Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
523rd Meeting

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Thursday, June 2, 2005

Work Order No.: NRC-423 Pages 1-168

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

523rd MEETING

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THURSDAY, JUNE 2, 2005

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ROCKVILLE, MARYLAND

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Graham B. Wallis, Chairman, presiding.

COMMITTEE MEMBERS:

GRAHAM B. WALLIS, Chairman

WILLIAM J. SHACK, Vice Chairman

GEORGE E. APOSTOLAKIS, Member

MARIO V. BONACA, Member

RICHARD S. DENNING, Member

THOMAS S. KRESS, Member

DANA A. POWERS, Member

VICTOR H. RANSOM, Member

STEPHEN L. ROSEN, Member

JOHN D. SIEBER, Member

ACRS STAFF PRESENT:

JOHN T. LARKINS, Executive Director
ASHOK C. THADANI, Deputy Executive Director
SAM DURAISWAMY
MEDHAT EL-ZEFTAWY
JENNY M. GALLO
MICHAEL L. SCOTT

NRC STAFF PRESENT:

RAJ ANAND, NRR
WILLIAM BECKNER, NRR
SUZANNE BLACK, NRR
LAURA A. DUDES, NRR
RAYMOND HV GALLUCCI, Ph.D., NRR
BAGCHI GOUTAM, NRR
NAEEM IQBAL, NRR
PAUL LAIN, NRR
CLIFF MUNSON, NRR
BIJAN NAJAFI, NRR
ROBERT RADLINKSI, NRR
JOHN SEGALA, NRR
SUNIL WEERAKKODY, NRR

MIKE WOODS, OGC

ALSO PRESENT:

GUY CESARE, Enercon

WILLIAM LETTIS, William Lettis & Associates

GEORGE ZINKE, Entergy

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A-G-E-N-D-A

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

9:10 a.m.

CHAIRMAN WALLIS: The meeting will now come to order. This is the second day of the 523rd meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting the Committee will consider the following, draft safety evaluation report related to Grand Gulf Early Site permit application, Draft Final Regulatory Guide, Risk Informed Performance-Based Fire Protection for Exiting Light-Water Nuclear Power Plants, status reports on the quality assessment of selected research projects, future ACRS activities, report of the planning and procedures subcommittee, reconciliation of ACRS comments and recommendations, preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswamy is the designated Federal official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. A

transcript of portions of the meeting is being kept.

And it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

We will proceed with the first item on the agenda. I'll turn to my colleague Dr. Powers to lead us through it.

MEMBER POWERS: Thank you, Mr. Chairman. We're going to discuss the second of the early site permit applications. Again, this is a first look at the application.

We'll actually go final -- look at the final assessment, probably in September, right? September or October, something like that. We previously looked at ANO.

We're now going to look at the Grand Gulf. We sent up a letter on ANO and have not yet received a response. But I'm told that the check is in the mail.

MR. ZINKE: Dana, that was North Anna.

MEMBER POWERS: I'm sorry, North Anna. Pardon me. And we're now going to turn to looking at Grand Gulf. And, again, this is one of those, really a pretty good site for locating nuclear power plants.

And so, they're interested in bringing another one there. And, with that, I'll ask George Zinke if he'll talk to us about why he wants to stick another nuclear power plant on the Mississippi River.

MR. ZINKE: All right. I'm George Zinke with Entergy. And, with me today is Guy Cesare, Enercon, who is on the ESP team, and Bill Lettis with William Lettis & Associates.

They did the seismic analysis. Grand Gulf is located in Claiborne County, Mississippi. It's on the eastern bank of the Mississippi, the site. It's already said it already has one nuclear unit, BWR 6.

The nearest large population center is Vicksburg, Mississippi, which is 25 miles north, about 27,000 permanent residents.

CHAIRMAN WALLIS: It's interesting you call it the eastern bank. It's actually a bluff, which is quite a distance above the bank, isn't it?

MR. ZINKE: Yes, the property goes up to the bank.

CHAIRMAN WALLIS: The property goes up the bank?

MR. ZINKE: Right. The site then is located about a mile off of the river. The principle town close to the site is Port Gibson, Mississippi,

about six miles away, population about 1,750.

The next slide is a small slide showing about the location of the Grand Gulf site. Site five, the original site was planned -- we had planned building two units.

We completed one, didn't complete the other one. The unit we're proposing now would not -- would be adjacent to where the two units were going to be.

It does not go on the exact placement that the original second unit was planned for. It would be in an area that right now is used as a parking lot.

The proposed footprint for the area is on land that was disturbed during original construction.

MEMBER APOSTOLAKIS: What's EAB?

MR. ZINKE: The exclusion area boundary.

MEMBER APOSTOLAKIS: Oh, okay.

MR. ZINKE: The site area population, zero to ten miles, approximately ten thousand, ten to fifty, 325. It's permanent. We did projections for the early site permit, both out to 2030, which would be where the permit expires.

We've requested a 20 year duration of the permit. And we also did projections to 2070, which would have been -- would be a 40 year life of a

facility.

And we saw the low to modest estimated growth in population. The Grand Gulf site generally is rural and remote. The land use is primarily in forestry, agriculture.

There are no commercial airports within ten miles. The closest large airport is 65 miles, which is the Jackson Mississippi International Airport.

Closest major highway is U.S. 61. Since the original construction of the Grand Gulf one, that highway, it was two lane while we constructed the original Grand Gulf.

It's now a four lane highway. We also evaluated in the SAR some of the characteristics associated with our unit, is it uses hydrogen injection.

So we did evaluate the hydrogen as a hazard, along with other kinds of hazards that would go up and down the Mississippi River. There are no active rail lines or military installations in the vicinity, gas/oil pipeline about 4.75 miles.

We evaluated air traffic corridors, commercial and military. Like I said, we evaluated the traffic up and down the Mississippi River for

hazards.

At the proposed elevation, the site is approximately 65 above the normal Mississippi River level. The Mississippi River in our area does normally flood part of the property every year.

It does not -- the water level does not flood the actual site of where the plant safety related structures are.

MEMBER POWERS: It seems to me a key part of our discussion in our subcommittee meeting on this flooding issue came up with -- well, normal is normal.

What about a 100 year? And we discussed your strategy of flooding Alabama instead of Mississippi. Maybe you should touch upon that.

MR. ZINKE: Louisiana.

MEMBER POWERS: I'm sorry, Louisiana.

MEMBER APOSTOLAKIS: There's a couple different kinds of flood levels that we evaluate relative to the site. One is flooding that is a result of the Mississippi River flooding.

And, with regard to that kind of flooding, because of -- one of the characteristics of the site is because of the elevations and because of the flatness of Louisiana, that with a small rise in the river the water will spread.

And so, to actually get, you know, major flooding concerns solely because of the Mississippi River, it takes a lot of water because of the amount of flat ground that there is to spread in the State of Louisiana.

MEMBER POWERS: I think that's clever.

MEMBER APOSTOLAKIS: Yes. The other kind of flooding that we talked about in the subcommittee is the local flooding. And that has more to do with the placement of the structures and the grading of the ground.

And a lot of that won't be finalized until we would actually select the design and where the structures go.

CHAIRMAN WALLIS: Now, the flooding won't flood the buildings, but it will flood the EAB presumably. Do you have a fence around there? Does the fence get flooded?

MR. ZINKE: The --

CHAIRMAN WALLIS: It looks as if it goes way down on the flood plain.

MR. ZINKE: The normal Mississippi River flooding doesn't --

CHAIRMAN WALLIS: Doesn't it flood Hamilton Lake and Gin Lake presumably?

MR. ZINKE: Yes, it floods that area.

CHAIRMAN WALLIS: So, presumably the boundary fence gets underwater. What does that do to exclusion zones?

MR. ZINKE: There is not a fence around the exclusion area.

CHAIRMAN WALLIS: There isn't?

MR. ZINKE: We have a fence around --

CHAIRMAN WALLIS: The fence is up on the bluff?

MR. ZINKE: No, the fence is actually located just around the unit 1 buildings themselves, the protected area. There is no fencing along the property boundary.

CHAIRMAN WALLIS: Now, this EAB is not --

MR. ZINKE: That's not fenced.

CHAIRMAN WALLIS: That's not fenced.

MR. CESARE: The EAB is established for dose calculation purposes.

CHAIRMAN WALLIS: Yes, that's one of those regulatory things.

MR. CESARE: It is, and the entire exclusion area --

CHAIRMAN WALLIS: Someone's going to stand on that circle and get radiated, that's the idea?

MR. CESARE: Yes.

MEMBER POWERS: One of the hormesis types can stand there.

MR. CESARE: But it is within the property, the owner controlled area of the site.

MEMBER POWERS: Which is the dotted line.

CHAIRMAN WALLIS: Yes, we're talking about floods.

MR. CESARE: And floods, as you say, would advance the flood level providing you don't go over the Louisiana levies at 103, it proceeds to the east of the bluff line. It would be that flood and --

VICE CHAIRMAN SHACK: Oh, I see. And the west bank is Louisiana. So, when the levy overflows, you flow --

CHAIRMAN WALLIS: It goes for miles into Louisiana.

MEMBER DENNING: But, is it possible that Louisiana will realize this and build higher levies?

(Laughter.)

MR. CESARE: My family is from Louisiana, they have not been able to change that since 1900.

MEMBER POWERS: Your prognosis is no advancement.

MEMBER DENNING: Is it technically

feasible? I mean, is that potentially what's going to happen in 20 years?

MR. ZINKE: No. And, in that area, the land that gets floods, you know, they plant some of the crops that are planted and the forestry, you know, it has accommodated knowing that it floods every year.

CHAIRMAN WALLIS: It helps the growth.

MR. CESARE: But there are levies that protect that land. And that's 103. And so, they do infrequently have floods. But it protects the land usually.

But, at 103, which is a very high level, you will have some floods of Louisiana. But, even at 103, there's still 29, 30 feet up to the plant elevation.

So, there's not going to be any changes there. It is possible the Corps of Engineers might consider a higher levy. But it wouldn't be 30 feet.

MR. ZINKE: Slide 9. In the SAR of the application we did consider riverborne hazards, did consider the hydrogen shipments that go to unit 1 for hydrogen injection.

Due to the number of shipments and the distance, we determined that was non-hazardous.

CHAIRMAN WALLIS: There'll be no hydrogen

shipments to this new reactor?

MR. ZINKE: None of the designs we've looked at have that. That doesn't mean that a design couldn't be picked that would require that. If that was so, you know, then that would have to be analyzed at the combined license stage where we pick the design, which is the stage where we would look at the hazards for the new plant and the hazards to the existing plant.

VICE CHAIRMAN SHACK: You didn't look at a BWR for one of the new designs?

MR. ZINKE: We looked at the ESBWR and the ABWR, the advanced designs. We don't -- we're not --

VICE CHAIRMAN SHACK: But they would run with hydrogen water chemistry, wouldn't they?

MR. CESARE: This is a risk analysis for the delivery of liquefied hydrogen to the storage facility on the site, which is on the eastern side of the site.

I think we'd have to get there to see -- we probably, in that it's so far from both the unit 1 on the east side and even farther from the proposed facility, then you'd have to talk about getting the hydrogen over to the new facility. So, that has to be looked at then.

MEMBER POWERS: I think your blast analysis is still correct. It's just changing the frequency of delivery.

MR. CESARE: True. This one was -- this was -- this one was based on 50 shipments per year. Right now they're receiving 36 per year. So, it's a conservative, correct.

Those were fifty per week, very big trucks. So, it had to be looked at to see if it would change the risk.

MR. ZINKE: On slide ten, again, as part of the application, we would do the -- show that an emergency preparedness plan could be developed for the site.

Exclusion area boundary was advised to encompass the proposed new facility. There aren't any resident residents within the EAB, it's not traversed by rail or waterway.

The low population zone would be a two mile radius essentially unchanged from what unit 1 is right now. Throughout the SAR we analyze all of the site characteristics.

And those were identified in the SAR. And we talked in a lot more detail in the subcommittee. The major portion of the SAR is the seismic analysis.

And I'm going to have Bill Lettis go through briefly the major elements of the seismic analysis. If you'll turn to slide 12, this kind of lays out the process of how the seismic analysis works because the seismic analysis for the new plants is under a revised part 100.

And so, it is different. It is a probabilistic based versus the seismic analysis for the current units, including the current Grand Gulf, which is a deterministic based seismic analysis.

MEMBER APOSTOLAKIS: The two analyses are consistent with the results?

MR. ZINKE: The two analyses are different in what they -- because one is deterministic, one is -- they are fundamentally different.

MEMBER APOSTOLAKIS: But ultimately, won't you have a design basis earthquake or some acceleration you will have to use? Are these different?

MR. ZINKE: The numbers are going to be different. And Bill is going to talk a little bit about how the numbers are different. But it's a little different in comparing the whole what the deterministic design basis for seismic and the probabilistic because, when you look at how they

really are developed, even though at the end you get an SSE number, they really fundamentally mean something a little bit different.

But Bill can give a little bit more detail on that.

MEMBER APOSTOLAKIS: Okay.

MR. LETTIS: Thanks George. Good morning. My name is Bill Lettis with William Lettis & Associates. And I'm a consultant to Entergy on this project.

So, next slide. George just showed the flow chart, which laid out the process. The two primary elements in the process of developing a SSE design ground motion spectrum is to perform a characterization of earthquake sources in the region, use attenuation relationships to characterize the decay of ground motion from that earthquake source to the plant site.

And that will give us a rock ground motion at the site. And then we need to perform a geotechnical analysis of the soil properties at the site to see how the soil will either dampen or amplify the ground motion to give us the SSE design spectrum.

So, we undertook both a geotechnical investigation of the site as well as the earthquake

source characterization at the site. This is a geologic map of the site.

I apologize that the colors shown on the PowerPoint are different than the colors that came out on the copier. But, as George described, the site is located on the eastern bank, the high eastern bluff east of the Mississippi River.

The existing power block is located here. The proposed new site area is located west of the power block up near the bluff. So I'll show you the relationship of the new site to the bluff.

That's one of the features that we characterize. Just to describe some of the colors, the light tan on this is the -- are deposits that are about one million to two million years old.

So, underneath the entire site are deposits that are one to two million years old. And we're able to use those deposits to meet the regulatory guide 500,000 year threshold to show that there's no permanent ground deformation at the site in the last 500,000 years.

So, we have excellent geologic stratigraphy to be able to demonstrate that at this location. The area shown in yellow is the modified ground during plant construction of the existing Grand

Gulf plant.

But it's just modified ground of this light tan material. Next slide. This is a close-up now of the proposed power block area for the new ESP.

The existing plant is over here. Unit one was constructed. Unit two was not completed. And the blue symbols here represent existing borings that were performed for the existing Grand Gulf site and which we adopted for this investigation.

Shown in black are the new locations of subsurface borings and investigation to supplement the existing bore holes that were already there. Also shown on here are -- this is cross section B-B prime, which I'm going to show in the next slide.

We constructed several cross sections across the site to demonstrate or to document the site variability and subsurface materials because, you know, the new power block may be down here, or it may be over here, or it may be over there.

So, given that we don't know where the power block will be, we characterize this entire site for subsurface conditions. Next slide.

CHAIRMAN WALLIS: The cafeteria is an existing building?

MR. LETTIS: Yes.

MEMBER SIEBER: Where is that?

MR. CESARE: It's actually the engineering building of which that particular portion is a cafeteria. But it's the site engineering.

MR. LETTIS: If you've been to the site, this building exists, this is a broad, flat slope with a break in slope right here. This is basically a completely empty area.

Also shown -- this is another feature I'll point out -- shown in this tan color here and here are swales that existed in the original land surface that were grated over and filled during construction of the existing Grand Gulf site.

And so, on the next cross section on the next slide, this is the cross section. These are the swales shown in gray now that have been filled with artificial fill.

This shows the stratigraphy in the site. The yellow is a windblown loess sand and silt. And, underlying that in the orange and green are deposits that are, as I mentioned earlier, one to two million years old.

Beneath this green, which we just haven't shown here, are deposits at a Catahoula Formation, which are five million years old. Each of these, the

Catahoula Formation, this is called the Upland Complex, provide excellent datums, stratic geologic datums from which we can document the absence of deformation in the site area.

Okay. And this is the maximum possible depth or likely depth of any of the existing reactor discussions that have different embedment depths. So this is the potential range and embedment depth.

Groundwater is shown, existing groundwater level is shown here in blue. Next slide.

MEMBER POWERS: Before we leave that slide --

MR. LETTIS: Okay.

MEMBER POWERS: We spent in the subcommittee some substantial portion of our time discussing collapses that occurred along the bluff area.

MR. LETTIS: This bluff right here?

MEMBER POWERS: Did we come to a resolution on those discussions? I don't think you were actually part of them.

MR. LETTIS: I wasn't at the meeting.

MEMBER POWERS: Yes. But maybe George can fill us in on -- I bring it up just because you have the figure.

CHAIRMAN WALLIS: It's not what the scale is exaggerated for --

MR. ZINKE: Right, and that's -- the next slide, if you go to the next slide. One of the things we talked about when we talked about a bluff, the previous side was exaggerated in order to -- but it also led to a misconception on how big this bluff is.

This is the drawing to scale so that you can see that when we talk about a bluff --

MEMBER POWERS: It's a virtual bluff.

MR. ZINKE: It's a virtual bluff. It's a small -- yes, it's a Mississippi mountain.

CHAIRMAN WALLIS: Well, it's a beginner's ski slope instead of an expert one.

MR. ZINKE: Yes. But, part of the analysis did go into then as far as how close the facility might come to that edge and the design considerations that would need to be Gulf if we actually did bring a stretcher that close and the set-off distances.

And so, those were the subjects that we came, you know, we believe that we fully analyzed that and, if for any reason we actually did bring a structure that close to that, we've decided on what the minimum set-back distances would need to be.

MR. LETTIS: Right. Thanks for clarifying that, George. This is a one-to-one scale diagram just to illustrate to you the actual dimensions of the slope.

From the toe of the slope to the top of the proposed power block area is an eight degree project, which is a very low slope. And there's a very low likelihood that slope failure will occur back to the power block area.

