It will require  
24 plant information where we are looking to dig deeper  
25 on this so we do know what to tell KEMA to do

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 because, currently, it's very easy to -- yes, we will  
2 need a sample profile to give.

3 MR. TAYLOR: Yes, and then we'll also  
4 have to enter discussions with KEMA to see what  
5 they're capable of doing. And if they're not capable  
6 of doing what's representative, we need to maybe see  
7 what they can do, run some tests with that, and then  
8 have comparison.

9 Okay. So if there's no more discussion,  
10 we'll go to see where we are. So for the decay  
11 versus that steady state, who thinks that's a highly  
12 important parameter? One vote, two vote, three,  
13 four, five. Five for high. Medium? Six for medium.  
14 And low? Two for low. I think that's it for this  
15 sheet.

16 You have a question from the webinar?  
17 Okay.

18 MR. MELLY: We have another low from Dave  
19 Lochbaum on the phone.

20 MR. TAYLOR: So one low from the  
21 participant on the webinar.

22 MR. MELLY: Also, for those on the  
23 webinar who are listening in, feel free to also voice  
24 your opinion and we will include the counts. That's  
25 very easy for Tom to relay that information to us.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Yes. And just to add on to  
2 Nick, if we missed you going through those, the  
3 rankings, you can see them on the screen. Please  
4 feed that to Tom and we can update.

5 MR. MELLY: Yes, if we can update any of  
6 these fields, if you would like to provide your input  
7 on what's currently shown on the screen.

8 MR. TAYLOR: Okay. Let's just work down  
9 my list. It's not in any particular order.  
10 Enclosure thickness. Who thinks that -- is there any  
11 discussion on enclosure thickness? So who thinks  
12 that's a highly important parameter? Medium  
13 importance? One in the back, two, three. And low  
14 importance? Eight. So three for medium and eight  
15 for low.

16 The next one is bus insulation. I think  
17 what we talked about earlier is we tried to split the  
18 experiments up half insulated and half not. But,  
19 again, do we think that's important for, an important  
20 variable for the HEAF phenomena? Do you want any  
21 discussion on the bus insulation?

22 MR. TURNER: Can you define it a little  
23 bit more? Are you talking about the really thick  
24 ceramic we put on bus bars sometimes, or are you just  
25 talking about some insulation that's thermal, like a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 boot?

2 MR. TAYLOR: I'm not an expert in the bus  
3 insulation. I don't know if anybody --

4 MR. SHUDAK: Ours is a thermal boot.

5 MR. TURNER: Yes. And so those, the arcs  
6 just tend to blow right through those. If you have  
7 a heavier ceramic that surrounding, like a square bus  
8 bar, it doesn't tend to burn that back as fast. You  
9 won't burn as much of a bus bar. And if it's  
10 aluminum, you won't need as much aluminum in there  
11 because you didn't run as much bus bar. But if it's  
12 just a heat shrink wrap on there or a boot, it's  
13 hosed. It's going to go right through that stuff,  
14 and it just makes the experiment messy.

15 MR. TAYLOR: Are we aware of any that's  
16 ceramic configurations out there?

17 MR. TURNER: Well, that's what you tested  
18 on the bus duct design, that real heavy ceramic that  
19 was --

20 MR. FLEISCHER: Yes, probably Norrell,  
21 right? It's like a sleeve. It's actually, it's not  
22 rubber, it's a sleeve you slide on.

23 MR. TURNER: Yes, and it's pretty heavy.

24 MR. MELLY: And where we initiated the  
25 arc, we removed that wrapping.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TURNER: It's one of those, I think  
2 it's high. If it's just a boot, I don't think it  
3 matters.

4 MR. TAYLOR: Okay. So I think what I'm  
5 hearing is it depends on type, but, you know, I  
6 think, with that understanding, whether it's either  
7 the shrunk on or the ceramic type, do we think that's  
8 important for the HEAF phenomena?

9 MR. FLEISCHER: I have one clarification.  
10 Ken Fleischer, EPRI. So I think what I'm hearing,  
11 though, is maybe we separate that bus insulation for  
12 switch gear in bus insulation. We're not saying bus.  
13 It sounds like it makes a difference there. It  
14 sounds like for one it doesn't make a difference.  
15 You said, regardless, whether it's the rubber or the  
16 boot, it's going to blow by anyway. And I think a  
17 majority of the switch gear is either non-insulated  
18 or if it is insulated it's that, whereas a non-seg  
19 will typically have that more robust insulation. I  
20 would recommend splitting that. Yes, so the first  
21 one would be a bus insulation for non-seg bus, and  
22 the second one would be bus insulation for load  
23 centers and switch gear.

24 MR. TAYLOR: All right. So on the first  
25 one, bus insulation for enclosures, votes for high

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 importance? Medium? Low? Eight for low.

2 MR. MELLY: Do we have anything else?

3 MR. TAYLOR: Nobody for medium or high.

4 Bus insulation for non-segregated bus duct. High?

5 High importance? One, two, three, four, five, six,

6 seven, eight. Eight votes. Oh, nine votes for high.

7 Medium, medium importance? One, one vote for medium.

8 Low? No votes for low.

9 All right. Next is circuit  
10 characteristics. And this, I think, from our  
11 discussion was characteristics from a plant to help  
12 us inform and understand how to set up the generators  
13 that came up. I don't know if we want to have any  
14 discussion or clarification on that, Dan. I think  
15 that was one of the comments you brought up.

16 MR. FUNK: Well, I think you probably  
17 did.

18 I think the discussions over the past two days, the  
19 voltage current, time duration, detriment, we've  
20 probably beat that to death. And the idea of being  
21 able to characterize the test circuit, you know, we  
22 got feedback from KEMA on that already. We've  
23 discussed that we may need to try to come up with a  
24 representative system that we would expect them to at  
25 least be able to replicate within reason.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Any other discussion?

2 MR. TURNER: And I think they can  
3 probably give you, once they set the circuit up, they  
4 give you an effective reactance for that circuit, so  
5 here's what it is and here are the components we used  
6 to get it. They're still confused on why you need  
7 that information, but I said don't worry about it,  
8 they do models and stuff.

9 MR. TAYLOR: Okay. So from the ranking,  
10 who believes that to be highly important for the  
11 program? We got one high, two highs. Medium? Four,  
12 five, six, seven. Sorry, seven. Two highs, seven  
13 mediums, and low? Anybody believes that to be of low  
14 importance? Okay.

15 Bus gap separation? I think we've kind  
16 of shown that it has an effect on your arc voltage,  
17 and we already ranked arc voltage before as being a  
18 highly important parameter. So, you know, we could  
19 group it there, but keeping it separate, who believes  
20 that that's highly important to characterize and  
21 understand what we're testing in the program. So for  
22 high? Eleven, eleven highs. Medium? And low  
23 importance? One low.

24 MR. TURNER: And let me explain why I'm  
25 low. Usually, when these arcs set themselves up,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 they're trying to go phase to phase. What matters is  
2 where they can find a way to connect the circuit so  
3 this phase can connect back to that phase. And it  
4 could be a metal wall that's a certain distance away  
5 where it's just at an open space. It really doesn't  
6 matter how far the bus bars are apart, even if it's  
7 a half an inch or an inch. It's the length it's  
8 going to to find its way back to the phase it's  
9 trying to come back to, so I don't think the spacing  
10 has as much effect as the surroundings, but it's the  
11 closest thing by which usually is what sets the arc  
12 voltage.

13 MR. TAYLOR: Okay. We're going to skip  
14 over this one. We'll come back to it. DC offset and  
15 phase angle. And phase angle when you initiate the  
16 arc, so it's this phase angle. You start the arc,  
17 and it has some effect on your asymmetric nature of  
18 your current wave form. And I think just from what  
19 I discussed earlier, it may have some effect on the  
20 pressure. But from the overall program, you know,  
21 what do we expect the importance of the DC offset or  
22 the asymmetric nature of the wave form on the HEAF  
23 event? Is there any discussion on that parameter?

24 So who believes it's a highly important  
25 parameter? Medium? Five mediums. Low? And three

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 lows.

2 I don't know why it took Kenny so long to  
3 do. We're doing this in an afternoon. I wonder if  
4 Ken is still on the line.

5 Next one is ventilation. So this is the  
6 ventilation, and this one might be one we were going  
7 to separate enclosures and bus ducts, as well. But  
8 ventilation for enclosures, who believes that to be  
9 a -- well, first, is there any discussion on the  
10 ventilation aspect?

11 MR. FLEISCHER: This is more for  
12 clarification for me. So we're talking about a  
13 ventilation, I think I heard earlier that it can make  
14 a difference as to where the arc plume is directed.

15  
16 MR. TAYLOR: Some of the literature I've  
17 looked at, it can have an effect on the arc  
18 characteristics: the diameter of the arc, the arc  
19 voltage to a point. I don't know if Steve has got  
20 anything else on that piece.

21 MR. FLEISCHER: All right. Since we're  
22 worried about the zone of influence and whether it's  
23 going to be directed at it or away from it, and it  
24 sounds to me that, okay, so it sounds to me it's  
25 really important.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: I think the other thing is,  
2 you know, Nick brought up yesterday with the louvered  
3 vents in some of those, and Mark touched on it, too,  
4 some of the effects there, that might have some  
5 impact of where the arc projects energy out of the  
6 enclosure and the breach occurs or a door opens.

7 MR. MELLY: Well, what we've seen in  
8 testing is that the ventilation points for a lot of  
9 these cabinets are typically where the plume and the  
10 plasma is directed just from that's where all the  
11 material is going. We have seen the louvers just  
12 completely vaporize, but that is the location where  
13 the louvers are that these zone of influence is  
14 typically directed. It's a weak point in the  
15 cabinet. It's where the easiest, the path of least  
16 resistance.

17 MR. TAYLOR: Okay. So any other  
18 discussion on that ventilation?

19 MR. RHODES: And this is Bob Rhodes,  
20 Harris. I've seen buses, I've got buses that have a  
21 ventilation that you all haven't discussed which is  
22 on the top, it's got a top hat arrangement, and so I  
23 haven't heard any discussion about that.

24 MR. MELLY: So we have had experience  
25 with the top hat arrangement in some of the Japanese

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 testing that was done. When they were trying to  
2 recreate the event that occurred at Onagawa, they did  
3 use a top hat design, and we, again, saw that that  
4 was the direction that the plume and the plasma  
5 wanted to head because of the ventilation.

6 MR. TAYLOR: Okay. So for ventilation on  
7 enclosures, not bus ducts but on enclosures, who  
8 believes that to be a highly important parameter?  
9 Nine. Medium importance? One. Low importance?  
10 Zero.

11 Okay. What about the bus ducts now? I  
12 think we've had a discussion of some of the  
13 variations. Who believes that to be highly  
14 important, ventilation on bus ducts? Medium  
15 importance? One, two, three. Low importance? Seven  
16 on low.

17 Okay. And on the last one that I have,  
18 well, second to last, aluminum alloy. We haven't  
19 really talked too much about this. In the test plan  
20 that we had for the small scale, we had some  
21 discussion in there on the different types of alloys  
22 that can be encountered. And I think, you know, we  
23 picked one of the alloys in there, but I think  
24 there's going to be some variation of what's used out  
25 in the plants.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So just on that variable of different  
2 alloys, aluminum, I don't think there's going to be  
3 much variation, but do we believe that there's going  
4 to have to be a big impact from the HEAF phenomenon  
5 that parameter? Any discussion on the alloy aspect?

6           Okay. So who thinks that's a highly  
7 important variable or parameter?

8           MR. TURNER: Discuss it a little bit  
9 more. You mean an actual alloy, or do you mean the  
10 type of aluminum, or do you mean --

11          MR. TAYLOR: Type of aluminum. Type of  
12 aluminum in the bus bars, yes. Well, bus bars or bus  
13 duct. So who thinks that's of high importance on the  
14 HEAF phenomenon? I've got one. Medium? And low?

15          MR. MELLY: And I'm going to explain my  
16 --

17          MR. TAYLOR: Seven on low.

18          MR. MELLY: Let me explain my high is  
19 that if we did this testing for the first round and  
20 someone asked me if aluminum versus copper was going  
21 to be of high importance, I would have said not at  
22 all. And we thought that going into the first round  
23 of testing. So I think my state of knowledge as to  
24 whether aluminum is going to be such a large impact  
25 is so low that I'm going to err on the side of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 caution.

