Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title:	Advisory Committee on Reactor Safeguards
Docket Number:	(not applicable)
Location:	Rockville, Maryland
Date:	Thursday, May 6, 2004
Work Order No.:	NRC-1465 Pages 1-304

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

512th FULL COMMITTEE MEETING

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THURSDAY,

MAY 6, 2004

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ROCKVILLE, MARYLAND

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The Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Mario V. Bonaca, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

MARIO V. BONACA, Chairman

STEPHEN L. ROSEN, At-Large

GEORGE E. APOSTOLAKIS, Member

F. PETER FORD, Member

THOMAS S. KRESS, Member

GRAHAM M. LEITCH, Member

COMMITTEE MEMBERS PRESENT (Continued):

DANA A. POWERS, Member

VICTOR H. RANSOM, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

DAVID ALBERSTEIN

TONY ATTARD

TOM BOYCE

CINDI CARPENTER

MIKE CASH

STEPHANIE COFFIN

ANNE COTTINGHAM

JOHN CRAIG

A. EL-BASSIONI

P.J. HABIGHORSE

DONNIE HARRISON

WAYNE HARRISON

JIANG HONG

BILL KEMPER

FELIX KILLAR

STEPHEN KLEMENTOWICZ

RALPH LANDRY

KEVIN LaVIE

NRC STAFF PRESENT (Continued):

ALAN LEVIN

ERASMIA LOIS

STU MAGRUDER

BOB MARTIN

KEVIN McCOY

GEORGE MEYER

RALPH MEYER

CARL PAPERIELLO

GARETH PARRY

MARK REINHART

STACIE SAKAI

N.T. SALTOS

UNDINE SHOOP

WILKINS SMITH

BILL STILLWELL

T.R. TJADER

JARED WERMIEL

C O N T E N T S

C O N T E N T S (Continued)

P R O C E E D I N G S

(8:29 a.m.)

CHAIRMAN BONACA: Good morning. The meeting will now come to order.

This is the second day of the 512th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the committee will consider the following:

Use of mixed oxide lead test assemblies at the Catawba Nuclear Station;

Risk management technical specifications;

Trial and pilot implementation of Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-informed Activities";

Good practices for implementing human reliability analysis;

And then preparation of ACRS reports.

Dr. John Larkins is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments from members of the public regarding today's session. We have received a request from NEI for time to make oral statements regarding Regulatory Guide 1.200, and from

NEI and Dr. Lyman of Union of Concerned Scientists regarding the use of MOX fuel lead test assemblies at the Catawba Nuclear Station.

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.

Also, I want to remind you that during lunchtime today, between 12:45 and 1:15 p.m., Mr. Paperiello, who is the new RES Director, will meet with the members informally to discuss his vision for the Office of Research. So I think you'll essentially have half an hour for lunch and then half an hour is indicated to Mr. Paperiello.

I will begin with some items of current interest. You have in front of you, in fact, this package, items of interest and in it you'll find speeches from the Commissioners.

You'll find also an NRC announcement, mid-page, Office of Public Affairs, "NRC provides update or review process for Vermont Yankee operator request," where it is indicated that there will be a special review of Vermont Yankee power up-rate and also the ACRS will be involved in that review.

There is also an interesting article at the end of the package regarding MSPI. We have shown for the level of interest in MSPI, and there is information there regarding that indicator.

Before we start with the first item on the agenda, I would like to recognize Mr. Jain. Mr. Jain has been with ACRS staff for a year and will be leaving on May 28th, 2004 to join Research. We appreciate the outstanding technical support that he has provided us in several matters, including license renewal applications and recently the resolution of the ACRS recommendations related to the DPO on steam generator tube integrity. Hopefully we will finalize that report today so that it will be done while you're still here with us, and also the support he has provided on good practices for human reliability analysis.

Thank you very much and good luck.

(Applause.)

CHAIRMAN BONACA: With that we can move to the first item on the agenda. Dr. Powers, if you could.

All right. I know from good memory that --

DR. POWERS: Agendas are precious items.

CHAIRMAN BONACA: It was mine and I lent it to you.

DR. POWERS: Well, that was your mistake.

CHAIRMAN BONACA: The first item on the agenda is the MOX fuel LTA, and Dr. Powers will lead us through that presentation.

DR. POWERS: Right. It's titled "Use of Mixed Oxide Lead Test Assemblies at the Catawba Nuclear Station."

CHAIRMAN BONACA: Very good.

DR. POWERS: I think most of the members are aware there's a national policy to dispose of excess weapons grade plutonium as mixed oxide fuel in commercial nuclear power reactors. This is, of course, the first time that we made a conscious effort to use mixed oxide or MOX fuel in nuclear power stations.

And it is true that there is some significant experience with mixed oxide fuel in power reactors in Europe especially. But that experience is with reactor grade plutonium that does not have the enrichment of the 239 isotope, the weapons grade plutonium has.