We define this edge of the proposed power block area by looking at the maximum possible depth that a reactor embedment would be and took a one-to-one projection from that location to the top of the bluff.

So that -- we have a one-to-one projection from the top of the bluff down to the lowest likely embedment depth. And that identifies our exclusionary zone or our zone of potential influence.

And so, we're setting back from the top of the bluff that entire zone of influence. And so, we're not likely to, by constructing the plant here, load the slope and induce slope failure.

So we've gone through that analysis. And it's in the SAR. Next slide. A question came up about salt domes during the subcommittee meeting.

This is a slide of the Glendon Limestone, which is about a 50 million year old lime stone layer.

These are contours on the surface of that limestone at depths beneath the site. It's about a 50 million year old horizon. And two salt domes have been identified in the site area, the Bruinsburg salt dome and the Galloway salt dome, up north of the site.

These are six and eight miles from the site. This is a file mile radius around the site. So, these are over six and over eight miles away from the site.

And this limestone horizon documents the absence of any other piercement salt diapirs in the site area within the five mile area. Furthermore, the Catahoula Formation that I mentioned before, which is a five million year old stratum, overlies both of these salt domes, and the entire area, and show that there has been no diapiric rise or deformation of that five million year old horizon.

So, the rise of these diapirs sees over five million years ago in this area. And we don't see any evidence of any other diapirs in the site area.

In fact, this provides direct positive evidence for the absence of those features in the site area.

CHAIRMAN WALLIS: That shadowy thing on the left is an old Mississippi course, is that what that is? Way over there.

MR. LETTIS: Yes.

CHAIRMAN WALLIS: That's an old Mississippi River?

MR. LETTIS: Yes, the Mississippi River has meandered and relocated itself actually through history, but also through geologic time as it meanders back and forth across the Delta area, the Mississippi Delta.

This is its present location. And you can see recent abandoned -- these are oxbow lakes, they call them, recently abandoned channels of the Mississippi River.

These are frequently -- when we were talking about flooding, the first thing that happens is you re-flood old channels. Those are the low spots on the river flood plain.

And those are the first things that occupy the flood waters or carry flood waters. So, it takes a pretty extreme flow to both overtop the bank of the Mississippi here and overtop the banks of these earlier flood channels.

Anyway, next slide. This is now a

regional geologic map of the southeast southern U.S. This is the Grand Gulf site located here, 100 mile radius and a 200 mile radius just to give you a feel for scale.

Shown in these dots are historically recorded earthquakes. The blue dots are those that were recorded up until 1984. And the orange dots are those recorded from 1984 up until 2004 because we wanted to look at was there any changes in pattern or rate of seismicity in the last 20 years or so.

And basically the same pattern of location of seismicity emerges in the same -- and we did some calculations -- the same rates of seismicity are occurring in these principle areas of seismic activity.

This is the well-known New Madrid seismic zone that's located over 200 miles from the site. But still, the New Madrid -- the largest earthquake on the New Madrid source zone is one of the controlling earthquakes for ground motion at our site.

That's a good thing. It demonstrates that there's not a lot of other things closer, not a lot of other faults or seismic sources closer that can control ground motion at the site.

In fact, within 100 miles of the site,

there's only been three historic earthquakes in the historical record. It's one of the most seismically low areas in the entire U.S., this region around Grand Gulf.

So, from the seismic perspective, it's a very good location, very promising location for a reactor. We also identified these features --

MEMBER APOSTOLAKIS: I don't quite understand that though. I mean, you seem to be basing your conclusion on the fact that there haven't been many earthquakes.

MR. LETTIS: Yes, that's part of it.

MEMBER APOSTOLAKIS: But you had one that was a lion. I mean, New Madrid was big.

MR. LETTIS: Yes, that occurred over 200 miles away up here.

MEMBER APOSTOLAKIS: But my understanding is that it was felt at distances much bigger than 200 miles.

MR. LETTIS: Oh yes. And, like I say, it is the controlling earthquake down here. It contributes most of the ground motion at this site. And I'll show you that result.

MEMBER APOSTOLAKIS: You are sure there are no other faults anywhere?

MR. LETTIS: Right. This is both -- there are several lines of evidence that indicate the absence of earthquake activity closer to the site. One is looking at instrumentally recorded seismicity.

There's no patter emerging that there's some active seismic source, such as the eastern Tennessee source over by the Appalachians, the New Madrid source, this over here in Oklahoma, which might be related to the Meers Fault, which is a newly discovered fault.

But there's nothing near the site instrumentally. In addition to that, most of this site area from this zone of green faults right here called the Ouachita Orogenic Belt in south, most of this region is underlaid by thousands of feet, up to ten thousand feet of un-deformed strata.

So, we have -- like I showed the Glendon limestone, you can contour the surfaces of these geologic strata at depth up to ten -- back to the cretaceous period, over 65 million years ago and show that there's been no deformation of these, there's no faults located closer to the site, with one exception.

And that's this group of faults right here, which we've grouped together and called the Saline River Fault Zone. This is a recently

identified fault zone, in the last ten years.

There is some distributed but fairly sparse micro-seismicity to it. This is -- it's not for certain that there's an active fault there. But, in our probabilistic study we allow a 50 percent likelihood that there is a seismic source at that location because there's no Rosetta Stone yet that's been identified that says here is an active fault.

MEMBER APOSTOLAKIS: How -- you say these ones were identified 20 years ago?

MR. LETTIS: Yes, in the last ten years or so.

MEMBER APOSTOLAKIS: How does this happen? How do people identify faults? Are they looking for them or --

MR. LETTIS: Yes, people are looking and always looking. Can you go to the next slide? That will --

CHAIRMAN WALLIS: What do you look with? You don't look with your eyes, do you?

MR. LETTIS: We look -- there are a lot of phenomenon that you look for that are suggestive of active faulting. The first thing a geologist like myself would look for is we would look for geomorphic features on the land surface that are indicative of

active faulting.

Usually active faulting scars the land surface. And that's preserved over time. And it leaves lineaments or scarps, or other features. And that's what a professor at Memphis identified, were three -- what appeared to be three linear river alignments, the Ouachita River, Saline River, and the Arkansas River.

They all trend to the southeast. And he thought that that was suspicious. He came down here and started looking. And he found these areas shown in yellow, which are areas of obvious liquefaction.

The New Madrid earthquake produced liquefaction in this area shown in yellow, the large 1811-1812 earthquake sequence. That liquefaction field ends right here.

Nothing's been found from there southward until they located this. One possibility is that this is just far-field liquefaction from the New Madrid earthquake.

It's possible. I mean, you can do calculations and show it's possible. Or, these liquefaction fields may indicate a local earthquake source.

And we, because this is a nuclear site and

we're doing a probabilistic study, we have to allow for that uncertainty. So we've allowed that there may be an earthquake source.

So there's both geomorphic evidence that there are these linear river segments. That's one thing that a geologist looks for. There's evidence of liquefaction, geotechnical evidence of liquefaction, which is a phenomena that's fairly unique to earthquakes, generally earthquake induced.

There's flooding induced liquefaction, but not very often. And then thirdly, we look for a coincidence of earthquake, mirco-earthquake activity with potential faults or lineaments.

MEMBER APOSTOLAKIS: Now, these three obviously were not known when the current unit was licensed, correct?

MR. LETTIS: Right.

MEMBER APOSTOLAKIS: How as the safe shutdown earthquake determined for the current unit? Does this discovery affect anything with your existing --

MR. LETTIS: No, I'll show the results and compare it to the result of the existing unit. So, it --

MEMBER APOSTOLAKIS: But, for the existing

unit --

MR. LETTIS: The existing unit --

MEMBER APOSTOLAKIS: It was only the New Madrid earthquake?

MR. LETTIS: We used New Madrid as the deterministic controlling source. The deterministic approach, as George was describing, there are two very different methods of calculating ground motion.

And both of them have given us SSEs at this site. The deterministic approach says what's the largest possible magnitude earthquake that could occur in the site region and produce largest ground motion without considering the likelihood of that earthquake occurring?

The probabilistic approach looks at the likelihood of all earthquakes occurring and the contribution of all of those earthquakes to ground motion at the site.

So, it's the probabilistic ground motion SSE spectrum is not a single earthquake. It accommodates the contribution of earthquakes form all possible sources.

MEMBER APOSTOLAKIS: So, the discovery of these three faults could affect the probabilistic approach, but not the deterministic because the New

Madrid was so big?

MR. LETTIS: Yes, I haven't --

MEMBER APOSTOLAKIS: Is that correct?

MR. LETTIS: That's probably true. The deterministic approach also -- there's a requirement that you use a capable -- it's from a capable fault in those days, appendix A of 10 CFR 100.

You identify capable faults and you assign the largest magnitude earthquake to those capable faults. And you look at what that earthquake will do in terms of ground motion at your site.

And you take the biggest, regardless of the likelihood of it occurring. With the Saline River source zone, I would be hesitant right now to say that this meets the definition of a capable fault under appendix A.

There's no hard, direct proof that there is an active fault right there. That's why in the probabilistic approach -- and the beauty of the probabilistic approach, it allows you to assign a likelihood that there might be an earthquake source there, which we have done.

We have given it a 50/50 percent chance of being there or not being there. And, in the -- if I was doing this in the old days, I haven't gone through

this analysis, I'm not sure I would have assigned a capable fault in the Saline River area given the information that's available to date.

So it would probably still be -- the deterministic approach would probably still be based on New Madrid. Even if you do assign a capable fault in the Saline River area under the old approach, the maximum magnitude would probably be a magnitude six and a half as opposed to a magnitude eight on the New Madrid.

And, once again, I haven't done that calculation either to see whether we would have revised an old deterministic ground motion.

MEMBER APOSTOLAKIS: Okay.

MR. LETTIS: But, just to move on, this is the New Madrid source. We considered three -- in our analysis for Grand Gulf we used the existing EPRI earthquake source model, which is allowed under Reg Guide 1.165.

And we modified -- conservatively modified that existing earthquake source model by adding this source, the Saline River source, and by adding a new New Madrid source to the existing New Madrid source.

MEMBER APOSTOLAKIS: Let me understand this, the EPRI methodology actually gives you curves,

right? It gives you curves for --

MR. LETTIS: Right.

MEMBER APOSTOLAKIS: -- spectrum acceleration.

MR. LETTIS: Right.

MEMBER APOSTOLAKIS: If we chart the result of expert opinion elicitation.

MR. LETTIS: Right.

MEMBER APOSTOLAKIS: At the same time, wasn't there a study from Livermore that had different codes?

MR. LETTIS: Right, Lawrence Livermore --

MEMBER APOSTOLAKIS: Much more conservative because of the way the expert opinions were processed. And then, to reconcile the two, there was a Senior Seismic Hazard Analysis Committee that came up with a sort of a methodology.

MR. LETTIS: Right. They define the methodology.

MEMBER APOSTOLAKIS: So, why then are you using only the EPRI methodology?

MR. LETTIS: The Reg Guide 1.165 allows you to use either. They don't require you to use both.

MEMBER APOSTOLAKIS: Either meaning which

ones?

MR. LETTIS: EPRI or Lawrence Livermore.

MEMBER APOSTOLAKIS: How can it do that? I mean, there were significant differences between them.

MR. LETTIS: And --

MEMBER APOSTOLAKIS: When was this regulatory guide approved?

MR. LETTIS: I'm not sure that I would agree with the comment that the Lawrence Livermore is always more conservative. In some areas it's more conservative.

MEMBER APOSTOLAKIS: Well, the seismic curves are. I mean, it was more conservative --

MEMBER POWERS: Only for eastern seaboard earthquakes.

MEMBER APOSTOLAKIS: Yes, and that's where we are, right?

MR. LETTIS: Now, we're in the south, not in the eastern --

MEMBER APOSTOLAKIS: No, east of the Rockies. We are east of the Rockies.

MEMBER POWERS: I think you have to move east to get significant differences.

MR. LETTIS: Some of the key --

MEMBER APOSTOLAKIS: East of this?

MR. LETTIS: Yes. A couple of key different -- I was on --

MEMBER APOSTOLAKIS: Shouldn't you compare them? I mean, did you compare them? Did you look at the Livermore curves at all to --

MR. LETTIS: No.

MEMBER APOSTOLAKIS: Shouldn't you? The reason why I'm saying this is because that difference which may, you know, may have been more significant east of your site, let the three major organizations in our business, DOE, EPRI and NRC, you know, create this new committee to try to resolve the differences.

So, how can we just say now we only use EPRI. I mean, you have to give some consideration to the other stuff and dismiss it or do something about it.

MR. LETTIS: I think that that isn't -- I mean, fundamentally I agree with you. But that's not the responsibility of an individual Applicant to do.

Those two were -- EPRI and Lawrence Livermore were carefully reviewed and looked at by the NRC. And the NRC has concluded that you may use either.

They have accepted both studies. And they

don't require you to compare both or to use both. And I would also -- in this area -- and I haven't done that so I can't tell you the actual answer.

But, in this area I don't think there will be that much difference. In the eastern U.S. -- I worked on both of the two of them. In the eastern U.S. -- I was one of the seismic source guys for the Lawrence Livermore study.

In the eastern U.S. more weight was given to the Triassic Basin being sources of large earthquakes. So, Charleston earthquake could float up and down the eastern seaboard.

MEMBER APOSTOLAKIS: That's one of the major differences in the attenuation models that were used?

MR. LETTIS: Yes, I think that's also a difference. I wasn't part of it.

MEMBER APOSTOLAKIS: It was a driver.

MR. LETTIS: Okay. I wasn't part of the attenuation --

MEMBER APOSTOLAKIS: A famous expert from southern California was driving the Liver more curves way out there.

MR. LETTIS: I also --

MEMBER APOSTOLAKIS: Don't you think

though that the issue will come up? Somebody will challenge you. I mean, maybe the regulatory guide doesn't say that.

By the way -- who is the -- Med, are you running this?

MR. EL-ZAFTAWY: Yes.

MEMBER APOSTOLAKIS: I'd like to have a copy of our guide.

MR. EL-ZAFTAWY: Sure.

MR. LETTIS: It's Reg Guide 1.165.

MR. EL-ZAFTAWY: There's also some indication, at least my understanding, that maybe the NRC is in the process right now to meet with the industry to revise Reg Guide 1.165.

MEMBER APOSTOLAKIS: Do you have a copy of it here?

MEMBER DENNING: But you do agree, George, that he's on solid ground in terms of saying I followed the regulatory guide. The burden isn't really on him.

The burden is on us now to look a little more closely. But certainly --

MEMBER APOSTOLAKIS: Well, I don't know about that. You know, if you know that there is -- if you want to go by the letter of the law, you're right.

MR. LETTIS: If I could add one additional comment that might help ease the pain a little bit. We used the EPRI seismic source model. You're referring to that there was -- that the big driver and the difference was the attenuation.

MEMBER APOSTOLAKIS: I think it was the seismicity but the attenuation was a bigger one.

MR. LETTIS: Yes. And so, what was done for this study is the attenuation relationships were completely updated through a new SSHAC process so that we did not use the old EPRI attenuation relationships to calculate ground motion.

There was a SSHAC workshop process that was completed in 2004 where a group of around 13 or 15 individuals were convened and they selected a new set of attenuation and weighted these attenuation relationships for the central and eastern U.S. both for the Gulf Coast region, which has its own set, and then the rest of the eastern central U.S.

And so, the disagreement between say the Lawrence Livermore camp and the EPRI camp is no longer important because there was a new group that was convened that developed a new set of attenuation relationships to use in the current -- all of the ESP Applicants are using this new ground motion

attenuation set.

MEMBER APOSTOLAKIS: So what you are using is really a mix of the old EPRI and the --

MR. LETTIS: Well, it was a SSHAC process. All of the old attenuation relationships that were used in the late 1980s have been updated significantly.

The attenuation relationships are much improved. And so, there's no hold over of any attenuation relationship that was used either by Lawrence Livermore or the early EPRI.

They're all new. And so, a new group of attenuation relationships were considered and weighted and used for Grand Gulf as well as North Anna, as well for Clinton.

MEMBER APOSTOLAKIS: And you were on those workshops?

MR. LETTIS: I was not on the workshop, no. That was an EPRI workshop.

MEMBER APOSTOLAKIS: Oh, EPRI, not just for you?

MR. LETTIS: Not ours. There was an EPRI -- that was in the original flow chart. EPRI convened a panel of experts. And it was about a two year process where they met several times and fully vetted

all the various relationships, tested the relationships and came up with a weighting scheme for this.

This was under EPRI. And it was published by EPRI in 2004. And that was -- those were the attenuation relationships that were used by all three applicants.

MEMBER APOSTOLAKIS: But they used the SSHAC methodology?

MR. LETTIS: The SSHAC methodology of expert elicitation was used. It was a SSHAC level three elicitation.

MEMBER APOSTOLAKIS: Okay, that's better.

MEMBER POWERS: And, just to be clear, you used the EPRI seismic source relationship as modified by the recent USGS?

MR. LETTIS: We considered all new data in updating the EPRI seismic source. One of the new data sets was the USGS. And, you know, there's been a lot of -- one thing about geology and seismology is its' constantly changing and evolving. And there's lots of new publications.

MEMBER APOSTOLAKIS: Constantly changing? When you talk about five million years --

MR. LETTIS: Our understanding of geology

is changing.

MEMBER APOSTOLAKIS: It changes every few million, right?

MR. LETTIS: Geology stays the same. But our understanding is continually being updated. And so, a big, big effort in this study as well as all ESP applicants that will come before you is an update of the geology, seismology, tectonics, and geophysical database because it's been 25 years since EPRI was published in the late 1980s.

And a lot of new work has been done and improvements made. And so we need to carefully consider this new data in terms of, you know, identifying characterizing earthquake sources.

And so, the two main changes that we -- just to conclude this. We updated New Madrid. We assigned different magnitudes. And most importantly, in the early EPRI and Lawrence Livermore days, the recurrence of a New Madrid earthquake was assumed to be thousands of years, five thousand years roughly.

It's now thought to be around 500 years with a range of between 200 and 800. And so, we used that updated recurrence and maximum magnitude and also identified three possible fault sources within New Madrid, the Blytheville Arch, the Reelfoot Fault, and

the East Prairie Fault.