2 MR. TAYLOR: So you're making the  
3 discussion of we didn't think aluminum versus copper  
4 would be much of a difference, but we saw a big  
5 difference. I think what the question here that  
6 we're asking is does the alloys make a big  
7 difference, and you're saying that, because we saw a  
8 big difference in the other things and also the  
9 alloys, there might be differences between aluminum  
10 material. We're not comparing it to copper and  
11 aluminum. So is that the --

12 MR. MELLY: Yes. Because if we had a  
13 state of knowledge ranking, as well, it would be low.

14 MR. TAYLOR: So I think we had seven.  
15 One low -- sorry. One high and seven low, eight low.  
16 Who votes low on that one? Seven. So it was seven.

17

18 And then the last one doesn't really have  
19 too much to do with experimental plants, but we did  
20 bring it up when we were talking about the pilot  
21 plants and that relates to the equipment separation  
22 and understanding, you know, out in the plants, the  
23 different separation of equipment that's important  
24 for either safe shutdown or redundant divisions. I  
25 wanted to bring up a discussion point. It may go

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 into some of the decisions of where we put the racks,  
2 the instruments, you know, how we space those.

3 So I put up here is there any discussion  
4 on aspects of equipment separation out in plants and  
5 how we would then instrument the experiments as that  
6 being an important parameter. I think right now,  
7 just a little more clarification, we're basically  
8 looking at multiple distances, so we have maybe three  
9 feet, six feet, nine feet, something along those  
10 lines, from a horizontal distance out from the  
11 enclosure is what we're planning on doing right now.  
12 You know, is there some logic or some configurations  
13 where we would look at something different?

14 MR. AIRD: A question from the webinar  
15 real quickly back to the aluminum alloy. The  
16 question is from Preston Cooper from TVA. His  
17 question or comment is that can we include the  
18 testing of this alloy using a chemistry tape  
19 analysis?

20 MR. TAYLOR: I'm not sure I'm following  
21 the comment.

22 MR. AIRD: If we get better information  
23 from Preston, we'll get back to you.

24 MR. TAYLOR: Does anybody else in the  
25 room have an idea of what their comment was --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. PELLIZZARI: Well, I guess is the  
2 intention to, I mean, are you going to intentionally  
3 test different alloys with aluminum, or you're just  
4 presupposing you're going to get different alloys  
5 with aluminum in your various equipment?

6 MR. TAYLOR: So we don't know what the  
7 population is out there. So we looked in a little  
8 bit, and there's some variation among the alloys that  
9 we could procure that are commonly used in electrical  
10 conductors. So we wanted to make sure that we were  
11 being representative but also, if there is variation  
12 among there, that, you know, we vary it accordingly.  
13 And what we're asking here is do we think that that  
14 parameter has a large effect on the HEAF phenomena,  
15 HEAF energy?

16 MR. MELLY: And as part of the Cooper  
17 testing, it was also a question that came up as to  
18 what the composition or the alloy of aluminum is used  
19 for the enclosure. This is very difficult  
20 information to obtain from the specifications that  
21 were done 30 - 40 some odd years ago as to  
22 specifically what alloy of aluminum is used in the  
23 manufacturing of the equipment, and there are  
24 primarily two different predominant alloys that can  
25 be chosen for use in the electrical distribution, as

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 well as the enclosure design.

2 MR. TAYLOR: Did you get any  
3 clarification? Okay. We'll wait on that. Again, I  
4 put this equipment separation up here because it was  
5 on the board back there and I thought it might have  
6 some impact, at least for the instrument. So is  
7 there any additional discussion on that?

8 MR. SHUDAK: This is Tom Shudak from  
9 Nebraska Public Power. So just a sort of  
10 clarification on this question. Those rotation racks  
11 will have coupons on there that will be able to  
12 determine the impact on equipment. I think it's  
13 important that we are going to have cables on there  
14 to see if those can ignite.

15 The location of the equipment is also  
16 important, too, and that they can penetrate that  
17 equipment because that's one of the ways we're  
18 looking at it. It's not just a three foot or five  
19 foot. It's also to the point where it comes up  
20 against something non-combustible that's going to  
21 stop the projectiles. So those facing that is, I  
22 think, critical. Right now, I think we're using  
23 three foot and five foot, so I think we have to  
24 follow on at least with the current, and the tighter  
25 those are the better. I'd hate to have to go from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 three foot to nine foot if I modeled it in our  
2 current plan.

3 MR. TAYLOR: All right. So maybe I can  
4 rephrase this. Rather than equipment separation,  
5 sensor separation or measurement device location.  
6 That might be a better way to characterize it.

7 MR. MILLER: Was that what the item was?  
8 Like GDC 17 separation?

9 MR. TAYLOR: So I think it was related to  
10 one of the comments that Bob brought up of over  
11 equipment having both safety and non-safety equipment  
12 in the same room and the separation can vary. So  
13 that's kind of where I got it from, but, you know,  
14 from a test parameter, how do we relate that into  
15 what we're going to be capturing? I think it might  
16 fit better on where we locate the instrument rack so  
17 that we can then, you know, look at the impacts that  
18 we're measuring from the instrument racks to the  
19 separation because separation is plant specific. I'm  
20 not sure we can go out and capture everything for the  
21 test years that we're going to do.

22 MR. MILLER: This is Kenn Miller. When  
23 I think of separation, too, I guess the conducted  
24 plume aspect of this is of interest because of the  
25 visibility to reach beyond the range, particularly

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 filling the room.

2 MR. TAYLOR: So on that piece, we're  
3 looking to use those aerial gels by carbon tape and  
4 then do the XPS analysis to see what the conductivity  
5 is. We don't have a live measurement of  
6 conductivity, like a temporal measurement.  
7 Obviously, if anybody knows the way to do that, we're  
8 more than interested to learn about it. But that's  
9 one way we're looking at measuring the conductivity.  
10 And, again, those coupons can be put on these  
11 instrument racks and post-analyzed.

12 So if I can kind of rephrase the  
13 parameter to measurement, what did I call it?  
14 Measurement separation or measurement locations.  
15 Maybe in the comments, we can put target locations.  
16 And position, yes. So distance, as well as whether  
17 it's above, to the side, in front for positions.

18 So anymore discussion on that parameter  
19 there? Okay. So who thinks that this is a highly  
20 important parameter for the experimental? Thirteen.  
21 So thirteen high. I don't think there -- that was  
22 pretty much everybody. Medium? Medium importance?  
23 And low?

24 MR. MELLY: We also got the most votes  
25 for this one.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Okay. Make sure you save  
2 that file, Nick. I don't want to lose the progress  
3 we've made so far. So I think that's all I had for  
4 the list. Were there any other parameters that we  
5 thought were important, or not important but we felt  
6 should be considered and ranked? Okay. Not hearing  
7 any. Is there anything else from this morning's  
8 discussion and early afternoon's discussion on test  
9 parameters that we want to touch on?

10 MR. MILLER: Or definitions.

11 MR. TAYLOR: Is there anything on the  
12 webinar?

13 MR. TURNER: Does anybody ever anticipate  
14 using arc resistance switch gear in the future where  
15 the flap opens and all the hot gas goes out a vent  
16 and goes around a corner and gets dumped outside or  
17 something like that? Does anybody anticipate having  
18 that? Because we haven't done any testing on that  
19 stuff, even though it really helps the worker who's  
20 standing right in front of the cabinet. We keep  
21 telling the people that invented it that this is  
22 really bad for us in fire protection because now you  
23 just put the flame over there. The response is yes,  
24 but we've got barriers in there. It captures most of  
25 the heat, and those emissions only last for a couple

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of tenths of a second, so they're consumed. So if we  
2 had one of these long arcs, here I am putting the  
3 flame out 20 feet away from where the accident is and  
4 changing it. So I'm just curious if anybody ever  
5 plans on putting those things in there, which are  
6 great for personal protection but horrible for . . .

7 MR. MELLY: Stan.

8 MR. GARDOCKI: We are in discussion on  
9 our panels. We were discussing how the arc transits  
10 through the atmosphere, so one of the parameters I  
11 was thinking, the atmosphere conditions, whether it's  
12 humidity or dryness, temperature, if that's the case  
13 of the arc transiting through an atmosphere but arc  
14 versus a thermal arc or something like that, is  
15 atmospheric conditions going to influence how far  
16 this heat goes with the aluminum that's in the cloud?  
17 I would open that for discussion for anyone who  
18 thinks that would be an impact on this aluminum heat.

19 MR. TURNER: A parameter of interest?

20 MR. TAYLOR: Was that something that the  
21 NFAA or IEEE will do for all their arc flash testing  
22 that you're aware of?

23 MR. EARLEY: No, we did not.

24 MR. MELLY: As part of our testing on  
25 phase one, we did record all atmospheric conditions

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 on test days: humidity, temperature --

2 MR. MILLER: Those were outdoors, right?

3 MR. MELLY: -- barometric pressure. We  
4 were outdoors. So we did have a range of conditions  
5 that we tested in. Rain the Japanese tested in, but  
6 a lot of snow. We were outside. We covered a fairly  
7 good range in Pennsylvania. We have not taken the  
8 time to look into the effect, primarily because we  
9 didn't have the electrical conductivity measure live  
10 to make the comparison to humidity or other  
11 conditions. But that's something that I guess is  
12 still open for discussion right now whether we think  
13 that's an important event.

14 For my opinion, I think it may be of  
15 importance to the initiation and to the frequency, as  
16 well, and some of the events, the Monshawn  
17 particularly saw the humidity, the atmosphere, and  
18 the salt, potentially the outdoors, that could have  
19 contributed to the initiation of the event. I don't  
20 know about the consequence of the event. Dan.

21 MR. FUNK: Yes, I would second what Nick  
22 is saying. I've seen an amount of research done for  
23 pollution and surface contamination but only as an  
24 initiator. Like, a lot of utilities have programs  
25 where they go out and wash down switch gear and stuff

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 for just their very purpose for the measure, what  
2 part of the country you're in or where you're at for  
3 cumulative deposits of pollution and continue to  
4 degrade the overall surface resistance, but I've  
5 never heard it being a factor once you get an arc  
6 started. It's such a minor contributor to the  
7 temperatures and forces.

8 MR. TURNER: My perception of it is the  
9 original atmosphere that starts in the cabinet is  
10 completely changed in five milliseconds. Everything  
11 is completely difference because you push all of that  
12 out real quick. And then the plasma itself is behind  
13 the initial pressure front, and it's kind of doing  
14 its own thing in its self-made atmosphere. There's  
15 not much difference in that self-made atmosphere,  
16 depending on the original conditions.

17 So I agree. It might have something to  
18 do with the initiation of the fault that started it.  
19 But once you get that arc going, it kind of, I don't  
20 think it's going to have much effect at all. And you  
21 can see some of the effects on the atmospheres around  
22 it because there's a lot of tests with SF-6. So you  
23 don't even have air insulated anymore, so you know  
24 that SF-6 and air insulation see some differences in  
25 terms of how the arc is located and the energy, but

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 not as much as you'd think. So I don't know if you'd  
2 want to handle SF-6 different than here.

3 MR. TAYLOR: Okay. That's great  
4 feedback. Any other discussion on atmospheric  
5 conditions for the actual HEAF event? Okay. Let's  
6 take a quick vote then. So who believes that the  
7 atmospheric condition parameter has a high impact on  
8 the HEAF phenomena? Medium? One for medium. Low?  
9 Ten, ten for low.

10 Anything else that we've missed?

11 MR. MILLER: I'm sorry.

12 MR. TURNER: Oxygen availability. Is  
13 that an atmospheric condition?

14 MR. GARDOCKI: You need to oxidize the  
15 aluminum to get the --

16 MR. TURNER: And we're not sure how that  
17 works in the testing we do. When I've made  
18 calculations, I said let's just assume the oxygen is  
19 there. It might run out of oxygen, we just don't  
20 know because I've run tests where you get a nice  
21 plume going out the top, you could conceive that it  
22 could actually draw air in, like your fireplace in  
23 your house when you've got plenty of oxygen because  
24 arcs feed the oxygen going into the arc, not this  
25 way. They feed it from the ins where it's starting.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           We plan to run some tests to try to  
2 figure out how the oxygen level changes in these  
3 larger things. So that's a big effect that we're  
4 testing for Japan.