As a consequence, we don't know as much about mixed oxide fuel as we would like to know, and the way we obtain some of that information that we need to have to use mixed oxide, of course, is to use lead test assemblies, and that's what we're considering, is the safety of using some mixed oxide lead test assemblies in the Catawba reactor.

Our interest is can this be done with adequate assurances of the public health and safety.

The Fuel Subcommittee met with the folks from Catawba, the staff, and the Union of Concerned Scientists to discuss this use of mixed oxide lead test assemblies to some detail, and of course, we have asked those various institutions to present to the committee far more material than the time slot allows.

And, indeed, we're going to go through this with some dispatch in order to transmit all of the information that we've accumulated on this issue.

Before the committee, of course, is a safety evaluation report you've all seen and read in some detail. There is an administrative difficulty in that the core that was analyzed did not recognize that some other lead test assemblies not connected with the MOX will be in the core, and that particular issue has to be sorted out before we can actually proceed to communicate to the Commission our findings on the lead test assemblies.

But at this stage, I think what it is is to try to summarize what the status is on the use of lead test assemblies in the Catawba reactors at this point.

So I think we'll start by asking Mr. Steven Nesbit of Duke Power to present the applicant's case for these lead test assemblies.

MR. NESBIT: Shall I do it from up there or over here?

DR. POWERS: It's strictly up to you, but up here is probably easier for all concerned. They'll even give you a chair if you're nice.

Sometimes people sit; sometimes they stand. It's pretty much up to you.

MR. NESBIT: No, this will be fine.

DR. POWERS: And, Steve, I want to try to hold you to about 45 minutes or less on this.

MR. NESBIT: I did a run-through. Just hit that button for now. I did a run-through, and I got through it in 45 minutes. Of course, that's assuming no questions. Some people would say that's a low probability event.

DR. POWERS: That is a silly assumption.

(Laughter.)

MR. NESBIT: But what I'm going to do is

take you at your word before that people can actually read on their own. So I'm not going to read all of the slides. I'll be very quick about as much of this as I can, and hopefully we'll get through it in about 45 minutes.

Good morning. I'm Steve Nesbit. I'm the mixed oxide fuel manager for Duke Power.

Duke Power is the utility that will be using mixed oxide fuel in its reactors as part of the plutonium disposition program, and we have put forward a license amendment request to the Nuclear Regulatory Commission to let us use four MOX fuel lead assemblies at Catawba.

I have a brief introduction, and then we'll talk about some general MOX fuel characteristics, our safety evaluation, our environmental evaluation, and a summary.

I think Dr. Powers has covered the disposition program sufficiently. I'm not going to belabor this. I'll make one point. The MOX fuel lead assembly program at Catawba is an essential part of the program. Without that the MOX fuel project doesn't go forward, and the plutonium disposition program doesn't go forward.

Here's an outline of what we're going to do or, in some cases, what we're actually doing. Polishing plutonium oxide powder at Los Alamos National Laboratory.

DR. POWERS: You might want to just for clarification purposes explain what you mean by "polishing."

MR. NESBIT: Okay. What we're doing or what LANL is doing and has essentially wrapped up now is they have put the plutonium oxide that's derived from weapons material through an aqueous process in which it's dissolved and then precipitated out, and the result of that process is the removal of impurities, such as gallium that you may have heard something about, and the production of a plutonium oxide powder that meets the spec and is consistent with the powder that's used in the European programs.

That work is essentially done. The plutonium oxide paddle will be transported over to Europe to a facility called Cadarache, which is operated by COGEMA, and there it will be fabricated into mixed oxide fuel pellets, and the pellets will be loaded into rods. The rods will be welded shut.

The rods will then be transported to another facility operated by COGEMA in France. That's the Melox facility, and there the rods will be bundled into fuel assemblies. The completed fuel assemblies will be transported back to the United States, to the Catawba Nuclear Station, where they'll be loaded into the reactor in the spring of next year, about a year from now.

And then ultimately after the fuels are irradiated, we will have in addition to pool-side post irradiation examination, some hot cell post irradiation examination as planned for Oak Ridge National Lab.

DR. APOSTOLAKIS: How is this transportation done from the U.S. to France and back?

MR. NESBIT: Inside the U.S. the transportation will be done by Department of Energy safeguards transporters. It's the same approach that they use to transport sensitive nuclear material in the DOE complex.

The material will be transferred to Europe by ship using PNTL special purpose ships that have been used in past shipments of sensitive nuclear material between Europe and Japan.

Within Europe the plutonium oxide will be transferred in the same manner that it's typically done, by truck in France as part of commercial reprocessing. And then going backwards it's just the reverse.

Catawba Nuclear Station is where the MOX fuel will be used. It's located in South Carolina. It's 3,411 megawatt standard Westinghouse four-loop, pressurized water reactor operated by Duke Power.

I will note there's 193 fuel assemblies in the core. So we're talking about four assemblies out of that number. It is a plant that has ice condenser containment design, and the Catawba and McGuire reactors all share a common primary system and reactor core design. Those are the reactors that the MOX fuel will ultimately be used at in larger quantity.