And each of those three faults may produce magnitude seven to eight size earthquakes. And that's been incorporated into our analysis. Okay, just to close, given all of these earthquake sources, this is the seismic hazard curve that --

CHAIRMAN WALLIS: What's the frequency of these New Madrid events?

MR. LETTIS: The New Madrid earthquakes occur on the order of every 500 years.

CHAIRMAN WALLIS: Five hundred years, okay.

MR. LETTIS: Yes. And whether just one occurs or whether three occur, like in 1811-1812 where three occurred, that variability is also incorporated into our model.

So, given these earthquake sources, you run through the PSHA analysis. It plots hazard curves for different frequencies. I've just shown the five hertz frequency.

And the red line is the mean hazard. And this is the median and the 85^{th} and 15^{th} --

MEMBER APOSTOLAKIS: So, this is the result of the workshop now?

MR. LETTIS: This is the result taking the

EPRI attenuation model and our revision to the source model and running through the probabilistic hazard code.

MEMBER APOSTOLAKIS: And the SSHAC part and everything?

MR. LETTIS: Right.

MEMBER APOSTOLAKIS: Now, I will say, a major driver in the SSHAC approach, which does not say that because it's relevant to other things we have been looking at.

If you follow what SSHAC recommended, then the claim is that these curves are not just the state of knowledge of the SSHAC of the people in the workshop.

They are representing in the community's views. Okay? The worldwide community of experts, they are trying to put themselves in a position. You know, how good they do that, how well, is a different story.

But, the important point is that they are asking themselves that, what does the community feel? And there is typically one order of magnitude in frequency differences if you go to a particular acceleration.

MR. LETTIS: Yes.

MEMBER APOSTOLAKIS: And the 85th.

MR. LETTIS: Yes.

MEMBER APOSTOLAKIS: And, for some reason, the seismic guys want to be different. So the upper and lower bounds are the 85th and the 15th.

MEMBER POWERS: Just as capricious as any other number.

MR. LETTIS: Okay, next slide.

CHAIRMAN WALLIS: You need some ones on the axis there.

MR. LETTIS: That gives us --

MEMBER APOSTOLAKIS: Wait, wait, wait. The previous curve now, how do you use that? This one, do you use it to do anything with it?

MR. LETTIS: Yes. We're using at ten to the minus five probability median.

MEMBER APOSTOLAKIS: Median?

MR. LETTIS: And so, in this case it would be -- you develop hazard curves for all different frequencies. And you use that to construct your response spectrum.

MEMBER APOSTOLAKIS: Okay.

MR. LETTIS: This tells you, at ten to the minus five what the ground motion would be, roughly point two G at ten to the minus five at five hertz.

MEMBER APOSTOLAKIS: Okay.

MR. LETTIS: And so, you can construct -- you have your ground motion at the different frequencies as your rock input at the base of the soil column, which is over 10,000 feet thick at Grand Gulf.

So now we have to translate that ground motion at 10,000 feet depth up through the soil column. And so, the next slide will show this is the upper part of the soil column at Grand Gulf.

We developed velocity information for the different horizons. And we put this down to 10,000 feet. And we have developed site amplification. This is the transfer function.

So we develop our site amplification, or the amplification factor for all the different frequencies. And so, we'll take our rock ground motion and multiply it by either an amplification or a dampening factor to develop the final free field SSE ground motion.

Next slide. And so, this is the -- shown in red is our computed SSE ground motion, free field ground motion incorporating the effects of site response at the site.

MEMBER APOSTOLAKIS: We can't read it.

MR. LETTIS: the blue is the --

MEMBER APOSTOLAKIS: The 100, ten, geeze.

MR. LETTIS: Yes, I'm sorry. The frequency across the bottom is point one on the left corner. And this is a log scale. So, one, ten, and 100 hertz, 100 hertz essentially being the PGA, peak ground acceleration.

The blue curve is existing SSE deterministic spectrum for Grand Gulf, the existing plant. And this shows the red. The units on the left, this is spectral acceleration from .001 acceleration, .01, .1 and 1G.

So, you can see that the PGA, just for comparison, was --

MEMBER APOSTOLAKIS: This is the peak horizontal ground --

MR. LETTIS: This is the peak horizontal. I'm showing just an example of --

MEMBER APOSTOLAKIS: The blue? For all of them?

MR. LETTIS: All of them are the horizontal ground acceleration.

MEMBER APOSTOLAKIS: Okay, very good.

MR. LETTIS: And, comparing the existing Grand Gulf deterministic SSE with our recent -- our newly computed probabilistic SSE for the ESP. And

this is the target design spectrum for the standard plant, anchored at point three G.

MEMBER APOSTOLAKIS: Who gives you that black one, the standard design spectrum?

MR. LETTIS: This is the spectrum used by the vendors.

MEMBER APOSTOLAKIS: The vendors, okay.

CHAIRMAN WALLIS: For any plant anywhere?

MR. LETTIS: This is the --

MEMBER APOSTOLAKIS: I think that's all, yes.

MR. LETTIS: Yes, the plants are using this as their -- the vendors are using this as their target design. Some of them have slightly modified the high frequency.

MR. ZINKE: Not any plant anywhere. The design is being certified in the United States.

CHAIRMAN WALLIS: It's remarkable to me, this place where no earthquakes have been for all this time, the curves are so close to some standard plan.

It seems to -- you don't think it's remarkable at all? You mean the curves were about the same?

MR. LETTIS: Yes, most of the driving input to the ground motion for probabilistic comes

from the repeat of the New Madrid earthquake and then also a local source magnitude five, five and a half or six that occurs locally, infrequently, but locally near the site.

MEMBER APOSTOLAKIS: When people said in the deterministic days that peak horizontal ground acceleration was this, did they consider frequency?

MR. LETTIS: Yes.

MEMBER APOSTOLAKIS: And it corresponded to 100 hertz you say?

MR. LETTIS: Corresponding to -- I'm sorry?

MEMBER APOSTOLAKIS: To 100 hertz. Is that the frequency they quote?

MR. LETTIS: No. Commonly ground motion is -- you'll hear someone say PGA or peak ground acceleration is something.

MEMBER APOSTOLAKIS: Yes.

MR. LETTIS: That's usually referred to -- that's a very high frequency ground motion, PGA. In 100 hertz is --

MEMBER APOSTOLAKIS: Okay. So, that would be a good approximation?

MR. LETTIS: So that would be an approximation of the PGA.

MEMBER APOSTOLAKIS: How much is it for the Grand Gulf deterministic, the blue?

MR. LETTIS: I think it's point one seven. And the new one is point one nine.

MEMBER APOSTOLAKIS: This is not the SSE, the safe shutdown earthquake?

MR. LETTIS: Yes, but that's just -- that one frequency, the PGA, peak ground acceleration, at the high frequency end.

MEMBER APOSTOLAKIS: Yes. I mean, that's what you designed.

MR. LETTIS: The SSE is defined as --

MEMBER POWERS: In order to stay on schedule, this tutorial is going to have to be cut short and move on to this.

MEMBER APOSTOLAKIS: Well, at least the three numbers. Can I get the three numbers?

MEMBER POWERS: You can read them off the slide or I can read them to you.

MEMBER APOSTOLAKIS: Well, I can't see them.

MEMBER POWERS: George, I'll read them to you.

MR. SCOTT: Dana, can I make a quick point to speak to Graham's question?

(No verbal response.)

MR. SCOTT: You may recall from the North Anna application that their site curve actually exceeded the design curve. So this is a generic issue that the Staff is addressing currently.

MEMBER POWERS: I need just to move on with this discussion.

MR. ZINKE: This slide -- through the application review, currently there is, before issues the draft SER, there's 23 open items that we have responses due June 21st.

We've been working with the Staff. And we've been developing our responses to those. I've attached the status matrix, which shows draft -- the direction we're heading on responding to those questions.

The actual response are in review now. And so, we would be submitting them on or around June 21st, which my understanding is then that would end up a subject when we get to the -- ACRS meets again on the final SER.

The conclusion through our evaluation of the Grand Gulf site, we characterize it in accordance with part 52 and part 100, and we found the site remains acceptable for new construction.

MEMBER POWERS: Is that a -- it seems to me that that's one of those nicely lawyerly statements boundless in its conservatism. This is a pretty good site for new construction, isn't it?

MR. ZINKE: Yes, it is.

MEMBER POWERS: A bolder statement, the site's not just acceptable, it's a pretty good site.

MR. ZINKE: Right. These are just statements, this is what --

MEMBER POWERS: You can defend that statement easily?

MR. ZINKE: Yes.

MEMBER APOSTOLAKIS: What is it that makes you say that, it's a pretty good site?

MEMBER POWERS: The general low population around it, the lack of a heavy industrial area, the low seismicity, the rather mild weather conditions.

MEMBER APOSTOLAKIS: Okay.

MR. ZINKE: And that concludes our presentation.

MEMBER POWERS: I mean, the only thing you guys have got going against you is the world's worst humidity as far as I can tell, right?

MEMBER KRESS: It doesn't do much damage.

MEMBER POWERS: Well, look what it'd done

to you.

MEMBER KRESS: I know.

MEMBER POWERS: George, thank you a lot. We now turn to hear from the Staff. Or did you want to open with some oversight on this?

MS. DUDES: Yes. Actually, thank you. This is Laura Dudes, Section Chief of New Reactors. On behalf of Dr. Beckner, the Program Director, I just wanted to give an intro.

I was trying to figure out how to open this up.

MEMBER POWERS: Well, I guess it would be useful to us to -- maybe the speaker will give us. But it would be useful to know your intuition on the open items.

Are there things that you see as significant impediments? Or is this mostly dotting I's and crossing T's work?

MS. DUDES: That's a good lead-in. For this application, as we're coming to you, we received three early site permit applications in 2003, North Anna, for which we've come to you.

We've gotten a letter. As you said, we're going to respond. Clinton, the Exelon application for the Clinton site and Grand Gulf, the SERI people, for

this we've completed the draft safety evaluation for all three.

Except there is an issue. And it has to do with the seismic method or a method of analysis for the Clinton ESP. And so, our meeting on the DSER with that will move into August or September time frame because the Staff is taking more time to go through this.

For North Anna and for Clinton, for which we're here today, they're using a -- or, I'm sorry, Grand Gulf -- they're using the approved Reg Guide method.

So, the Staff is on schedule to complete. We have the DSER out. We're here to talk to you today with respect to the open items that we have questions, as these are first-of-a-kind reviews.

But again, we don't see any big show stoppers or issues that cannot be resolved at this time. Many of the issues for North Anna and Grand Gulf may be similar in nature in terms of looking at weather, hydrology, asking clarifying questions on their seismic work.

But it's not necessarily something that's new to the Staff. We have existing guidance. Whereas, for the Clinton application, we're carving

new ground. So that may take a little bit longer.

MEMBER POWERS: And, it's also important for the committee to be aware. We have not yet received that portion of the Clinton SER appeals with the seismic.

MS. DUDES: That is correct. Yes, the Staff is still working on -- we issued the draft safety evaluation report for the Clinton site, except for the one section.

And we're going to issue a supplement when the Staff approves that. And, you know, one of the challenges is we're looking for an agency-wide perspective on that performance-based seismic method as opposed to just an NRR or a single reviewer's perspective.

We're trying to get much wider group of experts to weigh in because it's a significant issue as we move forward in new ground.

MEMBER POWERS: I suspect what we'll do is ask Professor Apostolakis to go through that with some detail.

MS. DUDES: Yes. And perhaps one of the things we can do -- we have the specific application that we'll come to you and talk about. But I know there's been some discussion.

And perhaps can get -- once the Agency begins to take on a position and a perspective on that performance-based method and they are looking at revising the Reg Guides, they can come talk to the Committee on the technical issue alone without linking it up to an application.

And that would be -- separating those sessions would be educational. And that way we could focus on the seismic issue and then we can focus on the application at a different time.

MEMBER POWERS: I think that's the way we want to proceed.

MS. DUDES: And, that being said, I appreciate Dr. Apostolokis' comments regarding the Reg Guide. And I just wanted -- I was trying to think of how to open this up and put this into some perspective.

Reviewing these first-of-a-kind applications and what does that mean -- I know this committee also has reviewed the design certifications.

Well, we need to ask some of those questions about, you know, why is it okay to look at one method or another method? Because, as now we're moving forward and we're approving early site permits, we have design certifications, we'll before you again

with another design certification in 2005, six and seven.

Dr. Beckner and I go back to our office, and every day we're planning, and planning, and planning, and getting asked questions about how ready we are for combined license applications.

And these are looking more real than they have ever, actually, in my career, but more real in a long time. These early site permits are first-of-a-kind.

And we need to be right. We need to do them well. We need to do them right. And we need to think about and ask these questions because we may have existing guidance.

But we have new staff. Or we have new guidance, you know, and we're trying to marry these up. And, if we're going to be licensing new plants in the next five years, we appreciate the comments.

We appreciate the review. And I was thinking, as we go into the North Anna final safety evaluation report meeting, which will be with you in July, that maybe we can start with a process slide so we can understand where the Staff's review is on the early site permits, how we will incorporate the ACRS review, issue a NUREG, and how that document actually

becomes the fundamental basis for the ASLB's mandatory hearing.

So, all of these process issues and where each one of us has our roles and responsibilities in support of safety, you know, it's good to always remind ourselves of that before we go forward.

MEMBER POWERS: I'm quite certain we will as a subcommittee get together with you this fall, I suspect, some time when it's convenient for all concerned just to discuss the lessons learned from having gone through three of them and how to make it a useful, value-added process all around.

MEMBER KRESS: Could I ask the Staff a question?

(No verbal response.)

MEMBER KRESS: When they review these early site permits, do they look at all the Level 3 PRAs? I know at Grand Gulf I said there are several of these done.

I don't know about the other two. Do they -- is that a consideration when you look at these early site permits at all?

MEMBER POWERS: I certainly don't.

MS. DUDES: No, not that I know of.

MEMBER KRESS: It seems to me like level

three is the issue associated with the sites

MEMBER POWERS: We look at --

MEMBER KRESS: If you're looking at risk informing your decision --

MEMBER POWERS: I wasn't looking at risk informing my decision.

MEMBER KRESS: I was. Well, I'm not concerned about Grand Gulf because I agree with you, this looks like an excellent site. But I might have some trepidations about North Anna, you know, in terms of level three.

MEMBER APOSTOLAKIS: We come to the thing that the rule doesn't say that.

MEMBER KRESS: I understand. But the Staff can exercise judgment on --

MEMBER POWERS: One would hope that the ACRS would exercise judgment.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: This regulatory guide is dated March 1997.

MS. DUDES: That is correct.

MEMBER APOSTOLAKIS: Is there any plan to update it?

MS. DUDES: Yes. And I don't have the exact plan. I'm not sure if someone wants to speak to

that. I mean, I could give you a general --

MR. MUNSON: Cliff Munson, a geophysicist in the Division of Engineering. We formed a group with NMSS and Research. And, high on our priority list is updating Reg Guide 1.165.

So, I think we're looking at the next year or so to begin doing that.

MEMBER APOSTOLAKIS: I'm a little concerned about the timing here. By that time we will probably have some decisions regarding those first three ESPs.

You're updating the guide -- good idea to do it this way.

MS. DUDES: Cliff, can I -- you can correct me if I'm wrong in clarification. I think that the update of the Regulatory Guide, any decisions made in the ESP would be consistent with that.

We're not working in a vacuum. Therefore, we wouldn't be considering updates or changes to that guide that would not encompass decisions and analysis that support conclusions in our safety evaluation reports for the early site permits.

MEMBER APOSTOLAKIS: Laura, it should be the other way.

MS. DUDES: It should. It may be.

MEMBER APOSTOLAKIS: We were told today that, you know, the Guide says you can use this or that. And we didn't.

MS. DUDES: Well, ideally, perhaps --

MEMBER APOSTOLAKIS: Well, we'll wait and see. But, I mean, some time next year you say?

MR. MUNSON: Right, mid 2006 is the first draft version of the update.

MEMBER APOSTOLAKIS: And that's when the ACRS will get involved?

MR. MUNSON: I believe so.

MEMBER POWERS: Let's proceed on with discussion at Grand Gulf.

MR. ANAND: Thank you, Laura. Good morning. My name is Raj Anand. I am the Safety Project Manager for the Grand Gulf early site permit application.

I have with me John Segala. He will be flipping the slides for me. John is a Senior Safety Project Manager for the Clinton early site permit application.

Let me get started. We are on slide two, please. Our purpose here today is to brief the Committee on the Grand Gulf early site permit application, and to support the Committee's review and

subsequently the Committee's interim letter that we are going to request that you send it to the EDO.

We do have technical staff members here who can answer your questions. Slide three, please. This is today's agenda. After hearing Applicant's presentation we have got a little smarter in the last half an hour or so.

As directed by the subcommittee on May 16th, I will spend less time on the issues that have been discussed by the Applicant and more time on the issues that the Committee would like to discuss.

My total time for the presentation will be less than 15 minutes.

MEMBER APOSTOLAKIS: This is wonderful.

MR. ANAND: Thank you.

CHAIRMAN WALLIS: That's the plan.

MR. ANAND: Slide four, please. This slide discusses the regulatory framework, which of course is a subpart eight to 10 CFR part 52, which governs early site permit.

And Part 52 references subpart B to 10 CFR part 100, which contends to applicable citing criteria. 10 CFR 52.23 requires and ACRS report to the Committee on the portion of the application that pertains to safety.

And that's the reason we are here today, sir. As you know, Grand Gulf is the third of the three ESP applications the NRC is currently reviewing.

North Anna and Clinton application was submitted to NRC in September of 2003. And the Grand Gulf application was submitted in October 2003.

Slide five, please. Here are some of the completed milestones. System Energy Resources, SERI, submitted their early site permit application with their letter dated October 16th, 2003.

The NRC Staff docketed the SERI's application on November 21st, 2003. The NRC Staff issued a draft safety evaluation report with open items on April 7th, 2005.

The Staff also issued the draft environment impact statement on April 21st, 2005. In addition, the Staff and the Applicant briefed the subcommittee on May 16th on the Grand Gulf early site permit application.