5           MR. TAYLOR: So any other discussion on  
6 the oxygen availability ventilation aspects?

7           MR. PUTORTI: Tony Putorti, NIST. But  
8 that was something that I was thinking of when we  
9 originally were looking at ventilation. So, you  
10 know, is that something that we've already covered in  
11 ventilating the enclosure up top?

12          MR. MELLY: I think they're linked but a  
13 different aspect.

14          MR. TAYLOR: It might be worthwhile to  
15 separate, as you've done here. So, you know,  
16 ventilation is just more of a physical configuration  
17 and the impact it has on the event versus, you know,  
18 oxygen availability, especially on the aluminum  
19 piece. Do we have enough oxygen to oxidize the  
20 metal? So let's go ahead and -- I mean, it makes  
21 sense to me to keep them separate. Does the group  
22 agree? I see some heads nod.

23           Okay. So for oxygen availability for  
24 aluminum, who believes that to be a highly important  
25 parameter? Eight. Medium importance? Two, three.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 And low importance?

2 We'll do the same thing for copper. So  
3 high importance for copper, oxygen availability?  
4 Medium importance? Two. And low importance? Nine,  
5 ten. Your hand is up, right, Nick?

6 MR. MELLY: Yes.

7 MR. TAYLOR: Yes, ten. Anything else?  
8 Any other parameters? Anything from the webinar?  
9 Okay. So I think that kind of -- I appreciate all  
10 the feedback. It's really good information. I  
11 think, especially if we go and formalize the test  
12 plan and finalize what we're going to do moving  
13 forward, it's going to help provide feedback to us.

14 I think at this time it would be a good  
15 time to take a break. So it's 10 after right now.  
16 Let's come back at 3:30. And then Nick will get into  
17 the test plan and the changes that he's made to it  
18 that resolve the comments at the high level and then  
19 anything we want to bring up with regard to the test  
20 plan and that aspect, we can do that. So we'll go on  
21 break now until 3:30.

22 MR. MELLY: Small-scale testing, you find  
23 something or add, I mean, is that going to input  
24 something to this, or you don't think you'll have  
25 enough time after the small-scale testing to impact

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 this?

2 MR. TAYLOR: So the question is we're  
3 doing small-scale testing and how will that be used  
4 to impact how we're going to change the test program  
5 for full scale. Okay. That characterizes the  
6 question. I don't really see a lot of the small  
7 scale on the HEAF phenomena or the energy output  
8 really supporting much on the large scale, but the  
9 real purpose of the small scale is to characterize  
10 the particles to help further develop the model that  
11 Maryland is working on. So there will be some  
12 information there that can be used, but also it's  
13 proof of concept so those aerial gels and the black  
14 carbon tape, we can then use that for here and we can  
15 put those at those test stands, as Nick was showing  
16 you earlier, or we can even put those, because  
17 they're passive devices, we can put them inside the  
18 enclosure which is really where we want them because  
19 that's where a lot of the additional energy from the  
20 aluminum is going to occur inside the enclosure. So  
21 we'll have some feedback there.

22 But as far as, like, the HEAF phenomena  
23 and the parameters that we're using for large-scale,  
24 I don't see the small-scale informing that much. I  
25 don't know if Nick or anybody else have anything to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 add.

2 MR. MELLY: Yes, I agree. It's more for  
3 the additional instrumentation which may be used for  
4 the large-scale testing to focus in on that  
5 conductive cloud of aluminum, as well as some of the  
6 videography that we'll be doing to capture the  
7 particulate.

8 MR. TAYLOR: And that's a good point.  
9 And, actually, the question that David Lochbaum  
10 brought up, that's one thing we missed is that the  
11 Sandia equipment has the potential to be able to  
12 track particles to get the velocity, which can be  
13 important for the model that we're working on. So  
14 we'll probably try that out. We are going to try  
15 that out on the full-scale side, so that's another  
16 thing in the small-scale we'll be using.

17 MR. GARDOCKI: How about the percentage  
18 of aluminum of the components? Are we going to be  
19 able to draw an analogy to how much aluminum grams  
20 inside the cabinets, per se, and draw that out to say  
21 the more aluminum the larger HEAF, or are we going to  
22 do some kind of staging or percentages of aluminum  
23 content?

24 MR. MELLY: We can get into that a little  
25 bit when I discuss the test plan as our plan for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 evaluating that and trying to make some energy  
2 calculations, yes, energy correlations based on how  
3 much aluminum is missing from the bus bars after the  
4 test program, how we're going to be collecting that  
5 information, and post analyzing it. And, hopefully,  
6 there will be drawbacks to the small scale because,  
7 as Dave said, one of the things that we're looking at  
8 is the amount of aluminum that is removed in a small-  
9 scale testing to do our energy calculations there,  
10 which is one of the reasons why we're downsizing the  
11 bus bars at Sandia so that we can more accurately  
12 predict how much aluminum has been removed from the  
13 bus bar.

14 MR. TAYLOR: Does that answer --

15 MR. GARDOCKI: Yes, I mean, I don't know  
16 if you want to incorporate in your test parameters to  
17 get good representation of how much will be consumed  
18 or if it happens too fast, consume all of it, or how  
19 much in a particular time period. I'm not sure  
20 whether the physics of these dynamics of how the  
21 plasma develops and time spanning of the arc.

22 MR. TAYLOR: Yes, I think that's  
23 something that we'd probably measure on the back end,  
24 so measuring before and afters.

25 MR. GARDOCKI: If you don't have enough

1 aluminum in there, then you're not going to get the  
2 spectra.

3 MR. MELLY: I think we have that covered  
4 in both the factors that we have on the board, such  
5 as the ventilation, oxygen availability with the  
6 aluminum, as well as the duration of the event will  
7 both influence how much aluminum is involved in the  
8 process.

9 MR. GARDOCKI: But your cabinets are  
10 going to have a certain amount of aluminum or you're  
11 going to add it into it.

12 MR. MELLY: The cabinets will have a  
13 certain amount of aluminum, and we will be measuring  
14 the total weight of the bus bars before we run the  
15 test and after we run the test so we'll know exactly  
16 how much aluminum was lost during the test. One of  
17 the uncertainties, I will say, will be that we do  
18 have this particulate and you can see the objective,  
19 which is solid aluminum, rather than oxidized or  
20 vaporized aluminum, so there will be particulate when  
21 we have these tests to see the multiple aluminum  
22 pieces, as well as the slag thrown in all directions  
23 in the high-speed videos. That will be the  
24 uncertainty of the test. But in terms of the bus  
25 bars, we will be doing putting in post-monitoring of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the weight of the bus bars themselves. So that's one  
2 aspect that we'll be looking into in greater detail  
3 in the phase two test program, which does add a lot  
4 of time to the post-processing and the analysis of  
5 each test that we plan on running. And I'll cover  
6 that in a little bit more detail on my next  
7 presentation.

8 MR. MELLY: All right. I think we're  
9 ready for a break, and we will come back in 15  
10 minutes.

11 (Whereupon, the above-entitled matter  
12 went off the record at 3:14 p.m. and resumed at 3:34  
13 p.m.)

14 MR. MELLY: Okay, we're going to get  
15 started here real quick on the -- this is the second  
16 to last presentation. It may end up being the last.

17 A lot of the comment review, we've kind  
18 of knocked off one by one throughout the discussion  
19 in the morning.

20 I'll quickly go through that last  
21 presentation, but I think that we may have covered  
22 almost everything.

23 So, this presentation is focused on the  
24 second draft test plan, what we've been talking about  
25 mainly all this morning, a lot of the parameters and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 things like that, but this will dig in to the actual  
2 document that we released for public comment as well  
3 as the updated version that we released for this  
4 meeting.

5 So, some of the objectives that we have  
6 semi already covered is discussion of how the  
7 phenomena identification and ranking table influence  
8 how we are going to be doing the testing.

9 Some of the experimental variables that  
10 we are going to be focusing in on for this second  
11 phase of testing, how we're going to be doing the  
12 measurement for the second phase of testing, what  
13 members we are currently working with inside the  
14 OECD.

15 We've alluded to the fact that we do have  
16 10 members. We'll share those members right now.

17 We're going to discuss the test structure  
18 which we've also shown a little bit, the experimental  
19 approach and the time -- the current time line which  
20 is very fluid, depending on how -- when we can get  
21 arrangements, contracts in place, updated test plans  
22 and things like that.

23 So, these were what the phenomena  
24 identification and ranking table identified as high  
25 important phenomena.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So, the cabinet to cabinet fire spread  
2           and secondary arcs and cabinet line ups, this was  
3           seen as a high parameter of interest from several  
4           countries, especially because we did see cabinet to  
5           cabinet fire spread in the Onagawa vent as well as  
6           additional secondary arc potentials in that lineup.

7           The thermal damage criteria and target  
8           sensitivity, for the short high heat exposures which  
9           we've discussed earlier, this gets to what we've been  
10          discussing this week as the -- we've been terming it  
11          target fragility as to how we make that link between  
12          this high heat extreme exposure for a very short  
13          period of time and whether that cable or secondary  
14          piece of equipment, will it be damaged?

15          Also, the likelihood and severity of  
16          secondary fires. We've been discussing this as to,  
17          if we have a short event, it's unlikely to actually  
18          propagate a secondary fire or a fire within the  
19          actual cabinet of origin, different methods of  
20          getting about that.

21          One of the high parameters was also the  
22          performance of HEAF shields. This is postulated  
23          method for mitigating the effects of damage from a  
24          high energy arcing fault through the use of a barrier  
25          between the cabinet of origin or the bus duct of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 origin and your secondary targets.

2 The performance characteristics were  
3 looked at as highly unknown and it was important to  
4 gain more understanding as to how those would perform  
5 in the actual HEAF environment.

6 Also, a high parameter was the likelihood  
7 and severity of damage from the arc ejecta on  
8 electronic equipment. This is what we're referring  
9 to for the aluminum cloud that's created as to what  
10 effects that can have on potentially shorting out  
11 secondary equipment.

12 Metal oxidation, that is in terms of the  
13 effect of aluminum and copper and the added energy  
14 from the oxidation of that aluminum material and the  
15 electrical -- the arc electrical characterization is  
16 to the points of voltage, current and duration. And,  
17 they're not in order of 1 to 10, these are just the  
18 high parameters.

19 So, these are the focused variables and  
20 we have covered this in great detail. And, you can  
21 see here that I've identified that this was going to  
22 be a focus for a later discussion through Gabe's  
23 questionnaire is that we're trying -- we were going  
24 to try and pin down collaboratively the current and  
25 the duration of testing which we have done, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 discuss the methodology that we created and put in  
2 the test program.

3 So, the current that we discussed earlier  
4 of using was a range from 15kA, 25kA for low voltage  
5 and 25kA and 35kA for medium voltage.

6 The arc duration, I think we discussed  
7 that and have decided that we should nominally be  
8 testing at the 2 and 4 seconds for both the low  
9 voltage and medium voltage range and the bus ducts,  
10 I think we maintain that we'll still be testing at 1  
11 and 3 seconds.

12 There were two additional tests at 5  
13 seconds and the driver for those were some  
14 international focus to have a longer duration event  
15 that corresponded with some of the operational  
16 experience, and especially on the generator-fed  
17 events.

18 Also, in the Phase 2, we've discussed  
19 that some of the main priority in the U.S. is this  
20 aluminum versus copper, so the electrical enclosure  
21 conductor material as well as the different  
22 configuration of bus ducts switcher I think that we  
23 have covered adequately.

24 Again, very little changes. You see a  
25 lot of what we've done here is in the last exercise

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we did that went to binning as well as I think that  
2 we've covered every single one of these that's on the  
3 board in terms of the importance to the zone of  
4 influence calculation.

5 Equipment type, bus bar material, bus  
6 duct material, voltage, current, frequency, power  
7 configuration, equipment grounding, arc duration, arc  
8 energy, bus bar insulation, bus bar spacing, bus bar  
9 size.