Slide six, please. This slide is just the review areas and the Staff reviewers. Most of the Staff reviewers are here today to answer the question in their areas of review.

Before I leave the list of the review areas and reviewers, I just wanted to mention that the

Staff benefited from a number of experts input to the draft safety evaluation report.

In the hydrology we had the support from Pacific Northwest Lab. In some cases the lab did independent evaluation of Applicant's evaluation and conclusion.

PNNL also supported the site hazard review. In geology and seismic area our staff was benefited from the support of the United States Geology Survey and the Brookhaven National Lab.

In emergency planning the Staff consulted extensively with the Federal Emergency Management Agency, FEMA. So, we had a large team involved in reviewing the Grand Gulf early site permit application.

Slide seven, please. The NRC Staff has identified 23 open in the draft safety evaluation report. These open items are listed in your handouts as a back-up slide, slide 22, slide 28.

The Staff needs additional information from the Applicant prior to developing a final safety evaluation report. The Staff has started a conference call with the Applicant to provide clarification on the open items.

The responses to all the open items are

due to Staff by June 21st, 2005. I spectrally submit to the Committee that we will discuss with you the open items and their resolution when we brief the Committee on the final safety evaluation.

MEMBER APOSTOLAKIS: Is this list consistent with Dr. Powers' statement that this is a pretty good site?

MR. ANAND: Yes.

MEMBER APOSTOLAKIS: Maybe I'm misunderstanding what an open item is. I mean, you said that they never -- it's a low population area, the seismology seems to be good.

And now they have five open items there, one on population.

MEMBER POWERS: Have you looked at --

MEMBER APOSTOLAKIS: Are these just clarifications or what?

MEMBER POWERS: Have you looked at the particular open items?

MEMBER APOSTOLAKIS: No.

MR. ANAND: Those are basically clarifications?

MEMBER APOSTOLAKIS: Clarifications?

MR. ANAND: Right, sir.

MEMBER APOSTOLAKIS: And you call those

open items?

MR. ANAND: Yes. Slide eight, please. Here are some draft safety evaluation report conclusions. The safety evaluation report that we published on April 7th, 2005 contained open items.

In those sections that contain open item, the Staff has not reached a conclusion regarding the adequacy of the information provided in the draft safety evaluation report.

In a number of other sections, however, where there are no open items, we have reached some conclusions. For example, the Applicant, we believe, has provide appropriate quality assurance measures equal to those in 10 CFR part 50, Appendix B.

Site characteristics are such that adequate security plans and measures can be developed, which is largely a function of both topography and the amount of the land they have available.

And we believe that SERI has adequate sites to support the security measures. Slide nine, please. Some additional conclusions from the individual section without open items.

SERI, the Applicant, has established appropriate atmospheric dispersion characteristics to support design basis radiological calculations. Based

on Applicant's use of the plant parameters envelope and the site character state, the Staff concludes that the site meets the radiological nuance consequences criteria as provided in 10 CFR 50.34(a)(1).

Of course, when actual design comes in the combined license application, then the Staff will need to compare these release characteristics with those that are assumed at the ESP stage.

Another conclusion the Staff has reached in the draft safety evaluation report is that the potential hazards associated with nearby transportation routes, industrial and military facilities, pose no undue risk to the facility that might be constructed on the site.

Slide ten, please. SERI requested their ESP site be approved for total nuclear generating capacity of up to 8,600 megawatt thermal with maximum 4,300 megawatt thermal per unit.

MEMBER DENNING: Excuse me, can I ask a question at this point in that?

MR. ANAND: Yes.

MEMBER DENNING: As far as approving the site for like 8,600 megawatts thermal, is the only thing that limits that -- is that the environmental impact?

In particular from a safety viewpoint, is there anything that restricts -- when you approve the site, is there anything from safety viewpoint that says that 8,600 is acceptable but 12,000 would be unacceptable?

Or is this strictly determined by environmental impact, heat loads and this type of stuff?

MR. ANAND: The Applicant has provided the PPE, we call it a plant parameters envelope. And, with a maximum, they can go up to the 4,300 megawatt thermal per unit.

As you mentioned, the environmental impact statement has considered the total approved nuclear generating capacity of 8,600 megawatt thermal on that site.

MEMBER DENNING: Yes. Radiological concerns, is there anything that limits it radiologically? From safety viewpoint, is there anything that, you know, they've asked for 8,600.

As you review it, is there anything radiologically that says 8,600 is acceptable but 12,000 would not be acceptable or something like that?

(No verbal response.)

MEMBER DENNING: I mean, it's not obvious

to me that there is anything in the early site permit review that is dependent upon that. And I was just curious.

Is that the case? I mean, obviously it's an area of particular concern to Dr. Kress. And I was just curious, does it enter into your assessment in any way from a radiological viewpoint?

MR. BECKNER: Yes, this is Bill Beckner. I've got Jay Lee here who will correct me if I'm wrong. But, there are assumed source terms for the various dose calculations that are done.

Again, it's done in an envelope type fashion. So you obviously couldn't put 10,000 megawatt plants on the site, or a 10,000 megawatt plant.

MR. SCOTT: It's what the Applicant submits and the Staff evaluates the combination of the PPE and the site. So, they don't do an analysis that says, what if they wanted to have 2,000 more megawatts.

That type of analysis is not done here. So, --

MR. BECKNER: But I think you're right. The heat load is the big driver and directly the does calculation to come up with the site of the plant.

MEMBER DENNING: But there's no standard source term per plant, is there? I mean, it would depend upon the design of the plant as to what the source term would be.

MR. SCOTT: And that's provided by the PPE as the surrogate design, which is made up of the parameters that the Applicant chooses to take credit for here at the ESP stage recognizing that, because they use the PPE concept, the early site permit is not issued for any particular design, but is issued for the acceptance of the site in conjunction with those assumed design parameters.

MEMBER DENNING: But then, when you pick the plant, it would have to fit within that envelope.

MR. ANAND: Right.

MR. SCOTT: Or further analysis would be needed.

MR. ANAND: Right. Thank you, Mike. SERI has declined to submit a specific design at this stage. But Applicant has submitted a plan design parameters that are represented.

And they intend to be the bounding for those reactor design, such as advanced boiling water reactor, Westinghouse AP1000 for economic and simplified boiling water reactor.

The Staff is reviewing the Applicant's planned parameters from the standpoint of whether they are reasonable. It is then the Applicant's burden to make sure that they pick up the plant parameters such that when they come for a combined license application with the actual design that it fits within those parameters.

Slide 11, please. Just to give you a few details of the Grand Gulf site and the Applicant, the Grand Gulf ESP application was submitted for the site, which is basically within the existing operating Grand Gulf nuclear station, unit one.

Original Grand Gulf nuclear site was designed for two units. Unit one was licensed in June 1982. Construction of the second unit was halted prior to the completion.

However, the switch yard for both the units was completed. The ESP Applicant, SERI, plans to use the existing switch yard for the proposed ESP units.

After the early site permit is received by SERI from the Commission, the SERI has no plan to perform any activity on the ESP site. Therefore, the Applicant has not submitted a site redress plan. Slide

12, please.

CHAIRMAN WALLIS: May I ask you about this?

MR. ANAND: Sure.

CHAIRMAN WALLIS: I asked earlier the Applicant about how they control the exclusion area. They said they didn't have a fence around it.

MR. ANAND: Right.

CHAIRMAN WALLIS: How do they control it? This is one of your open items, isn't it? How do they exclude people if there's no fence? What does exclusionary mean then if there's boundary?

MR. ANAND: I have attorneys from our Office of General Counsel, Mike Woods. Mike, would you please come to the microphone and explain to the Committee?

MR. WOODS: The definition of the exclusionary under the citing criteria of part 100 is that the Applicant has the authority to determine all activities within that zone, including the authority to determine activities that take place in that area, and the authority to exclude individuals and property.

We have been working with both the Staff and the Applicant to reach resolution of this issue. We believe that by the time that the FSER is issued,

we will have reached resolution of this.

In practical purposes here, the site boundary extends far beyond and encompasses the entire exclusionary boundary for the proposed new units for the ESP site.

And we, I suppose we feel that the ownership of the site being completely held by the Applicant, we are reasonably likely to be able to issue a finding that they have demonstrated the requisite authority and control in that exclusionary boundary.

CHAIRMAN WALLIS: They have authority, but there's no physical marking. I don't understand how you exclude people unless you have a fence.

MEMBER SIEBER: A lot of plants are like that.

CHAIRMAN WALLIS: People can just walk onto the site and then someone can throw them off?

MEMBER SIEBER: Yes.

MR. WOODS: As a practical matter, there is no physical barrier there existing. However, that would be similar to the situation at a majority of plants around the country.

The legal standard that they have to meet is that they have the authority exclude people and

property from that site. As a practical matter, there being security on site at all times, the Applicant has that ability. And we are reasonably sure that --

CHAIRMAN WALLIS: When the flood waters are lapping up on the bluff there, they still exclude people from the water?

MEMBER POWERS: I guess I'm wondering where you're going with this?

CHAIRMAN WALLIS: Well, it seems to me that, as a member of the public, if it says exclusion area boundary, I would expect to see something physical there to exclude people.

And I'm surprised that apparently people can wonder around. And then it's up to them to figure out whether or not we're going to throw them off. That seems to me rather peculiar.

MR. WOODS: Well, I guess as a theoretical matter, someone can pass across that boundary. For certain there is no physical item there. However, that is not what is required by Part 100.

CHAIRMAN WALLIS: I see. It's okay. I'm just learning. It's a little surprising.

MR. WOODS: I mean, for all practical purposes, the Applicant does control the site and its environs and, you know, maintains security at the

site, and ensures that people do not, you know, wonder about where they shouldn't be.

MEMBER ROSEN: Well, this line of questioning has raised a question in my mind about the fact that the exclusion area boundary doesn't extend to all of the structures and such outside down near the river.

Does that mean that people could just go up on that at will?

MEMBER SIEBER: The other concept I think that we haven't discussed is the outermost boundary is the owner-controlled area. And the owner-controlled area is much larger than the exclusion area.

And the owner-controlled area is typically posted. Sometimes at some plants it's fenced. It's typically patrolled or surveilled, you know, with TV or what have you.

The exclusionary is generally pretty small and may include things like the parking lot and cafeteria and warehouses and things like that. The protected area is much smaller.

It's always double fenced. It always has detection equipment located there. And so, that's where the prevention of entry to the public finally occurs.

MR. SCOTT: If you look at the rule at 100.3, it allows things like highways, railroads, and waterways to go through the exclusion area.

CHAIRMAN WALLIS: Exclusion is a funny term.

MR. SCOTT: It's exclusion --

CHAIRMAN WALLIS: It's a strange term to use to describe such an open area. It's not absolute.

MEMBER DENNING: And it's purpose, of course, is strictly for the 10 CFR 100 site does calculation.

MEMBER SIEBER: Yes, you don't want somebody building their house.

CHAIRMAN WALLIS: That's what makes it so artificial.

MR. SCOTT: It doesn't mean that people have to be excluded from it at all times. And it means -- and it says so in the rule -- that the Applicant or the licensee has the authority to remove, and the capability to remove people if an emergency happens.

MEMBER SIEBER: That's right.

CHAIRMAN WALLIS: So it makes this whole site dose thing rather artificial. Someone isn't going to stand on the circle. They can wonder inside

and get the higher dose.

MEMBER POWERS: Because it's a tool for assessing the design in the site. It is not particularly a safety measure. It's a matter of evaluating.

Is this a good place to put things? Is this an adequate design?

CHAIRMAN WALLIS: It seems to mean very little. So, maybe we should --

MEMBER DENNING: Well, it makes sure that people aren't going to build houses also inside.

CHAIRMAN WALLIS: Oh, okay.

MEMBER SIEBER: Or bring their cow there.

MEMBER POWERS: Please go ahead.

MR. ANAND: Yes. The small orange circle in the middle is the footprint area of the proposed ESP car bluff. The yellow circle is the proposed early site permit, ESP exclusion area.

And the green circle is the low population zone. The Applicant has defined the exclusion area boundary as a circle radius of 2,760 feet for a .52 miles. And the low population --

CHAIRMAN WALLIS: He can define that any way he likes?

MEMBER POWERS: There is a prescription.

CHAIRMAN WALLIS: I thought there would be a prescription.

MEMBER POWERS: There is a prescription.

CHAIRMAN WALLIS: So, the Applicant has defined it? Presumably it's according to some law or some rule.

MEMBER POWERS: Well, what there is is a minimum that you have to go in. And I believe this exceeds that.

MR. ANAND: And the low population zone is a circular radius of two miles both from the circumference of the 630 feet circle in passing the proposed power block housing containment structures for the ESP units.

The exclusion area boundary for the ESP unit is contained within the --

CHAIRMAN WALLIS: What's with all this describing it? If you just say that it meets all the regulations, we could get on with it. But, I mean, just going through the litany of describing it doesn't tell me anything. It meets all the regulations?

MR. ANAND: Yes, sir.

MEMBER SIEBER: Okay.

MR. ANAND: Now, let me talk some of the ESP site features related to hydrology. Slide 13,

please. Grand Gulf ESP site is located on the east bank of the Mississippi River near river mile 406 and approximately 25 miles south of Vicksburg and six miles northwest of the Port Gibson Mississippi.

The existing Grand Gulf operating unit one is located 700 feet from the proposed ESP site. The makeup and the normal service water for the ESP facility would be supplied from the Mississippi River.

The ultimate heat sink for the ESP facility will use the closed cooling water system, the mechanical draft cooling towers. The ESP unit will not rely on water intake from the Mississippi River. The ESP facility will --

CHAIRMAN WALLIS: You're listing all these things because these are things that have to meet some requirements?

MR. ANAND: Yes.

CHAIRMAN WALLIS: And yet they've all been checked that they do meet some requirement?

MR. ANAND: Yes, sir. The ESP facility will have a dedicated water storage basin to hold for 30 day emergency cooling water. The Staff independently verified that the flood in the Mississippi River is not a threat to the ESP site.

The nearest bank of the Mississippi River

is approximately 1.1 miles from the ESP site. The site is located 65 feet above the normal river level, therefore the distance and the river bluff provides the protective features for the ESP site.

Staff also consulted with the code of engineers and the Staff independently verified the ESP site is safe from flooding. In addition, the Staff independently verified that low water elevations resulting from the ice jams or other causes would not adversely affect the safety of the ESP facility.

CHAIRMAN WALLIS: What is a flood-carrying capacity?

MR. ANAND: Goutam? May I take a help from him?

MR. BAGCHI: My name is Goutam Bagchi. I did the hydrology review with assistance from DNNL. I do not remember off-hand what the flood-carrying capacity of the Mississippi River is.

But it is so substantial that any upstream damn failure was found to be not a problem at the site. I'm not probably addressing the question directly head-on.

But, if you need, I'll provide supplementary literature.

CHAIRMAN WALLIS: No. I just thought I

had to ask some question to find out if you knew what you were doing. You were just listing things.

MR. BAGCHI: No, we did it. For example, in our DSER we have figure which shows if we --

CHAIRMAN WALLIS: So this is the amount of water the river could carry in the case of a damn break. And it's okay.

MR. BAGCHI: Oh, yes, sir. Indeed.

MR. ANAND: Slide 14, please. The proposed Grand Gulf ESP site is located in a relative low seismic region. The Applicant has identified no active seismic force within a 90 mile radius from the location of the ESP site and no earthquake recorded within a 25 mile radius since 1997 -- 1977, I'm sorry.

MEMBER SIEBER: No, keep trying.

MR. ANAND: The Grand Gulf site is a deep soil site. The Applicant --

MEMBER POWERS: I think what they're asking you is your slide says 1777.

MEMBER APOSTOLAKIS: That's what you meant?

MR. ANAND: Oh, yes, 1777.

CHAIRMAN WALLIS: Which is the right answer?

MR. ANAND: I think 1777 is the right

answer. I'm sorry, I read it wrong.

MEMBER POWERS: I think that's not correct. I believe you have a seismic vent just outside the 25 mile relatively recently.

MR. ANAND: The Applicant has used the regulatory guide --

MEMBER APOSTOLAKIS: This is all not too elegant. Do you agree with me? Because the east coast is a very weak attenuator. So, whether it's within 25 miles or 200 miles, it's not California. In California that's important.

MR. ANAND: Yes, I fully agree with you, sir.

MEMBER APOSTOLAKIS: Okay.

MR. ANAND: The Regulatory Guide 1.165 describes the matters acceptable to the NRC staff for determination of the SSE. Slide 15, please. After Applicant's investigation and their seismic hazard analysis, the Applicant presented their SSE as shown in the red curve, which is based upon the regulatory guide 1.165 approach.

If a future reactor design at this ESP site follows the Regulatory Guide 1.160 and anchored at the peak ground acceleration at .3G, then their design response specter for a future reactor will look

as shown in the blue line curve.

Slide 16, please. First of all, regarding emergency planning, SERI, like other two early site permit applicants, elected to seek acceptance award our effort as a major features of the emergency plan as provided in 10 CFR 52.17.

The concept major feature is not defined in detail in regulation. So we end up having to deal with exactly what is a major feature and what finality does it provide to the Applicant?

The review guidance that we have used for the review of the major features is supplement 2 to NUREG-0654. This is the NRC and FEMA joint document.

There have been some concerns in the industry regarding the degree of the finality associated with the major feature because the Applicant objective at the early site permit is to achieve finality on as many features as it can.

The Staff can, at the early site permit stage, review that information against the planning standards provided in supplement 2 to NUREG-0654. And, if the Staff wants the description to be acceptable and conclude that the major features is acceptable, then the conclusion is final subject to the requirement of 10 CFR part 52.

However, the Staff can grant finality as to the overall description. But the Applicant will need to address the implementation details at the combined license application.

So we see that the Applicant can obtain limited finality with the major feature option. For example, the siren for notification is a major feature.

However, at the COL stage the Applicant needs to provide implementation as, for example, number and placement, power supply, etcetera. Slide 17, please.

Here are some future milestones. The NRC Staff requests ACRS interim letter to the EDO on the draft safety evaluation report by the end of June, 2005.