10 We did a pretty good job during our  
11 discussion this morning.

12 So, the measurement parameters that we're  
13 going to be focusing on, we had the presentation  
14 yesterday from NFPA where they had to develop a lot  
15 of the instrumentation it was using because of the  
16 challenge to actually collect the information.

17 We did this in parallel and it seems like  
18 we actually ended up in a similar place as to how we  
19 were collecting the information and what we were  
20 collecting.

21 We're going to be -- in the test report,  
22 there's actually a great detail into how these were  
23 developed.

24 Tony published a paper for the SMiRT  
25 which covers in great detail how these heat flux

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 measurements are working and detailed.

2 We're going to be looking at the  
3 temperature and the heat flux, the pressure we've  
4 discussed at internal to the cabinet.

5 For room pressure is an area that's not  
6 currently in the test plan but it may be slated for  
7 one of the spare tests if we have the budget.

8 We're also going to be documenting the  
9 furthest extent of damage. This was one of the tools  
10 that we were using the video for as well as post-test  
11 analysis.

12 We're also going to be looking at the  
13 mass of material vaporized during the tests. We  
14 discussed that in the last presentation. We're going  
15 to be doing pre- and post-test measurement of the  
16 cabinets themselves for the potential to develop the  
17 approximate energy release models from the classic  
18 energy conversion models.

19 This also has ties to some of the small  
20 scale testing and whether linkages can be made in the  
21 small scale energy release versus the large scale on  
22 mass loss.

23 We also discussed the cable sample  
24 materials. This is the cable hoop-ons that we  
25 discussed. We're not going to be doing full cable

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 trays. And, we covered that one in pretty good  
2 detail.

3 And, the byproduct testing. So, we're  
4 also going to be looking to do the conductivity  
5 measurements through, again, the proof of concept  
6 small scale work that we're doing, capturing that  
7 affluent that comes off and also coats material.  
8 We're going to be doing spectroscopy on that.

9 One main difference between the RGR fault  
10 Phase 1 and Phase 2 is we will not be measuring heat  
11 release rates in the Phase 2 of testing.

12 There were several reasons for that, one  
13 of them primarily is being that we only really saw  
14 the benefit when we were collecting heat release rate  
15 information on that in during fire within the  
16 cabinet.

17 If it was actually under the hood, that  
18 initial blast overwhelmed the hood with, I believe  
19 our max capacity for that hood was around 1000  
20 kilowatts, 3500, but it mainly was based on how much  
21 smoke we collected in a short period of time and you  
22 can see the entire facility was full of smoke, we're  
23 losing it. We had -- were exposed to the atmosphere  
24 and wind conditions.

25 We used -- tried to use a lot of curtains

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 -- wind curtains to capture as much as we could.  
2 But, we didn't really have a good way to capture all  
3 of that.

4 Additionally, it was extremely time  
5 consuming to set that up and work around when we were  
6 trying to put the instrumentation stands up and  
7 things like that.

8 So, by removing that, we'll have a higher  
9 focus on being able to collect the heat flux data at  
10 varying distances away from the cabinet.

11 This goes into the measurement devices  
12 that we plan on using. For the temperature, we have  
13 thermocouples, plate thermometers and the IR imaging  
14 camera we referenced.

15 For the heat flux, we're going to be  
16 using the plate thermometer for the time varying.

17 For the average we're going to have the  
18 plate thermometer and the thermal capacitance slugs  
19 which are new for this Phase 2 program.

20 Incident energy, we're going to be doing  
21 the equivalent slug calorimeter so we have  
22 comparisons to the NFPA testing as well and to the  
23 IEEE.

24 For the compartment internal pressure,  
25 we're going to be doing the piezoelectric pressure

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 transducers.

2 We also, in terms of videography, we've  
3 covered that fairly well.

4 We have the IR filter videography, the IR  
5 imaging. We have high speed cameras and high  
6 definition cameras placed at various locations around  
7 the test.

8 And, again, we're going to be doing that  
9 surface deposit analysis with links to the small  
10 scale testing.

11 So, in terms of the international  
12 members, we have Belgium, Canada, the Czech Republic,  
13 France, both their IRSN and which is the regulatory  
14 body and EDF which is their -- on the power  
15 generation side.

16 We also have Germany, Korea, Japan,  
17 again, we have CRIEPI which is their electrical power  
18 research institute.

19 And, we have the NRA which is the  
20 regulatory body.

21 We're also going to be including the  
22 Netherlands and Spain.

23 So, from the previous test program, we  
24 are gaining EDF, the Netherlands and Belgium and the  
25 Czech Republic as additional members from the first

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 round of testing.

2 The only member who is not participating  
3 in the second round that was in the first is Finland.  
4 And, this is primarily due to resource constraints,  
5 personnel challenges and for the ability to  
6 participate.

7 So, we have covered this in fairly well  
8 detail, but just to go over it again, is that the  
9 tests in blue will be part of the OECD test  
10 contribution and the ones in orange were those  
11 specifically driven by the GI program.

12 And, our focus, the U.S. centric focus on  
13 additional aluminum tests.

14 Same goes with the bus duct testing. In  
15 blue is OECD and in orange is the USNRC.

16 So, we discussed this in detail as well.  
17 One of the main things we want to do is limit the  
18 test variables. And, this was so that we can have  
19 the direct comparison between tests, a low voltage 4  
20 second, medium voltage 4 second.

21 And, we can look at the differences in  
22 the zone of influence, the differences in the  
23 calculation hoping to have an identical cabinet so  
24 these can be single variable differences in hopes to  
25 create that dynamic model based on the parameters

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that we have deemed to be high importance and we can  
2 adjust those to evaluate the zone of influence.

3 Again, we talked about the repeatable arc  
4 location. This becomes very important in the  
5 discussion we had about the NFPA testing in that --

6 In the NFPA testing we discussed that the  
7 horizontal direction showed a higher energy flux  
8 based on the calculations.

9 And, you can see on the tests on the  
10 picture in the upper left-hand side that, if we had  
11 a horizontal orientation and our instrument racks  
12 were located in the horizontal direction, clearly  
13 we're going to show that there is a higher influence  
14 or a higher instant energy reported there.

15 However, if we have test stands  
16 vertically above the cabinet, the vertical  
17 orientation is going to most likely show the higher  
18 flux from that testing.

19 So, right now, we want to be able to  
20 ensure that our test stands are located in a  
21 repeatable direction so we can get the affluent  
22 coming out of the cabinet from one of these tests.

23 If we -- if the arc location comes out  
24 the top and we have all of our instrument racks on  
25 the side, we're still going to be collecting data,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 but is that data relevant to the energy release  
2 during that actual test?

3 So, we want to make sure that we can have  
4 repeatable tests on whatever cabinet we use, which is  
5 why arc location becomes so important where we  
6 initiate the arc. If we miss a test, that's a full  
7 test where that data is not really applicable or  
8 relevant for comparison on the other ones.

9 Again, instrumentation will be the  
10 primary means of data collection. This is in terms  
11 of we're not going to have that cable tray above, but  
12 we're going to be using the instrumentation, the heat  
13 flux, the temperature as a surrogate to make that  
14 linkage between the actual materials.

15 And, again, I just wanted to reinforce  
16 this, that no testing will be performed -- no testing  
17 to be performed will be subject to any equipment to  
18 get to conditions that exceed the equipment ratings.

19 And, what I mean by that is, if we have  
20 a donated cabinet that's rated for 4160, we're not  
21 going to subject that to a 6.9kV situation.

22 So, this was the general lab that you've  
23 been -- that we've shown a few times. Multiple  
24 equipment rack locations to capture the direction of  
25 where we believe the arc is going to go.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           This is discussed in detail in the test  
2 report in that we're going to have a -- essentially  
3 a week -- the first week of testing will be a  
4 shakedown week where we are going to go with the  
5 proof of concept where we believe the instrument rack  
6 should be located, where the arc location is going to  
7 be.

8           And we are going to try and confirm that  
9 we can collect repeatable information from these  
10 tests.

11           We're doing that because we don't want to  
12 go secure 40 lab days and go just 40 at one time.  
13 Because, if we need to make adjustments to the test  
14 plan and to how we're collecting the information, we  
15 can adequately do that.

16           Test days are the most expensive part of  
17 the project along with the equipment that we're going  
18 to be testing. So, we are going to approach it in a  
19 careful manner.

20           So, the time line for the testing, it's  
21 not head workshop, but right in here, we're at the  
22 April 18th and 19th, the workshop date.

23           Next week I have the meeting with the  
24 OECD International Members where I'm going to relate  
25 this information to them. And, essentially discuss

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 how we plan on changing the test plan and finalizing  
2 the test plan.

3 I will also receive their input. I know  
4 many of the members have been on the webinar. And,  
5 I just want to make sure they have a fair chance to  
6 have an equal level of discussion of any plan changes  
7 or test changes that do come out of this meeting,  
8 that they are fairly gone over with them.

9 We will be doing a comment resolution.  
10 Essentially, we're still working on the comment  
11 resolution, we have to go over it a little bit. And,  
12 we've received a lot more information during this  
13 meeting.

14 So, we hope to finalize all 91 comments  
15 that we have received by mid-May. And, we also plan  
16 to revise the test plan based on feedback from this  
17 meeting and the international meeting, again, in mid-  
18 May.

19 We discussed earlier, the international  
20 agreement is currently held up with the lawyers.  
21 And, I left it a little bit vague as the summer is  
22 hopefully the data that we will have it signed,  
23 towards the end of summer, August.

24 I think everyone in the room realizes the  
25 difficulties with getting past lawyers. So, I really

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 -- that's a shot in the dark.

2           Again, one of the aspects of the project  
3 is we do have equipment delivery and that becomes a  
4 very complicated process from country to country as  
5 well. So, we're hoping to have everything shipped to  
6 our storage facility which is down the road from the  
7 Chalfonte facility in Pennsylvania in the fall,  
8 October time frame. And, we look to do the initial  
9 test series in October, that is the target date  
10 currently.

11           That first test series will most likely  
12 be on equipment that we do purchase, so the  
13 purchasing is in that range.

14           Depending on feedback from this meeting  
15 as well as management how the agreement goes, that  
16 October date is aggressive, but we hope to be able to  
17 do testing then.

18           Again, the second series of tests, we  
19 wanted to correspond that with an international OECD  
20 meeting to have our international partners a chance  
21 to witness testing. Again, this is in Pennsylvania.

22           And, Mark has already opened this up to  
23 try and set up a field trip up to the KEMA facility  
24 so you can see the generator capabilities as well as  
25 the KEMA facility.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           There will be several rounds of testing.  
2           Typically, we like to do a week or two weeks of  
3           testing in a row. That can usually accommodate one  
4           test per day because of the amount of effort that  
5           goes into instrumenting the equipment, safety related  
6           checks, high pot testing, prior to testing.

7           And so, we usually have one test a day  
8           for that week.

9           So, there will be several rounds of  
10          testing that goes on to complete the full series of  
11          tests which are currently slated at 36 tests. So,  
12          there will be opportunities in the future to  
13          potentially have visitors at the KEMA facility to  
14          witness testing.

15          We'll coordinate all that under the EPRI  
16          MOU or other avenues, I think.

17          And, that is our current time line of  
18          actions with the Phase 2. I think we covered most of  
19          this actually in our morning discussion, but does  
20          anyone have any questions of the overall picture of  
21          how we plan on performing the next series of testing?

22          MR. CHEOK: What do you mean by initial  
23          test series?

24          MR. MELLY: Initial test series is,  
25          that's document and the test plan is our week of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 scoping tests and to ensure that we're collecting the  
2 correct information.

3 Tony may want to speak to a little bit  
4 more of that as to what we envision and why we are  
5 calling them scoping tests.

6 MR. PUTORTI: Because we're using some  
7 new measurement techniques and also because we want  
8 to make sure that Nick alluded to earlier, that we  
9 can get the arc to exit the enclosure where the  
10 instrumentation is.

11 We wanted to just have one week of  
12 experiments. If you go and you book two weeks in  
13 advance, that doesn't really give us -- if we have to  
14 change something, it doesn't give us much time to  
15 change it and test days are very expensive so that's  
16 why we just want to do just one week to start with.