The Staff plans to issue the Grand Gulf early site permit final safety evaluation approved on October 21st, 2005. The Staff will provide a final safety evaluation approved to ACRS also in October of 2005.

As the current schedule indicates, the ACRS subcommittee meeting for the final safety evaluation report is scheduled for November 22, 2005.

And the full committee meeting is

scheduled for December 8, 2005. Again, we will request ACRS letter to EDO on the final safety evaluation report in December 2005.

The NRC Staff will incorporate the ACRS letter and will issue a final safety evaluation report as a NUREG by January 28, 2006. There are mandatory hearings for the early site permit applications.

These mandatory hearings will begin in 2006. There are no contentions admitted in the SERI's application. The uncontested hearing will begin upon the completion of the Staff's final safety evaluation report and the final environmental impact statement.

MEMBER POWERS: The mandatory hearing will be held in the Vicksburg area?

MR. ANAND: Well, it depends upon the Board, where they want to hold it.

MS. DUDES: There are three separate boards. I think that there was something about trying to locate the hearings at the sites. But I'm not sure if that decision has been made.

MEMBER POWERS: Okay. You will let us know?

MS. DUDES: Yes, absolutely.

MEMBER POWERS: I would not be -- I don't know that we would attend them as a whole group -- a

prescriptive aspect of our review. But I would not be surprised if we attended one or more.

MS. DUDES: Okay.

MEMBER POWERS: We being a member or more.

MS. DUDES: Well, these are the first mandatory hearings in 20 years and the first part 52 mandatory meetings, I think. I think hopefully a lot of people will attend.

MEMBER POWERS: I mean, I think it's worthwhile to at least --

MS. DUDES: Yes.

MEMBER POWERS: -- expose oneself to these things.

MS. DUDES: Yes.

MR. ANAND: Slide 18, please.

MEMBER DENNING: I'm sorry, is it normal for an SER -- I mean, it isn't normal for an SER to become a NUREG, is it?

MR. ANAND: Yes. The final safety evaluation report we published as a NUREG, which includes the ACRS letter and the NUREG. This is a standard practice.

This is just the wrap-up slide. The NRC Staff issued the draft safety evaluation report for SERI's early site permit application on April 7th,

2005.

The open is item responses on the draft safety evaluation report are expected by June 21st, 2005. We are looking forward to seeing interim ACRS letter and to briefing the subcommittee and the full committee on the final safety evaluation report during the November and December 2005.

I would like to emphasize that the Staff is on the right track, and will keep on doing a good job. This concludes my presentation. Thank you for your patience and for listening to me.

MEMBER POWERS: Thank you, Raj. I will comment that, despite the length of these documents you have to produce, I find them remarkably readable.

And I appreciate very much highlighting where open items and COL items, and things like that. I think you deserve a lot of credit for that. It is not difficult to understand why the Staff has done independent analyses and where they have simply reviewed material submitted by the licensees.

And I will comment that that has been an area of sensitivity by the ACRS on SERs for some time, that we couldn't tell what the Staff had done and what they were simply reading.

And I at least had no trouble

understanding where you had done independent assessments and where you had simply reviewed the material.

MS. DUDES: Thank you for the Staff.

MEMBER POWERS: Well, I think you've done a real good job.

MR. ANAND: Thank you, sir.

MEMBER POWERS: And, I mean, you get a document like this and you go, oh my God. And then you find it's actually quite readable. The stuff you provide at the beginning that tells me what to read, where, very useful.

MS. DUDES: You can turn around and see Mike Scott sitting over there who really designed some of the formatting of these documents.

MEMBER POWERS: I refuse to attribute any credit there at all.

(Laughter.)

MEMBER POWERS: He has to protect himself. I am sure that you changed everything as soon as he left.

MR. SCOTT: Moving right along --

MR. ANAND: Thank you, sir.

MEMBER POWERS: Now I'd like to bring up just a couple of issues. The two things that I would

like -- the Committee should be aware of, in a previous letter -- interim letter -- we have asked the Staff about how they prognosticate weather into the future.

MR. ANAND: Right. And we have responded.

MEMBER POWERS: And there is a yet-to-be-seen response on that. On this site we have another weather issue that I think we need to discuss at some time.

And that is, what they're in the business of doing is characterizing these sites, laying down what kinds of things need to be considered if you choose to build a nuclear power plant on this site.

Here we have a peculiar situation. If one defines how much snow can possibly be on the ground in this area, in Mississippi, one comes up with a big number, I mean a remarkably big number.

And you can't say, well, that was a peculiarity, because it's a relatively recent thing. Then if you ask on top of that snow build-up what can be the maximum snow fall that you would have over a finite period of time -- I think it's 48 hours -- you come up with another remarkably big number.

And, if you treat those two as independent characteristics of the site, you come away saying,

gee, that's a lot. But they're not independent. To get the big snow, you had a big snow fall.

And, the Staff has done this. I mean, they have written down here the characteristics of the site. And I wonder if that's a fair characterization of the site.

I mean, if I live in some place in Connecticut I could certainly understand a heavy snow build up in a 48 hour period in which I had some more snow fall.

In Vicksburg Mississippi, I just don't believe those are two independent events.

CHAIRMAN WALLIS: Storms tend to come in sequences too.

MEMBER POWERS: Yes, and that's another thing to think about.

MR. BAGCHI: Can I just make a comment, please? This is Goutam Bagchi. Sir, your observation about the snow load and probably winter maximum precipitation accommodation is appropriate.

Nevertheless, it is a function of the design of the roof whether or not that kind of load has to be carried by the roof. And also the ambient temperature conditions, where appropriate justifications are provided, those things could be

considered in a much more rational number.

I mean, it boils down to a much more rational number. And the structures would never have to be designed for that kind of load. It doesn't apply to those warm climates in the southern parts of the United States.

So, this is the provision that has been applicable throughout the entire continent of the United States. Many locations do need something like that.

And that's an extreme environmental load condition. It doesn't combine with anything else.

MEMBER POWERS: Any other questions. In that case, I would like to ask if there are anyone in the audience that would care to make comments?

(No verbal response.)

MEMBER POWERS: I see none. In that case, Mr. Chairman, I will thank all the speakers.

CHAIRMAN WALLIS: Thank you. I've been very eager to take a break. We seem to be slipping from our usual ability to keep on time. We'll take a break until 25 minutes to 11.

And I hope to catch up later on if we can. Thank you, gentlemen.

(Whereupon, the above-entitled matter

went off the record at 10:22 a.m. and went back on the record at 10:37 a.m.)

CHAIRMAN WALLIS: Let's please come back into session. I will turn to Professor George Apostolakis to lead us through the next item.

MEMBER APOSTOLAKIS: Thank you, Mr. Chairman. The purpose of this meeting is to discuss the draft final regulatory guide Risk-Informed, Performance-Based Fire Protection for Existing Light-Water Nuclear Power Plants.

Our subcommittee on fire protection met on this matter on May 17 of this year. And, just to remind a few facts to the Committee, the National Fire Protection Association issued the Performance-Based Standard for Fire Protection for Light-Water Reactors in 2001.

And it is known as NFPA 805. In July of 2004 the Commission amended its fire protection requirements in 10 CFR 50.48 to add 10 CFR 50.48(c), which incorporates the 2001 addition of NFPA 805 by reference with some exceptions.

Adopting NFPA 805 requires a submission of a license amendment of a license amendment to the NRC. And the Nuclear Energy Institute, working with representatives of the Industry and the Staff, has

developed a part commonly known as NEI 04-02 that is intended to assist the utilities in implementing the transition to NFPA 805 and then, you know, operating the plant using NFPA 805.

So this draft regulatory guide provides the Staff's position on the report of NEI 04-02. And we will hear from the Staff on this guide. And then we are expected to write a letter on this.

So, who is starting? Sunil? Okay. The floor is yours.

MR. WEERAKKODY: Okay. Thank you, Dr. Apostolakis. I'm Sunil Weerakkody, Section Chief of Fire Protection, NRR. We are here today to request that the ACRS endorse our issuance of the final Reg Guide on NFPA 805.

Sitting in front are Paul Lain, who is the project manager for NFPA 805, who is responsible for all aspects of 805. Bob Radlinski is the leading team leader for the NFPA Reg Guide.

I asked Naeem Iqbal to join us. He may not be saying a whole lot today. But, as we move on in future presentations to fire modeling, he's our in-house fire modeling expert.

He has a Masters in Fire Protection. He called the NUREG 1805 Fire Dynamics Two. And he

routinely advising the visiting inspectors on how they should be using fire models such as CFAST.

Next slide, please. As you all know, we issued the rule in June of last year. We issued the regulatory guide in September of last year for comment.

We are here today to ask for your endorsement to issue the final Reg Guide. Now about the outline, on May 17th, we provided a presentation to the subcommittee.

We decided to significantly modify our presentation to the full committee based on a number of comments and questions placed at that meeting. Almost all questions and comments we received during the subcommittee were related to use of fire PRAs and fire modeling.

Chairman Wallis specifically commented that the ACRS would be more interested in the technical as opposed to the process issues. As such, as you can see, Dr. Gallucci would be making a presentation showing how he would use the PRAs and fire models in support of a change analyses.

However, we wanted to make sure that the members that were not present at the subcommittee meeting are cognizant of the program and high level

issues with respect to the Reg Guide.

Therefore, Mr. Lain and Mr. Radlinski will give you a quick overview of the program and the Reg Guide. I have asked -- to the agency positions in accordance only Reg Guide, because I think one of the things he would recognize is that, in terms of what reg and where we want to go, we are aligned with you in terms of emphasis on the five PRAs.

And we will go as far as the rule would allow us to go. And so, we do look forward to your comments, Dr. Apostolakis. And, even though it's NEI 04-02, since it is going to be a part of the Reg Guide, we clearly have the option to ask them to change it in the way we like or take exemption.

So, we're not hindered in any way to do what we think is right. One other thing we need to mention is, after we met with you on May 24th, 23 met with CRGR.

They had a number of comments. But, one question that they raised was the safety security interface with respect to 805. Consequently, we cleared the paragraph that we paragraph that we plan to insert in the 805 Reg Guide, which was not in the version that we sent to you.

We have included that paragraph for your

information only. It's pre-provisional today. Finally, one of the things that I want to mention but not go into details is the fact that, unlike other risk informed regulations that you have received and approved, when the Agency, including yourself, approved 805, there was some subtle differences.

Please recognize that the rule is titled Performance-Based and we used risk informed in change analysis. And one of the things I want to emphasize is that, in terms of maintaining regulatory oversight in comparison to everything that we have in 50.48(c) or 805 rule, every licensee who comes to 50.48(c) or 805 is still required to meet 50.48(a), which refers to the general design criteria.

We will be -- I know you have access to those documents. But I took the trouble to print out, you know, a hard copy of both GDC 3 and 50.48. I think the point I want to make is that there have been concerns among different stakeholders whether a licensee were approved, 805 could make significant changes to the plan which could affect some key fire protection features, such as say if you have a diesel room and the core damage frequency coming from the diesel room is ten to the minus nine.

Can they remove the fire protection system

in the diesel room? The answer is no. 50.48(a) still requires some major -- some fundamental fire protection features to be at the plants.

With that, I'm turning it over to Paul Lain. And, in fact, I will not sit here. I'm going to sit there.

MR. LAIN: Well, Good morning everybody. I think most of the Committee members I've briefed before on this subject on NFPA 805. I work for Sunil, and John, and Suzie Black over here for another day, I think.

(Laughter.)

MR. LAIN: And previous to that I worked as a Project Manager under NMSS for Siemens Fuel Cycle Facility. And then, previous to that, Department of Energy.

I was in the Rocky Flats Program Office. So, that's a little bit about me. Our objective, as Sunil said earlier, is that we're seeking endorsement to publish the NFPA Reg Guide.

I'll be talking quickly about the Regulatory Guide schedule and industry interest. The Commission approved the rule in June. And it became effective in July.

ACRS deferred the review of the draft

comment we requested that went out for public comment. We had public meetings in October when it was initially out and then also again in January.

We received a number of comments, mainly from NEI. It turned out to be about 30 unique comments. And we addressed those with the public in a public meeting in January.

Most of those public comments were incorporated into NEI04-02. And then we address some in the regulatory guide. We have addressed the subcommittee in May and the CRGR in May.

And we're working on comments with CRGR. And then also we're addressing you today. We'd like to have -- try to have your letter here in June so we can get our final publication to go out.

Industry interest has always been a committee's question in the past on 805, who is really going to actually transition since it's voluntary.

Duke has sent in a Letter of Intent in February. They're the first one to test the waters. And they committed for Oconee to be one of our first pilot plants.

Their intent is also to transition all seven of their units. And this gives a basic time schedule on when they're going to transition. They've

also said that they are going to spend time, you know, developing fire PRAs for each site.

They're doing cable tracing. They're reconstituting their Appendix R program. So, they are spending a lot of money and time on each site to do that.

We've had another meeting with Progress Energy since the subcommittee meeting. They said they're going to send in their Letter of Intent in June.

They've also indicated that they would like their Harris plant to be one of the pilots. They also plant to do fire PRAs on all of their plants.

And I think that's the reason why it's going to take longer. We initially thought it was going to take two years to transition. But, some of them may be a little bit longer because they plan to do actually the fire PRA in that timeframe.

We've also heard through the grapevine that a few other facilities are looking at it. But we haven't gotten any real presentations or anything from any other facilities.

MEMBER ROSEN: Do they specifically say they're going to use the risk re-quantification methods and NUREG/CR-6850?

MR. LAIN: I'm not sure. We haven't actually asked that question. But, Ray, have you heard any indication?

MR. GALLUCCI: On Duke?

MR. LAIN: On Duke or -- I don't know if we've gotten to that level of --

MR. GALLUCCI: This is Ray Gallucci. Well, Dennis Hennecke is running the Duke analysis. So, he was part of all -- you know, he was the peer reviewer on the NUREG/CR-6850.

So, I would suspect that they're going to use that to the extent that's possible. They may have some existing analyses which they deem adequate and not choose to update.

But I would suspect that anything they're going to update would follow the techniques in there. I don't know if Progress Energy has the same intent.

But I would suspect they would. They should be aware of it.

MR. LAIN: Okay. Let me turn it over to Bob Radlinski and have him discuss a little quickly about the Reg Guide.

MR. RADLINSKI: All right. I'm Bob Radlinski. I'm a licensed Fire Protection Engineer. And I work in Suni Weerakkody's group. The first

slide is a summary of the scope of the regulatory guide.

The Guide endorses NEI04-02, which is the primary implementation guide. And it's for a plant that's transitioning to an 805-based fire protection program and also provides guidance on how to maintain that program.

The Reg Guide also endorses NEI00-01, which provides industry guidance for performing post-fire safe shutdown circuit analyses. The Reg Guide emphasizes key guidance issues that we feel are important.

It takes exception to Chapter 6 of NEI04-02. And Chapter 6 is guidance to the industry for licensees who do not intend to adopt a full 805 program but yet use aspects of NFPA 805 as a basis for submitting exemptions.

The rule does not endorse that approach, so the Reg Guide does not address that. The Reg Guide also identifies suggested fire models and provides guidance on fire PRAs, which Dr. Gallucci will be talking about next.

And it describes the Staff position with respect to NFPA 805 appendices, which are also not endorsed by the rule. But they do provide certain

guidance which we consider to be useful.

And we do specify in the Reg Guide which aspects of that guidance that we consider appropriate. One of the key issues that is addressed in the Reg Guide is how to address plant changes.

Plant changes include both modifications of the plant, modifications of the fire protection program, and modifications to the plant itself that could affect the fire protection program.

It also includes identified deviations from regulatory requirements. If the licensee elects not to fix the deviation so that it no longer is a deviation, then they can address it -- they have the option of addressing it as a plant change and justifying leaving the design as-is.

The Reg Guide provides high level guidance on screening of inconsequential changes and also endorses NEI's guidance, which provide more specific guidance of the same issue.

The Reg Guide emphasizes the need to perform an integrated assessment of risk, defense in depth, and safety margin for all fire protection program changes.

And it also endorses NEI04-02 guidance for the use of the various methods of evaluating plant

changes, including deterministic approach, fire models, risk assessments, and any combination of these.

Another key issue addressed in the Reg Guide is circuit analyses. As noted previously, the Reg Guide endorses NEI00-01, which is the industry guidance document for performing both fire safe shutdown analyses.

The Reg Guide advocates addressing fire induced spurious actuations using a risk informed performance-based method. And we leave that up to the licensee to determine how they are going to do that.

It also emphasizes that Information Notice 92-18 type failures should be considered. If you're not familiar with 92-18, that identified potential failures, fire-induced failures to the protective circuits of say a motor-operated valve such that the valve could essentially destroy itself and no longer be able to perform its safe shutdown function.

And finally, it provides guidance for addressing cumulative affects for multiple circuit analysis changes. And the third key issue is with respect to operator manual actions.

In NFPA 805's case they're referred to as recovery actions. And they also include repairs. The

Reg Guide explains that unapproved operator manual actions that have been credited by the licensee for III.G.2 areas should be transitioned as plant changes and evaluated using the licensee's plant change evaluation process.

I would also like to point out that 805 requires that any operator manual actions be evaluated using performance-based methods. And, finally, just to clarify any changes -- a single change that was made to NEI04-02 since the version that was distributed for ACRS review for the subcommittee, the only significant one was that we provide additional guidance on what plant changes related to the fire protection program can be made without NRC approval and just expanded on that guidance.

And for those that are keeping track, those changes were in section 5.3.1, 5.3.2, and Appendix I. And finally, in conclusion, the Reg Guide provides specific guidance on the implementation of an NFPA 805 fire protection program by endorsing NEI guidance documents.

It provides appropriate clarification and emphasis of the key issues. And it provides suitable guidance to licensees to assess the impact of adopted a risk-informed performance-based program. Any

questions?

CHAIRMAN WALLIS: What is the measure of this impact? You're assessing the impacts, I'm trying to think of what sort of measures of impacts you're using.

The final bullet you said is guidance to assess impact. This is in terms of increased safety or what? What's the measure of impact?