17 MR. FLEISCHER: Kenn Fleischer, EPRI.

18 The small scale testing, it's not  
19 integrated in this schedule? I thought it was going  
20 to be a predecessor.

21 MR. MELLY: Yes, the small scale testing  
22 is separate from the overall OECD arrangements. So,  
23 that's an oversight on my part of not putting it in  
24 here.

25 That testing will fall on the time line,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I believe it's June 25th that we're planning on doing  
2 the small scale testing at Sandia, that's the initial  
3 date we will start.

4 PARTICIPANT: They're not really tied  
5 together, right?

6 MR. MELLY: No, they are not.

7 PARTICIPANT: They're independent?

8 MR. TAYLOR: Yes, so, Nick's correct.  
9 June 25th, they start testing, that's the plan. And,  
10 we have the final report by the end of September.  
11 And then, publication on our end will take some time.

12 MR. MELLY: Any other questions on the  
13 path forward?

14 (No response)

15 MR. MELLY: Okay, I'll jump into the  
16 comments and I have a feeling that almost every  
17 single comment I'm about to show, we have covered.

18 Do we have any questions from the  
19 webinar?

20 PARTICIPANT: No.

21 MR. MELLY: Okay.

22 MR. MILLER: Well, that's good.

23 MR. MELLY: I'm hoping.

24 So, again, we've seen this slide. We've  
25 got 91 comments in total. Again, that is through the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Federal Registry as well as the EPRI MOU, 27 comments  
2 were received by EPRI.

3 I tried to breakdown the comments into  
4 categories because we did receive a lot of redundant  
5 comments as well as I wanted to find a way to cover  
6 them here.

7 Some of the comments were on the  
8 generator capabilities and the applicability for the  
9 HEAF testing. So, the decay of the generator itself  
10 as we have received a few comments on as well as the  
11 2250 MVA rating.

12 We received a lot of comments on the  
13 protective relaying and the duration of testing, the  
14 equipment ratings and how we're going to be selecting  
15 the equipment.

16 The test conditions, the equipment set up  
17 combustible load and cable trays.

18 Test parameters such as the voltage  
19 current grounding team and a lot of comparisons to  
20 the IEEE guide for the metal enclosed switch gear  
21 rating.

22 So, some of the main comments that we  
23 have -- that we haven't talked about, actually, is  
24 that we received one comment that the stated  
25 generator capabilities at KEMA were 2250 MVA. That

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is the maximum capability of KEMA's generator, but  
2 that's not what we're going to be testing each piece  
3 of equipment to.

4 So, there was a misunderstanding as to  
5 how much power we're going to be using for each test.  
6 I think that we've cleared that up through our  
7 discussion this morning. That is just their maximum  
8 capability.

9 And, KEMA does essentially dial in the  
10 current, the voltage and the duration that we're  
11 looking for and we have discussed even the ability to  
12 have that decay put on to certain testing. So, we've  
13 covered that pretty well.

14 We've also discussed the -- how they'd  
15 use process of the SuperX excitation to compensate  
16 for that decrease in voltage, and they have the  
17 ability to change that. So, we're going to be  
18 looking into that for future testing.

19 We also are still going to be putting out  
20 a request for an example of what that decay looks  
21 like.

22 So, there were a lot of comments as well  
23 on the ratings of equipment. And, we've been looking  
24 at the apparent power range of the values we selected  
25 versus the industry sample averages that Gabe has not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 shown.

2 This was part of his evaluation to look  
3 at the capabilities. We were looking at the apparent  
4 averages and the range that we're going to be testing  
5 at.

6 So, using the above calculation, the  
7 square root voltage times current, we calculated the  
8 range of applicability for the 4160 as well as the  
9 6.9 versus the industry averages that we calculated  
10 from looking at plant to plant variability.

11 PARTICIPANT: Sample averages?

12 MR. MELLY: Sample averages, this was not  
13 across the fleet. This is tied to the amount of  
14 plants that we had access to this data. I believe it  
15 was 18 and 23 plants, respectively.

16 MR. TAYLOR: We had more information of  
17 these ratings, so it's -- I don't have the actual  
18 numbers.

19 MR. MELLY: Right.

20 Well, we can see from this quick look  
21 that we were well -- we were inside the potential  
22 sample industry averages for what we're going to be  
23 testing at.

24 And, there were a lot of comments on the  
25 fact that most equipment is equipment is rated to 500

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MVA.

2 I think that we've covered this one in  
3 fairly good detail. There was a lot of discussion of  
4 the protective relaying and the potential to test  
5 these are going to fault to .5 seconds and 1 second.

6 And, we discussed why we're not going to  
7 be doing the testing in that short duration range.

8 And, the ability to separate the arc  
9 faults in to bins.

10 We saw those short duration events go  
11 into the Bin 15 frequency, not high energy arcing  
12 faults. This is a typical electrical cabinet fire  
13 because you only have that cabinet damage.

14 And, the potential to split Bin 16 into  
15 these arc blast categories as well as the full on  
16 high energy arcing fault, larger extended damage bin.

17 Again, the frequency of the HEAF events  
18 is a current area of work that we're going to be  
19 working on under the MOU. And, we plant to start  
20 that official work, I believe it was stated this  
21 summer on our plan.

22 MS. LINDEMAN: Yes, later on.

23 MR. MELLY: So, later on this year, we're  
24 going to start that work under the MOU.

25 Again, duration, I think we've beat this

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 over the head quite a few times. So, we're going to  
2 be basing that on operating experience as well as the  
3 plant specific designs. And, their circuit  
4 protection scans.

5 That is one area that we want to focus in  
6 on under the MOU as well.

7 And, a good place to look at the current  
8 work that's been done on that is in one of those EPRI  
9 white papers.

10 So, again, this is actually a picture  
11 from the Fort Calhoun event, the one that did last  
12 for 42 seconds. Just kind of wanted to show it as an  
13 example of these low voltage events that do hold in  
14 for an extended period of time.

15 Additionally, that event that I alluded  
16 to which is the 8 second German arc, and there is a  
17 link to where there is more information about that  
18 event.

19 So, we do see that some of these can hold  
20 in and there is an extensive amount of damage and  
21 vaporization of the conductive material from one of  
22 these events.

23 MR. MILL: Is that an aluminum bus bar?

24 MR. MELLY: That is aluminum bus bar.

25 So, in the Fort Calhoun event, the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 cabinet itself had the aluminum bus bar and  
2 conductive material. And, where the event actually  
3 occurred was at a transition point where it went from  
4 the aluminum bus bar to a copper stab for their  
5 breaker. And, they were using a silver oxide to --  
6 as the transition point for the aluminum to copper.

7 So, this is one that we discussed a  
8 little bit earlier. There were a lot of comments  
9 received on the fact that the initial test plant had  
10 no breakers installed in them due to both pressure,  
11 combustible load and things like that.

12 We have made a change and included the  
13 breakers, all breakers will be included in the  
14 cabinets that we're going to be testing.

15 Again, we talked about the cable trays  
16 and how we plan on making the jump from  
17 instrumentation to what would be there if we tested  
18 a cable tray and why we're not.

19 We also received a few comments that we  
20 need to do a better job at the internal combustible  
21 load, what is in the cabinet, how we load the  
22 cabinet, what arrangement the cables are in, whether  
23 we are introducing cables or we're using stock cable  
24 material that come with the cabinet purchasing.

25 And, we will be documenting all of that,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 including the size, orientation, mass, cable jacket  
2 material, cable instrumentation material. And,  
3 hopefully, we'll be including pictures of the  
4 internals of the cabinets with each test prior to the  
5 test.

6 The last category was the comparisons to  
7 the IEEE guide.

8 We've covered that in a fair detail right  
9 now, but the main point is that we're not trying to  
10 replicate the IEEE guide. We have different goals  
11 for what we're trying -- the data that we're trying  
12 to collect and different objectives.

13 Our objective is not personnel safety in  
14 this case, so we're not going to be -- that's one of  
15 the reasons where -- why we are not using the cloth  
16 targets.

17 What you could see from the test videos  
18 that Bas showed yesterday is that those cloth pieces  
19 of equipment or those cloth markers actually take up  
20 a lot of room as well as can potentially inhibit the  
21 flow of gases out of the cabinet.

22 So, we're not looking to do that because,  
23 if we show that we burn a cloth target, it's not  
24 giving us much information at the location they're  
25 specified in the IEEE guide which is very close to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the cabinet.

2 I expect that if we run one of these  
3 tests for 2 seconds, those cloth targets will be  
4 damaged in every single case.

5 Question?

6 MR. FLEISCHER: Kenn Fleischer, EPRI.

7 Not so much a question, but this is good  
8 info, you know, as we've gone through this workshop,  
9 a lot in my mind as to the paradigm we came in with  
10 has changed significantly.

11 I think what you're saying would really  
12 serve the industry well from a historical perspective  
13 is if this is all documented.

14 MR. MELLY: So, we do have an official  
15 comment resolution format. And, I think our plan is  
16 to make that public. That's an option that we can  
17 make it public as we move forward.

18 To every comment received, we've  
19 identified, if it were -- if it resulted in a change  
20 to the test plan, where that change was, how will  
21 that comment resolve or potentially an explanation as  
22 to why the difference is there.

23 MR. FLEISCHER: Yes, and that's the  
24 important part.

25 MR. MELLY: Okay.

1 MR. FLEISCHER: Yes.

2 MR. SALLEY: Nick, we can make that a  
3 part of the CP.

4 MR. MELLY: We can make that a part of  
5 the CP, yes.

6 Again, one thing that we already did  
7 discuss in detail was the wire sizes and why the  
8 first round of tests was done at the 10 gauge class  
9 case standard versus what's specified in the  
10 standard.

11 We are reaching out for more information  
12 on that. I think moving forward, unless we receive  
13 some information from IEEE which is in conflict of  
14 what we're trying to do, we plan on following the  
15 guide and using the 10 gauge for our low voltage and  
16 the 24 gauge for our medium voltage.

17 As we identified in the first series of  
18 testing, we had no problem initiating and holding an  
19 arc for the medium voltage tests where we did see an  
20 issue with the low voltage tests even using the 10  
21 gauge wire.

22 Another comment was on the arc location  
23 and the arc initiation phase angle, how we're  
24 potentially differing from the IEEE standard. We've  
25 discussed that as well as identified the reasons why

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we're going to be potentially differing from that  
2 location.

3           Primarily so that we can collect the  
4 information in a repeatable manner.

5           So, that's very important as to where we  
6 put the arc.

7           Again, I pulled this from Gabe's  
8 discussion. We flip-flopped, so these were  
9 everything we planned on talking about this morning  
10 that we've already covered.

11           But, that is a good point that we did  
12 receive all these comments and we have spent a  
13 considerable amount of time going over each comment,  
14 discussing with our partners, both NIST, KEMA, the  
15 International members as to how to resolve these  
16 comments, get clarification on what we need to  
17 understand in the comment and how it could  
18 potentially change the test plan.

19           So, it is a good recommendation that we  
20 publish it with this CP. I believe it'll give a  
21 historical perspective on how the plan has changed.  
22 We won't have Rev numbers, but it'll give an overall  
23 picture.

24           MR. MILLER: It also documents the  
25 interaction with the industries.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MELLY: Yes.

2 Any comments? Questions? Stones?

3 MR. GARDOCKI: What's your outcome of  
4 this? Are you going to put out a NUREG or --

5 MR. MELLY: For the comments?

6 MR. GARDOCKI: For the tests?

7 MR. MELLY: For the tests?

8 So, there is a plan.

9 MR. TAYLOR: You're not going to be able  
10 to talk about it?

11 MR. MELLY: I can get into it and you can  
12 correct me if I --

13 MR. TAYLOR: Okay.

14 MR. MELLY: -- get it wrong.

15 So, the test is going to be covered in  
16 several different ways. Because this is a  
17 complicated project where we are working with the  
18 international community as well as we have different  
19 phases where we are going to be -- some of the tests  
20 are going to be OECD, NEA, some of the tests are  
21 going to be NRC exclusive.

22 The plan is to publish the OECD tests  
23 which we are going to be doing internationally under  
24 that collaboration the same way that we did with  
25 Phase 1 where we have a Report of Test published in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the CSI -- CSNI documentation style much like the  
2 Phase 1 test with some conclusions of the test  
3 program and in that same format.

4 Additionally, this test will include two  
5 NUREGs. One NUREG including tester report of the  
6 aluminum tests as well as the overall picture.

7 And, a NUREG on enhanced methodology.  
8 That one's going to be the analysis of all the data  
9 and the initial work towards refining the zone of  
10 influence, the modeling approaches that we've  
11 discussed and things like that.

12 We do plan on that's a little bit down  
13 the road after the test program and we still need to  
14 discuss with EPRI -- it would be beneficial to do it  
15 under the MOU so we can get involvement and do the  
16 analysis much like the Helen Fire Program and the  
17 Rachel Fire Program were successful. And, that's a  
18 good model to approach this.

19 Additionally, I believe we're going to  
20 have a standalone NUREG for the small scale testing.

21 MR. TAYLOR: That's correct, yes.

22 MR. MELLY: So, those are the four pieces  
23 that are going to come out of this as well as the  
24 NUREG/CP which documents this interaction, so five  
25 NUREGs, one CSNI. And two IAs on the international

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 work.

2 MS. LINDEMAN: Two more IAs?

3 MR. MELLY: Two more IAs.

4 So, the Japanese have been performing  
5 additional tests focused on parameters such as  
6 pressure. And, we're going to be working under an  
7 MOU with the Japanese to publish two additional IAs  
8 to collect that information. So, we'll have the full  
9 leverage of information.

10 MS. LINDEMAN: And, I assume you'd have  
11 a joint NUREG after your report for the briefing you  
12 take for it?

13 MR. MELLY: Yes.

14 MS. LINDEMAN: Are we talking about that?

15 MR. MELLY: I should have made a slide on  
16 this.

17 MR. AIRD: Nick, we have a question from  
18 the webinar.

19 MR. MELLY: Okay.

20 MR. AIRD: It's from Mark Hewitt.

21 His question is, in the documentation of  
22 the enclosure, would an assessment be made as to the  
23 inclusion of any other aluminum pieces -- piece parts  
24 other than the conductor or enclosure duct?

25 For example, it uses relays, control

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 cables and the frame structure?

2 MR. MELLY: That is a good question and  
3 we have started to think about that. And, the  
4 questionnaire that went out to NEI was phrased in  
5 such a way that if aluminum was part of the  
6 conductive pathway that can experience the arc and  
7 become consumed during the arcing event, that was  
8 what we were looking for in terms of, is aluminum in  
9 the cabinet?

10 So, the real importance there was, can  
11 the aluminum become involved in the event and can we  
12 have the additional energy release from the oxidation  
13 of that aluminum?

14 So, if we did have aluminum pieces, parts  
15 that could be part of that pathway and consumed  
16 during the event, we would be -- we are interested in  
17 collecting information on that as well as having that  
18 part of the test program.

19 That's going to become important for what  
20 pieces of equipment we collect or procure and how --  
21 where we initiate the arc within the cabinet.

22 So, yes, that is an important part and  
23 it's still to be determined based on the procurement  
24 of equipment.

25 MR. GARDOCKI: Gabe, as far as small

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 scale testing, when do you think you're going to get  
2 your report done?

3 MR. TAYLOR: So, right now, like I said,  
4 I write it down to the contractors at the end of  
5 September.

6 So, we'll probably get a draft sometime  
7 late to early -- late July, early August. And then,  
8 go through an internal review and then Sandia will  
9 respond to those comments and finalize their report.

10 So, a final report from Sandia, I'm  
11 expecting by the end of September and then it'll go  
12 through the publication process which takes a few  
13 months.

14 MR. GARDOCKI: Months?

15 MR. TAYLOR: Yes, that's been our recent  
16 experience.

17 MR. GARDOCKI: And, it won't be  
18 publically available until next year?

19 MR. TAYLOR: That's right, late this year  
20 or early next year, depending on the politicians, the  
21 publications branches.

22 MR. MELLY: It took them six months to  
23 publish the PIRT.

24 MR. SALLEY: So, you know, did everyone  
25 see Stan put on his project man?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 (Laughter)

2 MR. SALLEY: If you didn't, okay.

3 MR. TAYLOR: The other option which, you  
4 know, this is more for the NRC management type  
5 direction is, you know, we could always issue it as  
6 a Sandia report rather than a NUREG. That would get  
7 it out a lot quicker, but it wouldn't have the, you  
8 know, the NRC NUREG stamp on it.

9 I'm not quite right now, but that's  
10 something we'd probably take back and discuss.

11 MR. GARDOCKI: Well, just for the eyes to  
12 see the report and the results at a quicker pace  
13 before the --

14 PARTICIPANT: Will this be released for  
15 public comment?

16 MR. TAYLOR: We weren't -- so, the  
17 question is when -- how fast we can get the  
18 information out and also will we release it for  
19 public comment.

20 For a lot of the testing that we've been  
21 doing lately where we've issued it for public -- the  
22 test plan for public comment, we haven't been going  
23 through a draft version followed by a final version.

24 In a lot of cases, it takes over a year  
25 between the draft version getting put out and getting

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the final version.

2 So, we weren't planning on doing a draft  
3 for public comment on this one. And, Mike Cheok has  
4 a comment.

5 MR. CHEOK: So, I think, you know, we can  
6 -- as soon as we approve the reports and your report,  
7 we can have a public webinar to announce the summary  
8 of the results and for results that might influence  
9 the next set of tests we do through that publically,  
10 we are now in a public meeting.

11 MR. TAYLOR: And that's a very good  
12 suggestion.

13 MR. GARDOCKI: Yes, I was just concerned  
14 of getting the results of the small scale testing.  
15 I'll be fully due to initial testing, in the time  
16 line of there. But, your initial testing, I've  
17 forgotten the date.

18 MR. MELLY: It's on the other  
19 presentation.

20 MR. TAYLOR: I think it's October, right,  
21 the first phase?

22 MR. MELLY: Yes.

23 MR. GARDOCKI: So, you think we can get  
24 something publically out before that October?

25 MR. TAYLOR: We can probably have a call

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 or a webinar to discuss the results, but the actual  
2 get a document out in the public around, I'm not sure  
3 we can meet that.

4 MR. SALLEY: Gabe, with the schedule  
5 here, I understand that Nick's schedule is very  
6 aggressive.

7 MR. MELLY: They tend to be.

8 MR. SALLEY: Yes, it's extremely  
9 aggressive. So, please don't hold us to this  
10 schedule. I mean, with some of it, the challenges  
11 we've got with the --

12 You know, we've got to work with the  
13 lawyers. We've got to get that right and we've got  
14 to work with our international partners. And, those  
15 things all take time.

16 So, we're not going to sacrifice quality  
17 for speed here. So, you know, we'll slow it down to  
18 ensure that we get the quality.

19 So, again, this is very aggressive.

20 MR. MELLY: For the first phase, I  
21 anticipated getting done three tests a day. And,  
22 that did not pan out, and 5 tests a day for the low  
23 voltage.

24 We did not pan out meeting that goal.  
25 KEMA usually shuts down shop at around 3:00. They're

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 on a different schedule than most.

2 We got done one test a day.

3 MR. TAYLOR: Yes, but I think, you know,  
4 as soon as we can get agreement with the results, we  
5 can communicate them in some form to the public and  
6 move on and not have to be delayed by the publication  
7 schedule.

8 MR. GARDOCKI: Especially with the  
9 important players. I know you're going to need the  
10 results very quickly, the small scale test, right?

11 MR. PUTORTI: Not to do our part.

12 MR. GARDOCKI: No?

13 MR. PUTORTI: You would need the -- I  
14 think that you'd need the small scale results for  
15 would be where would technologies you're going to  
16 take from small scale measurement technologies and  
17 use them in the larger scale. That's what you would  
18 need the results for.

19 But, as far as the results, I'm not sure  
20 how much that's going to change the first round of  
21 the full scale. I don't see that.

22 MR. GARDOCKI: I was thinking more along  
23 the lines of coupons and degrees of temperature,  
24 ranges to measure what the expectation of plasma  
25 coming out of this would be.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. MELLY: Right. And, we will have --  
2 those are developed right now and we will have those  
3 available to be putting in the first round of  
4 testing. We just won't have the results published by  
5 the time the initial tests are taking place.

6 MR. PUTORTI: All right, but if you're  
7 referring to the techniques that Sandia's looking at  
8 using for the small scale and bringing those into the  
9 large scale, that will take time for them to field.  
10 But, it won't change the rest of the large scale  
11 plan.

12 MR. MELLY: For instance, those coupons  
13 that Gabe was referring to to collect the eject of  
14 the aluminum, they are developed and available now so  
15 we can still use them in large scale testing.

16 Whereas, the relevance and whether we  
17 should be investing our time and energy is going to  
18 come out of the results, that's where the main trust  
19 and the main resource drag is for the small scale.

20 But, we can easily put them in the  
21 cabinet right now, shelve them and wait to see if  
22 they're worthwhile to be tested.

23 MR. FUNK: This is not the first time we  
24 ran into this issue. So, what we did in the past, I  
25 know, Gabe, you're familiar with this, once the NUREG

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 report has gone through tech review, and we're really  
2 confident there's not going to be any technical  
3 changes, that's when we started using it.

4 Can a target date be established for tech  
5 review? Because I believe that would be within your  
6 control where publication will not necessarily so.

7 MR. TAYLOR: I think that's reasonable.  
8 It's really going to depend on the quality of the  
9 first draft that we get from Sandia and how much, you  
10 know, feedback or changes the NRC reviewers see from  
11 that document.

12 And, but, if there's not much change and  
13 we don't see technical changes from the first draft,  
14 they may well make quick changes to address those  
15 comments. And then, at that point, we could get  
16 agreement within the NRC to, you know, issue the  
17 results or have the discussion of the results at that  
18 point.

19 So, I think that's the reasonable  
20 approach.

21 MR. MELLY: Yes, and again, to keep in  
22 mind that the small scale testing is going to be much  
23 in the style of a report of tests where there will  
24 not be any methodology changes proposed in that small  
25 scale testing.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: Yes, they're not going to  
2 try to, you know, do some type of modeling of the  
3 results to extrapolate different variables and how it  
4 affects particle sizes and whatever the other aspects  
5 of the testing are.

6 It's just you test at these variables,  
7 this is the size distribution, this is the fraction  
8 of oxidation, whatever they need to report.

9 MR. MELLY: Any other questions, time  
10 line, schedule, outcomes?

11 MR. PUTORTI: Just one small detail, we  
12 discussed this earlier in the day.

13 But, when we decide or when we get the  
14 enclosures that we're going to be testing, the  
15 question out there about if they do arrive with bus  
16 bars that are insulated, do we want to leave them in  
17 that state or remove the insulation?

18 MR. MELLY: I think that is going to  
19 depend highly on some of the things we have discussed  
20 here today.

21 For the internal or for the cabinets, the  
22 enclosures themselves, I think that we will most  
23 likely be -- it depends on how we procure them, but  
24 I see that typically they're not going to -- no  
25 insulation for an enclosure cabinet, we may be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 removing.

2 If they're for the bus bar or for the bus  
3 ducts, I think the decision was to test half and half  
4 with insulation and non-insulation.

5 MR. TAYLOR: I wouldn't see us going out  
6 and making a change to equipment. I think we'd want  
7 to procure it.

8 MR. MELLY: Yes. Now, one question that  
9 I think we may have missed in the discussion earlier,  
10 we were talking about procuring these cabinets and  
11 the initial thought was that if we're -- let's say,  
12 we're running 20 tests, 10 at copper, 10 of them at  
13 aluminum.

14 If we can procure both copper and  
15 aluminum from the same manufacturer, we will do that  
16 and the bus bar spacing may be a little different.

17 However, if we can only procure aluminum  
18 or a copper conductor, are we going to fabricate the  
19 aluminum equivalent for the other test series or for  
20 the other tests that we're going to run and what  
21 factors would be important if we go down that route.

22 Because, our electrical contractor right  
23 now does have the ability to wholesale and replace  
24 all the copper conductors inside the cabinet with  
25 aluminum conductor material. I know that may alter

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       how the design is working based on the spacing of the  
2       conductors internal to the cabinet.

3               Are there anything -- any concerns or  
4       approaches that anyone has in the room that we should  
5       keep in mind of if that's the route that we have to  
6       go?