MR. RADLINSKI: Well, no. What it does is it provides -- it clarifies the NRC's position with respect to the transition to maintain a program. It lays out what we consider to be an acceptable program so that the licensee knows what is expected of him if he adopts 805.

That's what I meant by providing a basis for assessing that. The licensee is considering transitioning to an 805 program, he wants to know well, what does that mean?

What's -- what are the implications? What's the impact going to be? And they should do, you know, a detailed assessment before they even commit, before they send a Letter of Intent in to make a decision whether or not this is the right thing for them to do versus staying with their current license basis.

MR. WEERAKKODY: Dr. Wallis, I think, yes, the Reg Guide will allow licensees to assess the dollar impact, you know, what does it cost to transition, and also the safety impact.

In fact, some licensees are -- the ones who are not committed are right now using the draft documents out there to do that. I know -- who are looking at information available in the public domain to find out the delta between 805 versus non-805.

MEMBER APOSTOLAKIS: Okay, move on.

MR. GALLUCCI: I guess I'm going to switch with Naeem because I don't want to block this.

(Pause.)

MR. GALLUCCI: I have an extra prop. So I'll move over here so I don't block it. What I'm going to go through is an example of how a plant change evaluation might be done under NFPA 805.

And my additional prop -- and you all have a handout of that, is the table from NEI04-02, which shows the plant change evaluation process. I'm only interested in the risk portion.

So I'm not going to work on the part that says defining the change under 532. I'm going to start with the preliminary risk reading, which is the first box under the top dotted line.

This is my hypothetical example for the plant change evaluation. We have a licensee discovering that there are two control cables unprotected for redundant high pressure injection motor operated valves lying in the same cable tray above electrical switch gear cabinets.

The CDF contribution has not been estimated since the case was not identified. It was just discovered. The actual configuration contributes to the fire CDF.

So, in order to start off this process I'm going to do the plant change evaluation from NEI04-02 to determine acceptability under NFPA 805. And that's the diagram there.

And, since this has not been analyzed previously, when I do my Delta CDF core damage frequency calculation, I can just -- the Delta CDF will be equal to the core damage frequency for the scenario, since I'll be subtracting zero from it.

So that's just a simplification for this example. If you look on the diagram, to the right, you'll see that we begin with a preliminary risk screening.

And the preliminary screen, the concern is that fire in the switch gear cabinets could cause

spurious closing of both high pressure injection motor operated valves through damage to the control cables.

MEMBER APOSTOLAKIS: There is a laser pointer.

MR. GALLUCCI: There we are. So here we are. What you can't see at the top here, which is behind there, but it's on your handouts, is you identify the plant change first.

And we did that already. So, we've come down through here, which I'm not going to talk about. That's not the risk part anyway. So, we have somehow reached this preliminary risk screen step.

Now, the method that I'm going to use for this example to do my preliminary risk screen, is an order of magnitude delta CDF approximation that comes out of Section 4.2 of NEI00-01.

Bob mentioned that earlier. That's the guidance proposed fire safe shutdown circuit analysis. And that section is titled a preliminary screen for risk significance analysis.

It's a tool that was originally developed by NEI and modified by us for use in circuits screening analysis. Under the preliminary screening method from NEI00-01, we looked at -- there's actually six factors that we look at.

We look at the fire frequency. We look at the probability of spurious actuation, what's called the challenging fire factor, the fire non-suppression probability, the CCDP, conditional core damage probability.

And this one here, the last one, the fraction for number of vulnerable fire zone is factor that's put in specifically for analyzing circuits issues where you would be concerned with an issue that might apply over multiple fire zones.

And you want a way to screen out the more risk-significant ones. So, when you actually do the analysis, you don't have to look at 20 or 30 zones. For simplicity I'm not going to deal with this in this example because I'm just looking at one specific scenario.

So, for my example, my delta CDF is going to be the product of the first five factors.

MEMBER POWERS: That's the step that always confuses me. I cannot believe that the probability of spurious actuation is independent of all the other factors.

MR. GALLUCCI: The probability of spurious actuation is not independent of the other factor. You have to have the fire. And the fire has to be of a

sufficient magnitude in order to do damage to begin with.

And, when you do your fire modeling you have your temperatures, your time to damage, etcetera, etcetera. And those probabilities of spurious actuation that have been developed, I guess, through the expert elicitation process and that are in the NUREG/CR-68.50 and extrapolate the fire protection SDP, do factor those considerations in there.

Those are high probabilities. Spurious actuation probabilities are typically point one or higher.

CHAIRMAN WALLIS: Well, they seem all to be powers of ten. One, or point one, or .01, or all these coefficients, F, P, G, S, C.

MR. GALLUCCI: Oh, yes. Well, this is a screening tool.

CHAIRMAN WALLIS: Yes.

MR. GALLUCCI: Yes, for this.

CHAIRMAN WALLIS: It's a very crude screening tool.

MR. GALLUCCI: Yes. Because, I'm up at the preliminaries. I'm just -- really all I'm doing up at this portion is I'm trying to determine whether if I do a very crude order of magnitude, hopefully

conservative analysis, am I going to find that I've got something that's in the ten to the minus ten range.

Do I need to even go down into the quantitative risk evaluation? So, yes, this is even -- this would be considered preliminary to the fire protection SDP itself, this screening tool.

MEMBER APOSTOLAKIS: So, the spurious actuation is the only threat here?

MR. GALLUCCI: Yes, for my example, that's what I chose.

MEMBER APOSTOLAKIS: All right, so you found those factors.

MR. GALLUCCI: Okay. Some of the values here, again, for fire frequency for the switch gear room, if I went to NEI00-01 section 4.2, I would find that switch gear room is listed as a medium frequency.

CHAIRMAN WALLIS: Which is .1?

MR. GALLUCCI: It's a range.

MEMBER APOSTOLAKIS: So the change here is I found this, I have not accounted for it, is it okay to leave it as-is?

MR. GALLUCCI: Yes, or --

MEMBER APOSTOLAKIS: Or do something.

MR. GALLUCCI: Or, how much do I have to

do to make it acceptable.

MEMBER APOSTOLAKIS: Okay.

MR. GALLUCCI: Yes, to answer the first question, yes, I ranges, I believe for medium, I think they're .003 to .03. But, the way the tool works in section 4.2 is the decision criteria just ranges for the fire frequency and the spurious actuation probability.

And then they use the factors for the .1s. And they also use threes, .3, .03s for the remainder. But, the first -- in order to determine where you're going to be on this table -- and, if you have copies of NEI00-01, you'll be able to look and see in table 4.5.

You'll see that initially assessing the range for the fire frequency and the probability of spurious actuation tells you which box you're going to be in there.

There's 12 boxes. And just look right -- and one of the numerical criteria associated with each box that will enable you to screen. So, for our switch gear room, we assign a fire frequency of medium.

For probability of spurious actuation, we have to assume what -- I'm assuming we have

thermoplastic, the bad kind of cables and that, since the conductors that I needed to initiate the spurious actuations are in different cables, I need inter-cable, between cable interactions.

So, if you look on table 4.6 that is in NEI00-01, you'll see that for thermoplastic inter-cable spurious actuations, the probability is listed as medium.

And then what medium translates into -- which is the factors F times P -- is it canted be lugged greater than .01 per year based on the ranges that are given there.

It doesn't give it a -- and there's also a lower range. But, all we care about is that it can't -- when we have a medium fire frequency with a medium probability of spurious actuation, we're going to be less than .01 per year.

And that's in table 4-1 of NEI00-01. The next factor is the challenging fire factor. And this kind of represents what percentage of the fires will be severe versus non-severe.

It's fairly arbitrary. It's possibly analogous to some of the SDP tools where they're using the 95^{th} to 98^{th} percentiles. But, for this screening tool we just use -- if it's not challenging, it's a

one.

If it's challenging it's a .1. It's basically a fraction that's used to reduce the fire frequency. We're assuming that we can have, with our switch gear cabinets, we can have either a large electrical fire, or a high energy arcing type of flaw from table 4-7.

That is a lower probability than the -- just the normal electrical switch gear cabinet fire. So, it receives a factor of .1 according to table 4-7.

So what I've done now is I've gone through the first three factors in my delta CDF calculation. And I know that I'm already down to .001 per year as a maximum.

Continuing along, I'm now going to look at the fire non-suppression probability. Because I have the possibility of a high energy arcing fall, there's a discussion in section 4.2.1.5 of NEI00-01.

And I believe it was mentioned yesterday during the research presentation on the requant study that if you have high energy arcing faults, you don't take credit for suppression because it happens because you can really do anything.

So, I take no credit for fire non-suppression in this example. The probability is set

to one. Next is the CCDP, the conditional core damage probability.

And, if I go to table 4-8, what I can find there is that if I assume I have a loss of off-site power for internal events, that's just the standard, I get .1 credit there.

And, if I assume I have another -- other redundant shutdown equipment available so that the high pressure injection system isn't the only system in there, I can get an additional .1 credit.

And so, I would get .01 credit. And what I would do then is I have my five factors for my delta CDF calculation. And, when I do the math, I get ten to the minus five per year as an upper bound.

CHAIRMAN WALLIS: This is the simplest method I've ever seen.

MR. GALLUCCI: Yes, this -- again, this is what -- if you remember from the subcommittee presentation, the preliminary risk screen said you can do qualitative or order of magnitude.

So, this is pretty -- this is about as sophisticated as you're going to get at this upper level. So I'm now down to this box. I ask the question, does the change impact the risk non-negligibly?

I have a delta CDF that I know could be as high as ten to the minus five per year. So, that's not negligible to me. So I'm going to say the answer is yes, I cannot bypass this entire quantitative risk evaluation and jump down here to just check defense in depth and safety margin. I --

CHAIRMAN WALLIS: How low would it have to be for you to say its negligible? Do you have a criteria?

MR. GALLUCCI: I have a sliding scale of criterion that I use. What --

CHAIRMAN WALLIS: Do you use some judgment as well?

MR. GALLUCCI: I would say -- if -- given the range of total core damage frequencies one might typically see for fire PRAs, I would say that in mind the concept of non-negligible or negligible would be no greater than ten to the minus eight per year if it's a fairly robust calculation.

CHAIRMAN WALLIS: It's a very small number.

MR. GALLUCCI: Yes. I'm a little reluctant even with seven because some of these fire protection issues can -- unless you -- if you're covering ten or fifteen fire zones with a circuit

issue, you might get a ten to the minus seven contribution over ten, 15, 20 zones.

So that's why I'm a little reluctant that ten to the minus seven to dismiss it. It would depend. If I got ten to the minus seven after looking at all the fire zones, or if I had an operator manual actions type of issue where the same type of manual action was taken over multiple zones and could contribute in multiple ways, I would use -- if I was going to use ten to the minus seven, I would want to make sure that I had added up the contribution from all those zones.

So, when I say ten to the minus eight, in this case, see, I'm looking really at only one scenario. And I'm not -- for the sake of this example I'm not considering --

MEMBER APOSTOLAKIS: This scenario, if you had gotten seven minus seven you would have been okay.

MR. GALLUCCI: Yes. If it was the only -- this being the only thing in there, sure.

MEMBER APOSTOLAKIS: Let's go on.

MR. GALLUCCI: Okay. So, I've answered the question. Does the change impact the risk non-negligibly? The answer is yes. So now we can do the fun part.

We can get down into the quantitative risk evaluation.

CHAIRMAN WALLIS: What if you just told us about it verbally? Is that in the guide? This is about ten to the minus ten, ten to the minus eight.

MR. WEERAKKODY: Can I add something? One of the things we did after we met with the subcommittee and also when we met with CRGR -- I understand, you know, you have concerns regarding creating these new terms called non-negligible.

And we looked at the rule makings like proposal on 50.46 where they used the volume consequential and where they have assigned a definition and award.

So we are in the process of putting, you know, because Ray has his ways. And what we want to do is, in the Reg Guide, create something final. And, when we do that, that change would be highlighted and sent to you. Okay.

MR. GALLUCCI: Okay. Now I'm down to the quantitative evaluation. This is essentially I'm sharpening my pencil. And the tool that I've chosen to use for my sharpen pencil analysis will be the fire protection significance determination process, at least the aspects of that.

One could go to the full fire requan study and do a detail fire PRA at this step. It depends. But, for the sake of an example here, I'm going to go into a little more detail than in the preliminary risk screen.

But, I want to be able to get it done in a fairly short time, so I'm going to use the SDP tools for fire protection. The first sophistication, or enhancement if you want to call it, in the fire protection SDP versus the circuit screening tool, is that my fire frequency, instead of being based on burning everything in the fire zone as I assumed before for the switch gear room, now I'm going to just look at the components that are of interest for the actual --

MEMBER APOSTOLAKIS: Now, let me stop you for a minute. You're planning to go to the right, aren't you?

MR. GALLUCCI: I'm actually planning to go both ways and then come back in the middle.

MEMBER APOSTOLAKIS: Both ways?

MR. GALLUCCI: Both ways, because what I'm going to find is that I need to look at fire modeling as well.

MEMBER APOSTOLAKIS: Okay. But, you are

doing a risk assessment?

MR. GALLUCCI: Yes.

MEMBER APOSTOLAKIS: You're going to do fire modeling as part of risk assessment?

MR. GALLUCCI: I'm going to use fire modeling to help me calculate some probabilities in risk assessment.

MEMBER APOSTOLAKIS: Okay. We have no problem with that. The problem that I have and I think other members of the Committee have is when you go left only.

When you go and say I'm going to do an initial fire modeling and I will come up with the maximum expected fire scenario, compare it to the limiting fire scenario and make a decision completely ignoring delta CDF and delta LERF. Can you address that?

MR. GALLUCCI: I would only go down that pathway is, if I did my fire model -- okay, I came down here and I decided I had a ten to the minus -- let's say ten to the minus seven.

I was just on the borderline where I couldn't dismiss it. As soon as I come down here -- see, I burned the whole zone up here when I did this analysis.

Now, when I come here and I actually map out my targets, my fire sources, etcetera, it may be impossible for the maximum fire for the components that I'm interested in, given the separation, etcetera for the targets.

It may be impossible to get the fire damage. And that to me is delta CDF equals zero. So that's one way I could go down that path.

MEMBER APOSTOLAKIS: Wait, you're rushing. That's not what NEI04-02 says. That's not what your guide says. 04-02 says under initial quantitative risk evaluation, which is the left, that I have to come up with the maximum expected fire scenario and the limiting fire scenario and then compare the two and decide that there is sufficient margin or not.

And, if there is sufficient margin then, quote, fire modeling alone can be used to demonstrate the acceptability of the change. This approach eliminates the need for additional risk assessment.

Now, this statement seems to me is in conflict with the requirement that any change in the fire protection system of an NFPA 805 based fire protection system should be risk informed, which means using Regulatory Guide 1174.

This is the problem I'm having with this

because I don't know -- I mean, this limiting fire scenario business -- I looked at the definition, and I'll tell you what it is.

The limit -- from NFPA 805 it says the limiting fire scenario can be based on a maximum possible, though very unlikely, value for one input variable or an unlikely combination of input variables.

Well, it seems to me that's what the PRA is supposed to do and tell you how unlikely these things are and not to pick things like that. So, this is where I have a problem.

I have no problem with you going to the right. You can use a method you mentioned, or you can use the re-quantification method. That's fine. I mean, this is something we can argue about.

But, it seems to me there is a problem here when we are arguing or saying somewhere there that when you transition to NFPA 805 fire protection system program, then all changes will have to be risk informed.

And risk informed means delta CDF, delta -- I mean, everything's there, delta CDF, delta LERF, defense in depth, safety margins, I mean, you know, the standard picture of a regulatory guide comes to

mind.

And then I'm hit with this thing on the left. And that's where I get lost. I don't think this is consistent with the risk informed -- the requirement of a risk informed changed.

MR. GALLUCCI: I'm not going to defend that pathway. But what I'll do is explain what I think that pathway is intended to -- this is basically a pathway that NEI wants.

MEMBER APOSTOLAKIS: I understand that.

MR. GALLUCCI: Now, to cover that pathway, we have added at least the initial risk quantification in the preliminary screen. That wasn't there earlier.

The way I view this pathway is, if you do what -- you do this limiting fire scenario calculation, you know, the fire dynamics, etcetera, you're qualitatively assuming that you were going to have an incredible -- this fire should be essentially incredible.

What that number is to me is ten to the minus nine.

MEMBER APOSTOLAKIS: But Ray, I don't get that feeling when I read the report. If there were clear instructions that, yes -- like, I had no problem with the screening you did in the second year.

I had no problem with. You used conservative values. You did the calculations. But, to tell me that I have to define a limiting fire scenario by taking these -- oh, listen to this, this is a beautiful --

MR. WEERAKKODY: Can I --

MEMBER APOSTOLAKIS: No.

MR. WEERAKKODY: Oh, sorry.

MEMBER APOSTOLAKIS: This is again from 805. The values used for the limiting fire scenario input should remain with the range of possibility but can exceed that determined or judged to be likely or even probable.

What kind of nonsense is this? It's complete nonsense.

MR. WEERAKKODY: Well I --

MEMBER APOSTOLAKIS: You have 30 years of PRA. Now I come down back to using it.

MR. WEERAKKODY: Yes, Dr. Apostolakis, if you look at the last, you know, we heard you, and your concern would go away. Bob just pointed out to me, look at the last triangle in that.

Do you see the word defense in depth safety model and the risk depth?

MEMBER APOSTOLAKIS: Yes.

MR. WEERAKKODY: Okay. Now, you know, I don't want to say that we simply accepted it because NEI wanted to. Really that other side is for the exception rather than the roof.

What we did recognize is that there may be certain situations where the fire modeling itself would show that the core damage frequency is essentially zero. And we wanted to accommodate that.

MEMBER APOSTOLAKIS: But, Sunil, I repeat, I would have no problem if you showed me that. But, you are not. You are saying I'm going to define a scenario completely arbitrarily that I will call a limiting fire scenario, and will pick the input so that these values will remain within the range of possibility but can exceed that determined or judged to be likely, or even probable, which is a completely wrong and nonsense statement.

MR. WEERAKKODY: We will take that back as a feedback.

MEMBER APOSTOLAKIS: So you are taking me back now to the hypothetical accident error of this agency, you know.

MR. WEERAKKODY: We will take that back and we will get that addressed, those wordings, yes.

MEMBER APOSTOLAKIS: And then I'm reading

all over the place that if you do all this Mickey Mouse stuff, there is no need for additional risk assessment.

This document is dead set against risk assessment.

CHAIRMAN WALLIS: Also George, at the subcommittee meeting we had a presentation from the other side. It seemed to be emphasizing how to avoid having to do the risk work.

MEMBER APOSTOLAKIS: Exactly.

CHAIRMAN WALLIS: Which we're not having today. We had it at the subcommittee.

MEMBER APOSTOLAKIS: No, I'm not blaming these guys. But I'm just -- I believe that this is something that should not be -- I mean, there shouldn't be this left thing.

You can have, Sunil, I'm all for screening. So, if you tell me like Ray just did, let's change it back to risk non-negligible, great. He did a good job, fine.

You keep going down. I do a more sophisticated screening along the same lines. And, if I pass even that, then I go now to an actual risk assessment.

And maybe I'll use the re-quantification

methods or some other methods, whatever. But it's all part of doing a risk assessment. I mean, anybody who has done a risk assessment knows that you always start by screening things out.

It doesn't have to be a fire risk assessment, internal events. You screen things all the time. But, it's within the risk assessment, not making detours, you know, that --

MR. WEERAKKODY: Dr. Apostolakis, I think what you're saying, if we overlook the verbage there, which we will address and then fix, I don't think you're saying to us that if we do a fire modeling and we look at the V&V and understand the uncertainties and conclude that the fire modeling tells us there is no impact on the target, which essentially is going to related to delta CDF is zero, okay, that's okay with you.

MEMBER APOSTOLAKIS: But that's not what it says.

MR. WEERAKKODY: I understand. And we'll relit it.

MEMBER APOSTOLAKIS: It's a judgment issue. It says define these limited fires and area in this ridiculous way. Then postulate a maximum expect frequency scenario, which is more realistic one.

Compare the two and somehow come up with a judgment that there is sufficient margin. And, if there is sufficient margin, don't even think of going to --

CHAIRMAN WALLIS: But George, I didn't understand the definition that you gave. I went to Appendix D. And the definition of a limiting fire scenario seems to be quite different.

It says one or more inputs to the calculation of varied to the point that the performance criteria is not met.

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN WALLIS: it's essentially a sensitivity analysis.

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN WALLIS: So you keep varying things until you get up to the point where something goes -- you burn something out. And then you look at what you think is a credible fire.

You say, well, how far are you away from -- well, you would have to be in order to not meet the criteria.

MEMBER APOSTOLAKIS: But, listen, also those definitions I gave you --

CHAIRMAN WALLIS: Your statements seem to

be nonsense?

MEMBER APOSTOLAKIS: What?

CHAIRMAN WALLIS: What you said sounded like nonsense.

MEMBER APOSTOLAKIS: And I'll tell you what it is.

CHAIRMAN WALLIS: In Appendix D it makes more sense.

MEMBER APOSTOLAKIS: Go to -- see 33 of 805, that's what it is. What I just read is --

CHAIRMAN WALLIS: Well, I went to Appendix D, which makes a lot more sense. Anyway, we can't spend time on this.

MEMBER APOSTOLAKIS: No, the section D.2.4.4 of NEI04-02 requires that the input parameter is set to the maximum expected fire scenario to represent conditions that are reasonable and conservative.

All this terminology is from a different era. And what you read is the same thing. That's why we have PRA, to actually know how likely these numbers are.

MEMBER DENNING: No, but PRA doesn't answer that particular question, I don't think, George. This is a question of -- and, you know, the

definition that Graham talked about does make sense as to what they're attempting to do here which is say, what's the threshold at which we really do get damage? And you would have a delta CDF.

CHAIRMAN WALLIS: The defining safety margin is what they're doing.

MEMBER DENNING: Well, and then they're doing this variability within the MEFS. But, the thing that bothers me is it looks to me like the guidelines for how to do that variability on MEFS are all aleatory variables.

It doesn't address, as I see it, the uncertainties in these fire damage assessment models that come from our state of knowledge. I mean, it looked to me like all the sources of variability they do to say, well, could the fire really be larger in a different position and all this kind of stuff.

It looked to me like that's all sources of variation, not getting into the real issue with these fire propagation models, which is how accurate are they really?

Given a defined condition, can they really do that? So, we're concerned about this left-hand side, but for different reasons, I think, George. Mine are, do we -- well, first of all, do we really have

enough confidence in models to go down that pathway and with confidence feel that we can say, yes, it does close target damage or it doesn't close target damage.

And the other problem I had there was, I don't think that the modeling uncertainties were really taken into account in the guidance that's given in comparing MEFS with LFS.

MEMBER APOSTOLAKIS: If they had said that the limiting fire scenario takes all the relevant parameters to their extreme values, to their worst values, and if you do that you still don't have that much, then I would agree with you. But it doesn't say that.

MEMBER DENNING: Well, wait. But what Graham read did say what the LFS is, that's the threshold. You vary them until you get damage, whether it's reasonable or not reasonable.

And then you look at your MEFS and see whether --

MEMBER APOSTOLAKIS: And you decide that there is enough distance somehow. Somehow you have enough margin?

MEMBER DENNING: Right, by doing variations of everything you think is reasonable.

MEMBER APOSTOLAKIS: And I don't agree

with that.

CHAIRMAN WALLIS: What puzzled me about the flow diagram is that this MEFS and LFS are used to define safety margin. I was looking for a definition of safety margin.

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN WALLIS: Safety margin is a difference between the MEFS and the LFS. And they said they're typically looking for a safety factor of two.

I mean, you calculate how much heat flux you'd need to do damage. And then you'd calculate the critical maximum heat flux you can realistically have.

And you say one is twice as big as the other. Therefore, you've got a safety margin. But, the puzzling thing is that you investigate it again and the diamond at the bottom.

Your supposed to look at risk and SM, are they all okay? And that's seems really funny because you bypass risk and then you have to look at risk again in box. I don't understand it.

MEMBER APOSTOLAKIS: Bijan.

MR. NAJAFI: I'm sorry to interrupt.

MEMBER APOSTOLAKIS: I don't understand the diagram, because you seem to be bypassing risk by

going down that path that we're on --

MEMBER APOSTOLAKIS: And that's the objection.

CHAIRMAN WALLIS: And then you have to evaluate whether risk's okay at the bottom again. So, how do you --

MEMBER APOSTOLAKIS: Because you have already decided on the left that delta CDF and delta LERF an acceptable.

CHAIRMAN WALLIS: Have you?

MEMBER APOSTOLAKIS: And I don't know how you -- yes, it's an alternative to the risk assessment.

CHAIRMAN WALLIS: There's no delta CDF on that side.

MEMBER APOSTOLAKIS: It's an alternative to it. All you do after that is you look at defense in depth and safety margins, which you have already looked at.

And it says explicitly in 04-02 that if this okay, you don't need to do a risk assessment. That's the objection. There is no objection to screening. Yes, Bijan?

MR. NAJAFI: I'm sorry. I just wanted to add one clarification. By the way, my name is Bijan

Najafi. I am a principle member of the NFPA 805 Committee.

In some of the discussion today I may have to take blame for it, or maybe credit, depending on what your point of view is. I wanted to make some clarification.

My comment does not neither reflect the Reg Guide or NEI04-02, plainly the 805. First, the definition and intent of the limiting fire scenario was written to be closer to what, I'm sorry Graham, Mr. Wallis suggested.

The intent was the standard NFPA wrote is a performance-based standard. It is not exclusively a risk informed. It's a performance-based standard. And in that sense it allows for methods typical or similar to equivalency testing that it's done in fire protection community in the previous years.

That you -- if you allow -- if you can determine that the change or whatever you did to your program does not challenge your performance criteria in one way or another at all, you may have demonstrated the adequacy of that change.

The intent of the limiting fire scenario versus the maximum expected was that, to acknowledge the uncertainty of these models you know that there is

some accuracy, you may be off.

So, you have to demonstrate some margin for that uncertainty. And, since you're not doing in a statistical way, you have to develop, let's say, the worst possible scenario.

And you don't do it only by heat release rate. Sometimes you may have to change the material you're exposed. Say, if I don't know what the cable type is, let me assume it is the weakest, it is a PVC cable, see if that affects my conclusion.

So you define basically the minimum change in your assumptions that can get you, violate your performance. And, if that margin is small, and does not cover the uncertainty that you have about your prediction or predicted capability of your tools, then you have not done it and you have to do something else.

It doesn't say what to do, risk or not. But you have not satisfied the need. But, if you have a situation that, for example, happens a lot, that you need a two, three megawatt fire, ten megawatt fire, nine megawatt fire to violate that performance criteria, then you have demonstrated that, in terms of you hazard, you have enough protection.

You still have to do your defense in

depth because, even in that, it says that you still can't go get rid of your -- because all that has done is demonstrated adequate mitigation.

It has not demonstrated adequate prevention. And it has not demonstrated adequate safe shutdown. You still have to demonstrate those two elements have not been violated.

So, I guess my point was to clarify the definition. The definition to the intent was there. If there are some places that there are some wording there that was not --

CHAIRMAN WALLIS: I think what you're saying is that this method, this old method of safety factor was if you have a big enough safety factor, it's pretty darn sure it can't happen.

MEMBER APOSTOLAKIS: Right.

CHAIRMAN WALLIS: Therefore you don't need to do the risk stuff at all. Isn't that what you're saying?

MEMBER DENNING: Delta CDF is zero.

CHAIRMAN WALLIS: But then the question might be, well, with a safety factor of two, there's still some probability. So, you can, you know, wonder how it --

MEMBER APOSTOLAKIS: You're dealing with

rare events here. There is nothing wrong with screening. As I say, we do it all the time. But screening has to be conservative.

VICE CHAIRMAN SHACK: But, it's not a rare event at this point. You've sort of got the fire. You have a limiting fire scenario is setting your upper bound.

MEMBER APOSTOLAKIS: No, but it's a matter of --

VICE CHAIRMAN SHACK: And then you look to see if you have a lot of distance between your upper bound and what you think is your bounding analysis.

CHAIRMAN WALLIS: That's the more dubious one, is what is actually the maximum expected?

VICE CHAIRMAN SHACK: Yes.

CHAIRMAN WALLIS: That's the one where --

VICE CHAIRMAN SHACK: Well, that ones comes to Rich's things. If you look at all the parameter variations, have you still covered the uncertainty of --

CHAIRMAN WALLIS: The LFS is where you vary parameters. And then you see what's the worst that could happen. But the MEFS is where you actually model something.

And that's your expected fire scenario,

isn't it? This is something different between how big it could be and what is the maximum you expect it to be. So, I mean, there's a difference.

MEMBER APOSTOLAKIS: So, what is your provision? I'm confused. Is this a valid approach or not?

CHAIRMAN WALLIS: Well, it has nothing to do with risk.

MEMBER APOSTOLAKIS: And, therefore?

CHAIRMAN WALLIS: Well, it's not risk-based. And it's not risk informed.

VICE CHAIRMAN SHACK: It's sort of like saying, what is the probability of failure of a steam generator tube if I meet the ASME code. And the answer is, I can't give you a number, but I know it's extremely small.

Well, you know, if you have a big margin between your damage and your insult, you don't know quantitatively what the probability is. But you know that it's very small.

MEMBER APOSTOLAKIS: But it seems to me this is all part of the risk assessment.

MR. LAIN: No, you have to look at where this came from. This is a consensus standard out of a fire protection engineers and a few PRA guys.

MEMBER APOSTOLAKIS: I know.

MR. LAIN: And that, you know, the fire protection, that's the fire protection side where the fire protection engineer feels that they can resolve the problem. And so, it's performance-based.

VICE CHAIRMAN SHACK: A PRA guy is going to have the same problem.

MEMBER APOSTOLAKIS: It says very clearly that all changes, if you choose to go that way, should be risk informed. And there is a single document in this agency that tells you how you risk inform a change, 1.174.

VICE CHAIRMAN SHACK: No, but --

MEMBER APOSTOLAKIS: And they're going out of their way to avoid using it.

VICE CHAIRMAN SHACK: But, if I have to tell myself, did something fail or doesn't it fail, I have to come up with that probability of failure. And, if I go the risk assessment rout, I still have the same problem.

How do I come up with that probability of failure? The answer seems to be, if I have a big enough safety margin, that probability is effectively zero.

MEMBER APOSTOLAKIS: Right. And that's

what I'm saying. That's part of the standard risk assessment.

VICE CHAIRMAN SHACK: Well, if they put that block in front of the delta CDF, you know, if you said, okay, what I'm really doing is evaluating the probability of failure, and if the probability of failure is zero and I bypass the risk you would have been happier.

But I think that's effectively what they're doing.

CHAIRMAN WALLIS: Well, I think what's confusing here really is that the DID and the safety margin part and the risk part are all somehow subsumed in this MEFS business.

VICE CHAIRMAN SHACK: As soon as your probability of damage is non-zero, you have to go into the yes box. And you have to sit there and somehow figure out what that probability -- you know, if it's zero that's easy.

MEMBER APOSTOLAKIS: Wait, wait. Zero what? What is zero? No, they never say that it has to be zero. It is a judgment --

VICE CHAIRMAN SHACK: That's what the box down there in the MEFS and LFS is telling.

MEMBER DENNING: I think Bill is exactly

right. I mean, I'd bet on it. I think it's exactly right. I think that you're --

VICE CHAIRMAN SHACK: It's sort of strange to have to guess what it means.

MEMBER DENNING: You're concluding down there that Delta CDF is zero. And so, you don't have to go through the risk. Just by looking at this particular case you've said, there's just no way that the buyer could have been large enough to have caused the damage that gives you a delta CDF.

MEMBER APOSTOLAKIS: But that's not what it says.

MEMBER DENNING: Ray, is that your understanding?

CHAIRMAN WALLIS: You do an analysis and you say that there's no target damage. But then, to check that you were conservative, you confirm it by doing an even more extreme fire analysis and seeing if that's okay.

MR. GALLUCCI: There was an earlier version of this diagram where this pathway the first question was, is your non-negligible's change zero or not?

It would only let you go down this pathway if your delta CDF was zero.

CHAIRMAN WALLIS: But now it doesn't.

MEMBER DENNING: It's not from other reasons.

MR. GALLUCCI: It essentially -- philosophically it's the same as the discussion you're having here. Basically this can happen. But, because this is a document like, I think Paul mentioned Bijan mentioned, that was written by 90 percent fire protection engineers and 10 percent PRA engineers.

Fire protection engineers, when they hear the word risk assessment, run and hide. And so, this pathway, the way it's drawn, and the wording you see is a comfort zone for the fire protection engineer.

So we're scared of risk assessment. But, in reality, I don't think you'll ever go down either of these pathways by themselves. I think there essentially is only one pathway here.

You go here and you use fire modeling to help you estimate some of your probabilities. There's really just one pathway. It's right down the middle in practical purposes.

MEMBER APOSTOLAKIS: And that's -- the screening part that is called initial fire modeling is really part of the risk assessment, which is one line.

Because, when I see things like a

comparison of MEFS and LFS is used to determine if a sufficient margin exists, I don't know what that means.

MR. GALLUCCI: To me it means delta CDF is zero. That's what it means to me. And I would not even -- if delta CDF is zero, I'm really done with the hole thing.

I don't need either pathway if I know what it is.

MEMBER APOSTOLAKIS: That's right.

MR. GALLUCCI: So, this pathway really supports this pathway. And, in reality --

MEMBER APOSTOLAKIS: It's screening.

MR. GALLUCCI: -- you're going to go right down the middle for all practical purposes.

CHAIRMAN WALLIS: You can't go down the middle.

VICE CHAIRMAN SHACK: Inside that box it says original risk assessment. You have to do exactly what you do on the left. You have to come up with a fire model.

You have to decide whether there's damage or not. You have to come up with a probability of failure. You have to do all of that. And, if I come up with a big zero inside that box, I'm exactly where

I am if I just went left.

But I'm going to do the same thing first. I have to come up with the fire model. And I have to come up with damage.

MEMBER APOSTOLAKIS: And I have to come up with these values that are --

VICE CHAIRMAN SHACK: That's a different problem.

MEMBER APOSTOLAKIS: Well, it's a --

VICE CHAIRMAN SHACK: Graham's statement was a far more sensible one.

CHAIRMAN WALLIS: I was just reading, it wasn't my --

VICE CHAIRMAN SHACK: What he read made sense. What you're reading doesn't make sense, I'll have to admit.

MEMBER APOSTOLAKIS: No. But also, another thing is the LFS can be based on a maximum possible though very unlikely value for one input variable or an unlikely combination of input variables.

It doesn't say the maximum possible for combinations. So I have freedom now to say I went high enough, this is unlikely enough and come up with a limiting scenario that is not limiting.

CHAIRMAN WALLIS: Well, the MEFS --

MEMBER APOSTOLAKIS: And then the reviewer has to go down into the details of all these assumptions I have made to catch me. And that's the whole point of the deterministic calculation.

CHAIRMAN WALLIS: The MEFS is to find an Appendix D. I don't know which appendix you're in. This is the maximum which can reasonably be expected to occur.

MEMBER APOSTOLAKIS: That's another definition.

CHAIRMAN WALLIS: And I don't know what that means.

MEMBER APOSTOLAKIS: Well, tell me what reasonably conservative is. It's the same idea as to the unlikely combination. I mean, that was the whole point of using PRA, that you would have some measure of these unlikely -- obviously if I go to the ten megawatt fire, which I know I will not have, and I show there is no damage, well, thank you very much.

Yes, that's a part of the screening that I do routinely in a risk assessment. But I'm not going to say that this is an alternative to risk assessment. Come on.

MR. WEERAKKODY: Dr. Apostolakis --

MEMBER APOSTOLAKIS: I think there is a subtle difference here. Of course we are screening out a hell of a lot of areas in a plant. There is no fuel there.

There is no anything to be damaged. And, even if there is no fuel, we start assuming transient fuels.