7               MR. SALLEY:     You're driving into the  
8       heart of Ken's discussion about the we won't buy the  
9       equipment starting out.

10              MR. FLEISCHER:  No.

11              MR. MELLY:    Yes.

12              MR. SALLEY:    And, we can't take that.  
13       And, that's was -- Ken, that's what I got from your  
14       whole discussion on that.

15              And, we need to start out with something  
16       that is certified.

17              MR. FLEISCHER:  Right.     Well, that  
18       discussion -- Ken Fleischer, EPRI.

19              That discussion was based on the premise  
20       of my paradigm coming into this workshop was that we  
21       weren't getting donations, I didn't know about  
22       donations and we would procure the equipment.

23              And, therefore, we would have total  
24       control over configuration.

25              In this particular case, I guess my

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 thought is, is why don't we just review what is our  
2 end game in mind? Our end game in mind is to see if  
3 the zones of influence are affected by the additional  
4 vaporization or oxidation of aluminum.

5 If our target is to set off or find out  
6 what kind of switch gear is going to do that to set  
7 off the equivalency between copper and an aluminum  
8 switch gear configurations may not be as important.

9 But, I think we should strive to try and  
10 keep some similarity with what we've got and minimize  
11 modifications.

12 I think if we start modifying things,  
13 then we have thrown in a new variable that we may not  
14 have fully thought through and have unintended  
15 consequences.

16 MR. MELLY: I agree.

17 And, on the flip side of that is that  
18 because that is one of the main parameters that we're  
19 looking at is the copper versus the aluminum, and the  
20 delta of the damage states between them, trying to  
21 minimize the amount of variables that we have  
22 different in that case is very important.

23 So, for instance, if I buy all aluminum  
24 GE Magne-Blast and all copper Westinghouse, that's a  
25 huge difference immediately as to the potential

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 damage state.

2 So, it -- whereas, I may be qualified  
3 aluminum for the Westinghouse and qualified copper  
4 for the GE, those are two immediately different  
5 cabinets which may have distinct zone of influences  
6 just on the cabinet design.

7 I wanted to try and limit the variables  
8 and I would love to find a manufacturer that can spec  
9 the copper conductors and the aluminum conductors in  
10 the same box. I just am not too familiar with  
11 manufacturing processes or the catalogue availability  
12 of this.

13 MR. MILLER: This is Kenn Miller.

14 I agree with you. I mean, if a  
15 manufacturer can sell above waste of waste --

16 MR. MELLY: Right.

17 MR. MILLER: -- that gets over this issue  
18 of making a new design yourself. It's not, quote,  
19 certified.

20 MR. MELLY: Exactly.

21 MR. MILLER: Whether that's true on that.

22 MR. FLEISCHER: Yes.

23 MR. MILLER: You should certainly start  
24 with that if possible.

25 MR. FLEISCHER: Ken Fleischer from EPRI

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       again.

2                       Yes, yes, I'd buy that that's what would  
3       be preferred. I guess maybe the bigger question,  
4       because I'm still not sure, are we looking to try and  
5       do this testing program with 100 percent donated  
6       equipment?

7                       Or, are we looking at donated equipment  
8       and then maybe with what we're going to get and we  
9       find out what we have, we can contact, let's say, the  
10      majority is going to be the GE Magne-Blast copper.  
11      Can we contact GE to maybe replicate a unit in  
12      aluminum?

13                      MR. MELLY: That would be the ideal.

14                      So, to answer the first question, no,  
15      we're not looking to have the majority of the test  
16      program on donated equipment. We're going to be  
17      using donated equipment for several of the countries  
18      who are not unable to provide monetary donations to  
19      be all inclusive to our international members who are  
20      interested in this work.

21                      The rest of the equipment will be  
22      purchased and procured through several of the  
23      contracts that we have in place right now.

24                      MR. FLEISCHER: Okay. Well, then that  
25      sounds good. And, I think we can be smart about it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 by looking to see what we have.

2 MR. MELLY: Okay.

3 MR. SALLEY: Or, as we -- or, Ken, as we  
4 discussed today, if we have some, you know, U.S.  
5 participation, well, some of that equipment we would  
6 be more than happy to work with you.

7 MR. MELLY: Yes.

8 MR. SALLEY: So, again, if we're looking  
9 at some of the plants that are closed up or -- I  
10 talked to Brenda Simril a little bit, TVA's cleaning  
11 out some warehouses, looking at some surplus. I know  
12 there's a lot of stuff out there, there's more out  
13 there and it would be very open to working with the  
14 industry on some of this.

15 MR. MELLY: Yes, and if we do receive  
16 more donated equipment, that is a good suggestion  
17 that, whatever we do receive in donations, it  
18 actually allows us to test more equipment because  
19 that's large cost driver for the test program, but we  
20 can reach out and see if there is an equivalent  
21 design or specification for how the internals need to  
22 be swapped out if we're going to be changing the  
23 conducting material.

24 MR. MILLER: Kenn Miller, NRC.

25 So, that is captured, though, what we try

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and when we try and go out and buy the additional, we  
2 will look for that option of getting the same design  
3 with both types of material.

4 MR. MELLY: Yes.

5 Sorry, I went off on a tangent there.

6 MR. TAYLOR: Anything else then on the  
7 test plan?

8 MR. MELLY: All right, is there anything  
9 else on the test plan, either webinar or in the room?

10 Anything we think we haven't covered or  
11 something you had in mind prior to the meeting that  
12 they were looking for a discussion on?

13 MR. TAYLOR: I think there was one follow  
14 up question from EPRI. I think Ken, he went back and  
15 looked at the fault monitoring equipment for the one  
16 event he talked about earlier.

17 Did you want to add anything on that?

18 MR. FLEISCHER: Ken Fleischer, EPRI.

19 Yes, I need to go back and go through the  
20 data in detail. So, I can put something together  
21 concise, but I have very high resolution digital  
22 fault recorder raw data that we can pull together.

23 It's for a 6 second -- it was not a --  
24 well, I don't know, I mean, it was an arc but it was  
25 an arc on the high side of the bushings of the main

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 power transformer.

2 And, I have the high data resolution just  
3 to give you a quick summary of what it looks like, it  
4 looks like in the first 26 cycles, it drops to the  
5 pre-position point for the voltage regulator. So, it  
6 goes from about 22 kV down to 17kV for about 26  
7 cycles and it holds steady. It's a very short  
8 duration.

9 My belief is that that's where the  
10 exciter switch gear breaker is still in service  
11 actually exciting the rotor.

12 Then, after that, you see a quick drop to  
13 about 50 -- so, that was about a 20 percent drop.

14 So, then you see another 30 percent drop  
15 down to about 50 percent. And, I believe that is  
16 when the exciter field breaker now pops open so now  
17 the field is no longer excited and it's residual  
18 magnetism.

19 And, yes, it slowly decays from there  
20 just as I would expect. It's a, you know, an  
21 exponential decay. It's not as fast as I thought and  
22 it continues well beyond 6 seconds. But, the final  
23 arc finally extinguishes at about 6 seconds.

24 What I can do is compile that together  
25 and maybe like a small mini white paper. I could

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 provide that back to the group and we can send it to  
2 KEMA to see if they can replicate that decrement  
3 curve.

4 Now, the thing is, is that it doesn't  
5 have to be an exact replicate, but I can give them  
6 the raw data, they can get as close as they want.  
7 But, it's definitely clear, there's a lot less energy  
8 coming out of that generator than if you were  
9 infinite bus through a transformer.

10 MR. MELLY: So, one of the things that  
11 would be a potential work around as well, if KEMA  
12 cannot replicate that decrement curve, there is the  
13 potential to calculate the energy release during that  
14 event and align the duration to the equivalent total  
15 amount of energy release.

16 MR. SALLEY: Ken, yes, that's a great  
17 idea. And, if we can do that, you know, this CP that  
18 we're talking about isn't going to happen overnight.  
19 So, if we can work with EPRI and do that, we'd be  
20 happy to include that and document that in here.

21 So, we're really open to that.

22 MR. TAYLOR: Any other follow up from  
23 this morning's discussion or this afternoon's  
24 discussion on the test plan? Are there any,  
25 especially on the test plan, are there any comments

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that Nick really didn't cover and you need a little  
2 more information or background on the NRC's initial  
3 disposition of the comment?

4 MR. MILLER: This is Kenn Miller, NRC.

5 I will do something probably with the  
6 HEAF definition and adding back in some time data  
7 based on the 2 and 3 seconds, based on the switch  
8 gear and the breaker ratings.

9 And, maybe we'll put that out to --  
10 that's the only thing I'm thinking of in terms of  
11 definition changes that we've talked about. But I'll  
12 put that out there and we can look at it.

13 Unless anybody else had anything else on  
14 definitions?

15 (No response)

16 MR. TAYLOR: Just getting back to, if  
17 there's nothing else, so, as far as the generic issue  
18 program discussion, I think it's worthwhile on our  
19 end to go back and formalize the milestones and  
20 dependencies so that when we do get asked questions,  
21 we have a more formalized and clearer response to  
22 that and direction on of how and when these different  
23 milestones are going to be completed.

24 On the PRA realism, I believe we need to  
25 continue working with EPRI on the frequency and the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 classification as well as these definitions. I think  
2 it's going to be very important especially from a PRA  
3 model to make sure everything aligns.

4 And, I should probably also put up here  
5 the very important thing on the pilot plants. And  
6 so, we'd like to identify some pilot plants for the  
7 GI program, potentially go out to the pilot plants  
8 and understand what the risk is for these HEAF  
9 scenarios with aluminum.

10 So, identifying the right pilot plants.  
11 Nick talked a lot about this about, you know, if they  
12 already assumed top isolator, everything in the  
13 room's lost, well, you increase ZOI, it's really not  
14 going to have that big of a delta risk for those  
15 scenarios.

16 But, there could be other modeling or  
17 compartment configurations where an increased ZOI may  
18 have an impact.

19 So, understanding what the risk change is  
20 in the plant for these events is important. So, I'd  
21 look to EPRI and possibly NEI to help us out to  
22 identify the pilot plants and support that  
23 understanding.

24 So, I think that's very important in how  
25 we go about that. We'd have to work with the Stan

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and the GI program and include everybody that's in  
2 that program working on it.

3 Also, we had some discussion of going  
4 back and understanding what tests IEEE and NFPA has  
5 performed for their research and make sure that we're  
6 not being repetitive and understand what came out of  
7 that work. We have that action item.

8 We talked about fault currents. So, for  
9 the personal safety, I think there's a lot of  
10 information that the plants have already done in that  
11 analysis. And, this gets into the fault currents that  
12 we're proposing for the test plan and the sample data  
13 that I pulled up, you know, is that representative of  
14 what we've seen in the personal safety assessment?

15 So, that's one for industry to go back  
16 and look in and just verify what we're doing, if it's  
17 in line with those studies.

18 Also, on sample circuit characteristics,  
19 this is one that Dan and I identified if there's any  
20 characteristics that are important for the tests  
21 limiting X over R or anything else that we would want  
22 how KEMA sets up their lab, we'd like that feedback.

23 We talked a little about the arc  
24 locations. Really need to get a clearer  
25 understanding of where we should put the arcs. So,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I think we have the three, at least for the  
2 enclosures, the three locations where we potentially  
3 put it.

4 But, we haven't come up with a definite  
5 road we want to go there. So, any feedback on that  
6 one would be important for us.

7 And, we agree, the equipment document  
8 when we get, we need to understand what the, you  
9 know, the manuals are for that equipment and document  
10 it in the report, this is what we got, this is its  
11 rating, this is how we tested it, pretty  
12 straightforward.

13 A more recent discussion, manufacturer  
14 design verification for the aluminum versus copper.  
15 Once we identify what equipment we want to procure,  
16 we have to reach out to the vendors and say, hey, we  
17 will bind this in copper.

18 If you're going to have aluminum or maybe  
19 they have aluminum in that product line, how can we  
20 configure it or could you maybe point us in the right  
21 direction to procure that equipment if we can't find  
22 it.

23 So, bringing the manufacturers in to make  
24 sure that we can test real representative equipment,  
25 it's important. That's on the NRC side to perform

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and go through procurement.

2 And, the last one I have here is I put  
3 EPRI on it, but the decrement curve. If we can get  
4 some information on that, we can work with KEMA and  
5 go from there for that.

6 So, I think that's the majority of it.  
7 I don't think we have too much traction on the  
8 verification tests. So, right now, I don't see that  
9 as being forward on our end. If there's discussion  
10 otherwise, we can bring that up now.

11 And, the other thing that we haven't  
12 really resolved is the grounding. So, you know,  
13 should we just move to ungrounded, resistance  
14 grounded? I don't think we can come to a conclusion  
15 here on that.

16 MR. MELLY: No, we have not.

17 MR. TAYLOR: We did rank it the day  
18 before, but I don't remember what that was.

19 MR. MELLY: We ranked the importance  
20 during -- we ranked it as low here with a few highs.  
21 A high left the room.

22 And, we had it ranked in the PIRT as  
23 well, so we'll take that into consideration moving  
24 forward. And, I'll discuss it additionally with the  
25 international members next week.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. TAYLOR: So, I think that's kind of  
2 the action items we have coming out of this meeting.  
3 Is there anything else that I missed?

4 MR. MILLER: Kenn Miller, NRC.

5 One thing on the equipment documentation,  
6 I know you mentioned the equipment is being donated  
7 by the Koreans and Germans.

8 Depending on who you're getting equipment  
9 -- who we're buying stuff from, if it's secondhand  
10 refurbishment commonplace, they may have access to  
11 documents that we would need for the other items that  
12 are donated, assuming we get the information on what  
13 exactly they are donating.

14 So, there may be ways to get  
15 documentation through that same contract that we're  
16 buying the equipment from to help us with this part  
17 of the deal.

18 Unless, I mean, we may get stuff from the  
19 people that are donating it, but if not, that may be  
20 an option to get it.

21 MR. MELLY: That's a good point.

22 MR. TAYLOR: That is a good point.

23 MR. MELLY: In terms of output from this  
24 meeting, what people can expect, we do plan on  
25 issuing the NUREG/CP which will document all of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 presentations that have been given, some of the notes  
2 that we've taken during the meeting. That's a little  
3 bit longer term.

4 Do we plan on putting out a meeting  
5 summary?

6 MR. TAYLOR: So, this is a public  
7 meeting, there will be a meeting summary, short two-  
8 page meeting summary of what took place. But, it  
9 won't be as detailed as the CP that we'll put out in  
10 the near future.

11 Questions in the back?

12 MR. FUNK: Kenn, I think this question is  
13 directed to you.

14 Yesterday, you mentioned that there is  
15 going to be an interest in looking at this testing  
16 and the results from a more traditional Class 1-E  
17 general design criteria perspective with regard to  
18 the generic issue.

19 What about your fire guys, for all  
20 practical purposes and so you can see that's the  
21 focus of everything here.

22 So, with regard to the pilot plants, what  
23 are your expectations or what do you see their  
24 involvement as it relates to the generic issue from  
25 the perspective of single failure and GDC-3

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 explosion?

2 They might not approach it, I mean, just  
3 as good to go forward with the blinders on if fire  
4 PRA unless we know there is some difference.

5 MR. MILLER: I'm not really sure how to  
6 answer that, to be honest with you. Because I'm  
7 still a little bit fuzzy on how this plays over on  
8 the GDC side because of the single failure criteria.

9 And, by definition, these HEAF events are  
10 indicative of a fault and then failed protection  
11 which goes beyond single failure.

12 So, I'm not really sure how to can that  
13 yet. But, I guess my thought was at least being  
14 aware of how this plays out and see if there's any  
15 issues with, for instance, some of the criteria we  
16 have for physical separation between safety trains  
17 and whether or not an event like this, you know, has  
18 the potential to affect and alternate train.

19 So, I'm not really sure yet how that  
20 plays. Just know that, you know, on the surface it's  
21 we've got to think about independence of safety  
22 trains and how this could affect that.

23 MR. FUNK: I understand. What is the  
24 inherent nature of doing the deterministic safety  
25 analysis, we know that fire can affect multiple

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 trains, you know, as a common cause. But, the  
2 Appendix R analysis --

3 MR. MILLER: Yes, fire --

4 MR. FUNK: -- deals in that so, it  
5 depends on while we're looking at this as this is a  
6 fire event or something else? Because that  
7 determines whether it's a single failure impact or  
8 not.

9 MR. MILLER: Well, in GDC specs --

10 MR. FUNK: Under the design basis  
11 criteria.

12 MR. MILLER: In GDC specs, it's a single  
13 failure. I mean, that's what you talk about, you  
14 know, the safety systems, what your dual train and  
15 you have some fill there of safety function assuming  
16 it's single failure.

17 So, I'm not sure.

18 MR. FUNK: Okay. There again, the safe  
19 shutdown analysis, if you separate -- and the single  
20 rule specifically states you do not assume single  
21 failure so, that's a rimless oxymoron.

22 MR. MILLER: Right, that's -- that's kind  
23 of a separate thing.

24 MR. FUNK: I've reviewed this.

25 MR. MILLER: That's a separate rule. But,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 yes, I'm not sure, I'm not sure.

2 MR. FUNK: I understand, sir. Thanks.

3 MR. MILLER: That will be an interesting  
4 observance when it comes out. And, I know that's  
5 what Bob was thinking also.

6 MR. GARDOCKI: To follow up with your  
7 saying that, there are some mitigated measures that  
8 we explored during our committees. The heat shield  
9 was one that we kind of touched on but we didn't go  
10 into depth on and I don't think industry is really,  
11 well, explored that and come up with anything that's  
12 qualified on how this is going to affect that type of  
13 mitigated measures.

14 So, this is really going to affect some  
15 of those mitigated measures.

16 There is some photo detecting, you know,  
17 light sensitive tripping breakers that the industry  
18 is exploring right now.

19 I'm not sure what stage industry is  
20 taking credit for those as mitigated measures for  
21 this kind of arc flash and tripping the breaker  
22 within microseconds.

23 So, those are some exploratory mitigating  
24 measures out there that we don't know exactly where  
25 industry stands. I don't know if anyone here can

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 touch on that.

2 MR. MILLER: Kenn Miller.

3 I know one thing I would say, based on  
4 looking at this type of event, certainly preventative  
5 measures is something I would be looking at from GDC  
6 deterministic perspective, obviously, that your  
7 protected schemes are proper in terms of clearing  
8 faults as quick as possible within the 2 second limit  
9 of the equipment which should preclude this type of  
10 event in the first place.

11 So, I mean, from --so, from that side of  
12 the house, I would -- that's something I'm hoping to  
13 see out of, you know, reaction to the industry and  
14 they go back and look at their preventative measures  
15 and getting in a position where this kind of event  
16 can't occur.

17 So, that's an important lesson here, I  
18 think, just because the potential of this event to do  
19 damage.

20 MR. TAYLOR: Anything else? We're getting  
21 -- I think we're starting to wind down here.

22 Anything from today's or even yesterday's  
23 discussion?

24 (No response)

25 MR. TAYLOR: What about on the webinar,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Tom, do we have anything coming in through the  
2 webinar?

3 MR. AIRD: No public comment on the  
4 webinar.

5 MR. TAYLOR: We do have to open up for  
6 public comment before we close.

7 MR. AIRD: All right, let's do that right  
8 now.

9 MR. TAYLOR: Okay, so, for those on the  
10 phone line, I'm going to have Tom open up the phone  
11 lines which will take a few seconds here. And, if  
12 you do have any comments, please identify -- unmute  
13 your phone, identify yourself and then make your  
14 comment.

15 So, I'll wait for Tom to give me the nod  
16 that the phone lines have been unmuted.

17 Okay, the phone lines are open, so if you  
18 have a comment, please identify yourself and make a  
19 comment.

20 Okay, so I don't hear any comments from  
21 the public. Okay, no comments during the public  
22 comment period.

23 With that, we'll go ahead and move to  
24 Mark Salley for some closing remarks.

25 MR. SALLEY: Yes, and then, Mike Cheok is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 going to make a couple closing remarks here at the  
2 end.

3 But, thank you all for attending. Gabe  
4 did a good job covering the actions. This is a  
5 couple I just wanted to touch on here.

6 Actually, working under the MOU, I'm  
7 sorry, I just wanted -- yes, work on the MOU, two  
8 things I just want to touch on.

9 Again, you saw the KEMA offered on the  
10 field trip if that makes it more understandable, the  
11 generator, the facility and that, please talk with  
12 NEI. If we have anything there, we'll be happy to  
13 set something up.

14 And then, do a -- meet you up there for  
15 a day trip or something along that line.

16 The other thing is, Gabe, again, touched  
17 on this, too, and it's the risk analysis nuclear  
18 pilot plants. Again, that's an area where we could  
19 work with you to get that and move the generic issue  
20 along, we would like to work with EPRI on that one.

21 MS. LINDEMAN: We would need to  
22 understand your expectations for a pilot plant as  
23 well.

24 MR. MELLY: We'd need a follow up meeting  
25 to be sure on specifically the pilot plant questions

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and actions.

2 MS. LINDEMAN: Do you want me to repeat?

3 MR. SALLEY: Sure.

4 MS. LINDEMAN: Yes, I think just  
5 clarifying the timing of the pilot plant just seemed  
6 that was uncertain. And, where the intern ZOI fit in  
7 to all of this, that and then, just what your  
8 expectations are.

9 As you saw, there's a wide variety and  
10 just tell us what you need.

11 MR. SALLEY: Okay. And, working on the  
12 MOU I can get with you and we can talk about that.

13 And, let's see, that's the only thing  
14 I've got, so I will give it to Mr. Cheok.

15 MR. CHEOK: So, thank you again for  
16 coming out. I know two days is a lot. And, thank  
17 you all the people on the webinar and the public  
18 phone lines, two days is a lot of time to spend with  
19 us and that's not even counting travel time. So,  
20 thank you.

21 And, hopefully, you'll have learned  
22 something about our process and understand it a  
23 little bit more.

24 I know, I sit in here and I understand  
25 your comments and your questions and concerns a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 little -- a lot better. So, I'm glad I showed up and  
2 we had this thing.

3 And, I apologize to those people out in  
4 their presentations yesterday afternoon. I fully  
5 intended to be here, but I made a mistake of opening  
6 some emails at lunchtime. So, that kind of affected  
7 my afternoon.

8 So, again, thank you. But, I want to  
9 mention something else, too. So, the generic issue  
10 process and everything else involves more than just  
11 the Office of Research.

12 NRR is also a player there, you know, our  
13 counterparts they are totally involved in this. And,  
14 I know my counterpart, Mike Franovich has been  
15 following this here with EPRI now and I've had a  
16 couple of emails from him, you know, actually making  
17 comments and asking questions.

18 So, he has been listening in. He's not  
19 been here, but so we have been working fully with NRR  
20 and they are on board and we will continue to have a  
21 panel basically with NRR and Research as we go  
22 forward.

23 Again, thank you.

24 MR. TAYLOR: Okay, with that, that's the  
25 end.

1 MR. SALLEY: Oh, one other thing. I'm  
2 sorry.

3 MR. TAYLOR: One more.

4 MR. SALLEY: Before Mark calls, is Kenny  
5 Hamburger not here, he's in Paris, you know, he did  
6 a lot of work to set this meeting up, do all the  
7 presentation material put together. So, I think we  
8 should thank Kenny for doing all that.

9 MR. MELLY: He's potentially still on the  
10 phone still working at 11:00 Parisian time.

11 MR. SALLEY: Mark Earley turned around  
12 and he reminded me of something.

13 So, Ashley one other thing with the  
14 definitions, NFPA and Research have been working and  
15 we've been having a few webinars, exchanging some  
16 ideas.

17 Mark has a very impressive thing that  
18 we've been talking to and we've been talking to and  
19 we've been learning a lot about the work they've  
20 done.

21 If you want to dial in with us on the  
22 definitions, Mark, if that'd be okay, we'd get EPRI,  
23 you know, you and Kenn work with us, we'd really  
24 appreciate that. And, I think, again, with that  
25 collaboration, I think we could really get some high

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 quality work turned around and a lot of work.

2 Okay, with that, we'll go off the record  
3 and we're done.

4 Thank you very much.

5 (Whereupon, the above-entitled matter  
6 went off the record at 4:52 p.m.)

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25