MR. WEERAKKODY: I want to share with you a couple of thoughts with respect as to why we brought that part as is to the committee. I'm not defending all the language there. We can get those things fixed.

There's an underlying -- first of all, if we came up with the Reg Guide that says it's got to be zero, anything above zero is unacceptable, we are going to suffer the same consequences we suffered in NSAC-125 50.59 where, if we had a thousand gallons of barrels and if you bring a spoon of oil, it does increase the failure probability an therefore you've got to do the risk assessment.

That's on aspect, okay? And so really I think I don't know the name of the member. But, what a couple of the other members said in terms of the intent is that you the fire modeling tools, the intent is that you make as, you know, with all the

conservatives that the fuel cannot burn the target.

So, delta CDF is essentially zero. I used another term there other than zero. But there is a danger in using the absolute values. Okay? Because, another example I can point to is the regulatory -- where we said, you know, for transition risk you've got to show that as well as risk-gained rather than saying that the risk increase is negligible.

So, we want -- that the second thing, okay, the second thing -- one of the things that Ray didn't share with you is as to what the underlying concern of the licensees asking for this.

And they do have a basis. Okay, and I understood that basis. They're not -- doing risk calculations. Just like anybody here, they could just say, you know, the fire modeling gives us such notice as delta CDF is ten to the minus 14.

What they are concerned is, if it is anything other than their calculated number, their perception is that they need to track, book keep that number.

That's where they are coming from. Okay? So they do have a valid concern of undue burden of having to boo keep ten to the minus 12, ten to the minus 14.

MEMBER APOSTOLAKIS: Nobody --

CHAIRMAN WALLIS: George, can we perhaps move on here? I mean, he's just about to lead us down the right-hand path.

MEMBER APOSTOLAKIS: No, I don't need this, unless you guys want to see it. This is a standard fire risk assessment.

CHAIRMAN WALLIS: But I would like to see him finish his presentation and lead us down the right-hand path so we can see if that's credible, how they do it.

MR. GALLUCCI: I think that would be very helpful.

MEMBER APOSTOLAKIS: No, I think the objection though is not there.

CHAIRMAN WALLIS: Well, I know. I understand the objection. But, that's different. But I think we aught to let him finish his presentation.

MR. GALLUCCI: Okay. Let's get back on the right path. Okay, so what I'm doing now is I'm sharpening my pencil.

CHAIRMAN WALLIS: Actually, you're going to do a risk assessment, down the right-hand path?

MR. GALLUCCI: Yes, but I'm actually going to end up here and go down --

CHAIRMAN WALLIS: Do it more accurately?

MR. GALLUCCI: Yes. I'm going to bring in fire modeling.

CHAIRMAN WALLIS: Okay.

MR. GALLUCCI: So, I sharpened my pencil. Instead of looking at zonal fire frequency, I now look at component fire based frequency. I'm assuming my cables pass horizontally above --

CHAIRMAN WALLIS: You don't assume it, you actually determine that?

MR. GALLUCCI: Yes, I say the word assume because I'm making up the example.

CHAIRMAN WALLIS: But in the reality you'd find out?

MR. GALLUCCI: Yes, you would count them. You would walk down the zone.

MEMBER ROSEN: Know where they are.

MR. GALLUCCI: Yes. We have -- the cables pass above ten switch gear cabinets. So, the frequency -- if you go to table A1-3 in the fire protection SDP, component based six times ten to the minus five per cabinet per year, ten of them, six times ten to the minus four.

Recall before I had a value that was a medium. This would be below medium.

CHAIRMAN WALLIS: It's much less.

MR. GALLUCCI: I sharpen my pencil. Next, spurious actuation probability. I have two thermoplastic inter-cable interactions. I go to table 28-3, the fire protection SDP.

The probability of a spurious actuation for an inter-cable thermoplastic cable is .2. I've got two of them, .04.

CHAIRMAN WALLIS: Inter-cable means?

MR. GALLUCCI: Between two cables.

CHAIRMAN WALLIS: So what is it for one?

MR. GALLUCCI: It's point two for one cable.

CHAIRMAN WALLIS: That's only one cable, how can they --

MR. GALLUCCI: No, it's two hot shorts. I'm looking at multiple cables.

CHAIRMAN WALLIS: Oh, within the cable?

MR. GALLUCCI: Yes, one cable would be --

CHAIRMAN WALLIS: Okay.

MR. GALLUCCI: Inter-cable is among the conductors within on cable. But, for thermoplastic within the one cable I think it's .3 is your number. Or, no, it's .6 in fire protection SDP. It's .6 within the cable, the intra-cable.

The challenging fire factor, I have done nothing to tell me that I can't have the high energy arcing fault or the large electrical fires. So, I'm going to leave that as it was at point one.

However, now I'm going to look at fire non-suppression probability. I'm considering the physical layout and fire modeling. The horizontal cables are within five feet of the top of the cabinet.

These will be protected against high energy arcing fault if the tray is covered. That's according to attachment 5 of the fire protection SDP.

So, I'm going to make that a requirement in my plant change that I cover these trays because I'd want to eliminate the possibility of high energy arcing fault damage.

Which means that only I have to consider the effect of the large electrical fire, which is a 650 kilowatt fire according to table 2.31 of the fire protection SDP.

So, I've eliminated the high energy arcing fault by enhancing my plant change modification.

MEMBER ROSEN: But, at that stage you've committed to a modification?

MR. GALLUCCI: Yes. That's the first. It's no longer going to be acceptable to -- at a

minimum I'm going to have to cover these cable trays because I could have a higher -- I can't eliminate the high energy arcing fault based on physical distance, other parameters.

So I've now enhanced -- I definitely have a plant change. And I'm going to have to at least cover my trace. Here's where I'm going to do a little fire modeling.

I'm not going to run any complicated tools here. I'm going to use the correlations from NUREG 1805, the fire dynamics tools. I look at my physical layout, my fire heat release rate, which was 650 kilowatts.

And, if I plug in the various spreadsheets and parameters, I come out with a temperature of about 500 degrees Fahrenheit occurring at the cables.

If I look at the table A7.2 of the fire protection SDP I expect a cable failure for a thermoplastic cable in ten minutes. If I assume that I have essentially detection within one minute, that gives me ten minutes for my manual suppression to take place.

And, if I look at table A8.1 of my fire protection SDP and I look under electrical fires, the probability of non-suppression in that situation for

that time is .3.

For my CCDP I'm going to take additional credit for Appendix R safe shutdown or ultimate shutdown strategies, which includes operator actions.

Typically when you do the fire PRA if you just take your internal events PRA and just plug the fire frequencies in and fail the components that are in the fire zone, etcetera, you're going to get something fairly conservative because some of the ultimate shutdown strategies that you might find in your emergency operating procedures for fire have not been modeled in the PRA until you update it for your fire PRA.

And so, you typically get alternate strategy, some manual actions that are proceduralized that you would not have in your internal events.

So, since my preliminary screen CCDP was basically looking at just what I had for internal events, let's assume that I went through, I looked at a -- enhanced my fire PR -- I enhanced my internal events model at least for the Appendix R strategies that were relevant to this case.

And, when I sequenced my number, I got down to .001.

VICE CHAIRMAN SHACK: Does this mean I

have to write new procedures now?

MR. GALLUCCI: No. This would be taking your existing procedures for fire, your existing fire procedures.

CHAIRMAN WALLIS: So I look at this example. Your initiating frequency or your components-based fire frequency is so low, 16 minus four.

You multiply that by your C from this one there --

MR. GALLUCCI: Oh, yes. I'm --

CHAIRMAN WALLIS: You're pretty well there without going far at all.

MR. GALLUCCI: Oh, yes. I just wanted to show for the -- obviously you could do -- after two steps here you might be so small that you don't have to look at anything else.

I just wanted to trace through the whole path for the sake of illustration.

VICE CHAIRMAN SHACK: What would have happened if I didn't cover my tray?

MR. GALLUCCI: Then I would have the potential for a high energy arcing fault. I would get no suppression credit.

CHAIRMAN WALLIS: It wouldn't make that

much difference. I guess it would be one instead of .3 or something. It wouldn't make much difference, would it? So, why do you have to cover the tray?

MR. GALLUCCI: Maybe I don't have to. But I'm saying I'm looking at that.

MEMBER ROSEN: Well, that's when you do your second pass through the analysis.

MR. GALLUCCI: Yes. I might go back and say the high energy arcing is -- but, of course, later on -- we won't -- when I get to the end the number isn't everything.

It's number defense in depth and safety margin. So, for now I'm going to retain all my numbers.

CHAIRMAN WALLIS: So you have to go and do the MEFS part as well?

MR. GALLUCCI: No, I won't be doing that, not --

CHAIRMAN WALLIS: It defines the safety margin.

MR. GALLUCCI: No, that's -- safety margin is defined as Reg Guide 1.174.

CHAIRMAN WALLIS: Well, I'm sorry. But it's defined in Appendix D as the difference between MEFS and LFS.

MR. GALLUCCI: But that's only for this pathway.

CHAIRMAN WALLIS: What?

MR. GALLUCCI: MEFS and LFS are not the definition of defense in depth and safety margins down here.

CHAIRMAN WALLIS: He has two different definitions of safety margin then.

MR. GALLUCCI: That's safety margin for fire modeling.

MEMBER APOSTOLAKIS: He has already decided that the left path doesn't help you. It's a screening path. What he is doing now is he knows that the left path is not going to help you, right?

MR. GALLUCCI: All I got out of that was .3.

MEMBER APOSTOLAKIS: Nothing on the left applies anymore.

VICE CHAIRMAN SHACK: Once he has a probability of failure that isn't zero, he's off of the left path.

MEMBER APOSTOLAKIS: I don't know about the zero, how you guys decided the zero. But anyway, yes. He didn't pass the screen test.

CHAIRMAN WALLIS: There is no such thing

as zero in probabilistic.

MEMBER APOSTOLAKIS: If it's zero, we're all going to be happy if it's zero.

MR. GALLUCCI: Okay.

MEMBER APOSTOLAKIS: Could you please accelerate this?

MR. GALLUCCI: Yes. I plug all the numbers in, I multiply and I get 70 ten to the minus ten per year. This satisfies the criteria in NEI04-02, one less than one to the minus seven.

So I'm happy with my number but I still -- I'm down here. The answer is yes. I've got to look at the defense in depth and safety margins.

CHAIRMAN WALLIS: That's where I think a lot of the problem may well be. But we'll get to it.

MR. GALLUCCI: And I'm not ignoring the LERF in this example. I would have done the same calculations for the LERF portion. But, to save time, I didn't do it.

MEMBER DENNING: But you didn't have to anyway.

MR. GALLUCCI: Yes, right. The uncertainty in fire delta CDF can span several orders of magnitude. So, even with the best estimate at 70 to the minus ten per year, the licensee must still

consider defense in depth and safety margin.

The magnitude of the uncertainty may reflect a degree of safety margin that is present, and may suggest acceptable level and suggest an acceptable level of defense in depth.

So, if he's comfortable with the uncertainty is only a factor of ten --

CHAIRMAN WALLIS: This is very much a judgment of the person. I mean --

MR. GALLUCCI: Correct.

MEMBER APOSTOLAKIS: Yes, it's not consistent with 1.174, which requires mean values?

MR. GALLUCCI: Yes. You could treat these as mean values. But --

MEMBER APOSTOLAKIS: I mean, do we use 1.174 anywhere except saying that we might want to look at it? This is not acceptable, especially if you're way down there.

You have to do an uncertainty analysis. These are mean values. 1.174 is very clear about it.

MR. GALLUCCI: Well yes, I would have -- in order to do the defense in depth and safety margin, I would have done an uncertainty. I didn't show it here, but --

MEMBER APOSTOLAKIS: Okay.

MR. GALLUCCI: There's uncertainties on all these. I can go the NUREG/CR-68.50 and pull out the probability distributions on the fire frequencies.

I can pull out the heat release rate. And I could plug them in. I didn't show them.

MEMBER APOSTOLAKIS: I understand that, Ray. But it's the words again that bother me. Uncertainty and fire delta CDF can span several orders of magnitude.

So the licensee must still consider defense in depth. This tells me that the defense in depth of you or examination is an alternative, is something that will take care of the uncertainty analysis so I don't have to do it.

MR. GALLUCCI: No, it's something that you have to consider. To me the safety margin -- defense in depth are the actions you take in order to ensure that you have sufficient safety margin.

Uncertainty is an approximation of the qualitative term safety margin. And so, you look at your safety margin. Obviously we consider the safety margin for a meteorite strike to be sufficient that we take no defense in depth against that, because it's about ten to the minus 13.

MEMBER APOSTOLAKIS: Well, --

MR. GALLUCCI: At 70 to the minus ten if I had a factor -- if this was my -- if I was in log-normal space and this was my median, and I said my error factor is 1,000, then I would say my upper-bound 95 or whatever, 70 to the minus seven, I'd say I need some addition -- I don't have enough safety margin, I need some additional defense in depth.

And that's all I'm saying here, is that I would use the uncertainty estimate as a quantitative way to give me insights into what currently in both Reg Guide 1.174 is a qualitative discussion of safety margin and defense in depth. I want to use some quantitative judgment.

MEMBER APOSTOLAKIS: The way I read this is different. But, anyway, that's not important.

CHAIRMAN WALLIS: Are we almost through, George?

MEMBER APOSTOLAKIS: We should be because we have another speaker in six minutes.

MR. GALLUCCI: Okay. So, at the end, the plant change evaluation concludes only after all three risk related elements are satisfied, the change in core damage frequency and LERF, defense in depth and safety margin, the licensee must also consider the cumulative effect of multiple plant changes, such as

the sum of these delta CDFs if he has multiple plant changes.

And then the licensee over here, he documents his plant change evaluation according to his procedures and maintains them for review by the inspectors.

MEMBER APOSTOLAKIS: So now, your example also refers to something that's in the document that I kind of don't like. You didn't -- the document says if the plant CDF and/or LERF, due to external hazards, is not available or is otherwise not known, then the delta CDF and delta LERF for a proposed change must be limited to ten to the minus seven and minus eight respectively.

An increase in these values is possible if there is reasonable assurance that the plant risk is in region two or three with fire and seismic risk included.

If an increased value is used, a basis or justification must be developed and documented. This is of the same kind of thinking that you said earlier that fire protection engineers' fear risk assessment and they run away.

How can my make these judgments about delta CDF and delta LERF without the fire risk

assessment? In fact, to say an increase in these values is possible if there is reasonable assurance that the plant risk is region two or three, and you would judge that without CDF and LERF, I suppose.

You know, I'm at a loss. If we approve anything like this, then what on earth are we doing here? Okay? I am at a loss. The Committee may not be.

I mean, this says, find delta CDF and delta LERF. Try to imagine in which region -- well, this is a pretty good plant. I'm probably in region three.

Well, yes, delta CDF is probably low. I think I will approve it. I mean, this is not the spirit of risk informing our decision making process.

I'm done with my comments. Any comments or questions from the Committee?

VICE CHAIRMAN SHACK: Aside from that, George, what of you think of it?

(Laughter.)

MEMBER DENNING: Well, I do have another question. I'm not sure if Ray is the right person to address it to. But I think that basically when we look at some of the elements of this that -- particularly going down that left-hand line there --

that we rely on the ability of the utility to use very sophisticated tools that don't have very well characterized validation and verification.

I realize those things are in progress. But, they require a great deal of experience, even when we get to the point of understanding what those uncertainties are.

And, by allowing them to use that within this context, it means that the utility can make a change in its plant, and that it will eventually be audited.

But, I think that today we can have exemptions and along the same lines for certain regions and stuff like that. But, it would be assured that it would go through a regulatory review before the plant made the change.

If we allow those things to happen now within the context of this new approach, that it puts a lot of trust in us that the utility is going to be able to have the expertise to assess just how big those uncertainties are.

And then it puts a lot of burden later on the inspectors when they go through to really identify that there's an issue here and bring it to the right people to have it checked.

And I am just -- I don't feel real comfortable with that. And I'd like to hear why I should have more comfort that that's an acceptable thing to do.

MR. WEERAKKODY: Yes, I could answer that one. I wouldn't say that our inspectors and the old licensees out there have that capability today. But, I could assure you that the inspectors who would be inspecting the plants will have procedures delivered by us.

And they will have the training that is compatible with implementing those procedures. In fact, for the 805 plants we will be creating new procedures just to look at the PRA and define -- up.

Now, with the licensees, we have the pilot observation visits. I'm not saying that -- I don't know how much expertise they have today. But I do know that at this point, for example, we have -- you know, I've been to region four once.

And we distributed all the CFAST models because they wanted these modeling tools. So, the level of knowledge even the licensees is on the increase.

And it really goes with the pilots we have every three or four months. For the pilots we do

observation visits from the head office. And these are the things we need to work through and make sure it does happen.

CHAIRMAN WALLIS: Are we finished?

MEMBER APOSTOLAKIS: Anything else?

(No verbal response.)

MEMBER APOSTOLAKIS: Well, thank you very much.

CHAIRMAN WALLIS: You asked for comments, George. My comment is it's somewhat miraculous we finished by 12 o'clock despite all the excitement. And I think the reason perhaps we did it is because we knew something else is going to happen at 12 o'clock.

MEMBER APOSTOLAKIS: Yes, our guest speaker is here.

CHAIRMAN WALLIS: I'm going to have a break of an hour. And the question I have for the Committee is whether you want to go away and get a lunch and bring it up here or whether you want to hear the speaker and then go to lunch.

I think we want to go and get a lunch and go back.

MEMBER APOSTOLAKIS: Wait. We were supposed to do that at 11:45.

CHAIRMAN WALLIS: I know George, but

unfortunately you didn't keep us on time. So, carry on.

MEMBER APOSTOLAKIS: Can we ask the speaker what other commitments he has?

CHAIRMAN WALLIS: Well --

MEMBER APOSTOLAKIS: He's not here just yet.

CHAIRMAN WALLIS: There's also a constraint. Okay. So, is that the agreement? That we will go away and get some lunch, bring it up here, those of us who have the time to hear the speaker.

And we will take a break from 12. And we will return here at one for our regular business.

(Whereupon, at 12:00 p.m. the above-entitled matter was concluded.)