The irradiation plans. We plan to irradiate at least some of the fuel three cycles. The first cycle will start up in the spring, will load the assemblies in positions that have typical power for first burn fuel, but not limiting power. It won't be the peak assemblies in the core. We'll do pool-side post irradiation examination after the first cycle.

Similarly, in the second cycle, we'll load it in a similar location for second burn fuel. By the end of the second cycle, we expect a peak burn-up of approximately 48 gigawatt days per ton on the peak rod in the MOX assembly.

So that's a pretty heavy duty to put on a lead test assembly program, but again, they won't be limiting.

We'll discharge some of the assemblies after two cycles and prepare rods for shipment to the lab for hot cell PIE. We'll also load one or more of the assemblies back for a third cycle of irradiation to take the burn-up up close to 60,000 gigawatt days per ton.

DR. SIEBER: That cycle three burn-up there is incorrect, right?

MR. NESBIT: I hope not. Sixty thousand, that would be a high burn-up for gigawatt days per ton.

DR. SIEBER: It certainly would.

MR. NESBIT: That's 60 gigawatt days per ton or 60,000 megawatt days per ton.

Here's a schematic diagram of the core design that we have in mind right now. I will point out a couple of things in this diagram. This is a core-to-core representation. These are the axes of symmetry.

This is the MOX fuel, the magenta or purple, and it's located in a location, core location C8 that's instrumented fully, which means each MOX assembly will have the ability to send an in-core instrument up and get a detection signal on the flux there.

Oh, great.

So that's the MOX assemblies. The feed for resident fuel, which is Westinghouse RFA fuel, is shown in the yellow, and then the once burned and twice burned are in the white.

This assembly here, which is supposed to be aqua -- it may not come through -- is the next generation fuel retest assembly from the Westinghouse program, and we've defined an area around the MOX assembly so that we won't load the two right next to each other to preclude any interactions between the two lead test assemblies.

This is the current loading pattern as the final fuel cycle design was approved. However, I will note that as cycle operations go forward, sometimes these things change a little bit. We tweak the enrichments and things like that.

Required regulatory approvals. This license amendment request is related to a number of other regulatory approvals, and I won't go through them in detail, but there's a number of things in front of the Commission.

Now I'd like to move on and talk about

some of the characteristics and attributes of mixed oxide fuel that pertain to this license amendment request. The fuel is going to be manufactured using the MIMAS process. I believe the ACRS has looked at this through the MOX fuel fabrication facility, and so I'm not going to belabor the MIMAS process.

I'll note a couple of things. There's a lot of experience with this in Europe. That's with reactor grade material versus we're using weapons grade material with more Plutonium-239 and less Plutonium-240.

The pellet structure that comes out of this manufacturing process is uniform on a macroscopic scale. However, when you get to the microscopic scale, it becomes heterogeneous, and we'll show some pictures of that in a minute.

There's plutonium-rich particles, agglomerates, and there's the depleted uranium oxide that the powder is blended with, and then there's a coating phase of intermediate plutonium concentration.

Here's the process, and I'll just point out one or two things. The first step is a primary blend of plutonium oxide powder, uranium oxide powder. We're going to blend this for the weapons grade material in a 20-80 ratio plutonium to uranium, and that's what produces the plutonium rich particles, which are subsequently blended in a second process with depleted uranium oxide powder.

DR. SIEBER: Why did you choose tails material as opposed to natural uranium as the carrier?

MR. NESBIT: Well, tails is what's predominantly used in Europe. So we're maintaining the greatest level of consistency with the European experience that way. That's the primary reason.

Also, I mean --

DR. SIEBER: It has some disadvantages, too, right? For example, you know that the plutonium grains create hot spots in the fuel, and those spots are hotter if the surrounding matrix is depleted in U-235, and so you have greater fission gas release. You have a more pronounced fueling effect. You have a greater potential in some accident scenarios for clad perforation.

So I'm curious as to why that decision was made.

MR. NESBIT: Well, I guess I don't agree that there's a significant effect there between the depleted versus the natural uranium in the matrix. Either way the predominant number of fissions are going to be in the plutonium, not in the uranium.

DR. SIEBER: That's true.

MR. NESBIT: And, you know, again, as I said, the experience base in Europe has been predominantly with uranium oxide, and I think --

DR. SIEBER: Well, there is a U.S. experience base that came out of Hanford in the '70s in the plutonium utilization project there that really concentrated on the effect of grain size, and I'm sure that you folks have looked at that.

MR. NESBIT: We have, and there is some experience in Europe using natural uranium instead of depleted uranium, but again --

DR. SIEBER: Well, that's not the key issue. The key issue is how big are the grains.

DR. POWERS: It seems to me that the difference here between what comes out of the MIMAS process and what was looked at at Hanford is you have a great deal more of the plutonium actually dissolved in the uranium matrix than they did, which can ameliorate some of the thermal gradient between the particle and the matrix itself.

MR. NESBIT: And we're going to see some pictures of that in just a minute

DR. SIEBER: Well, the specs on the milling process that goes on here comes out with a pretty fine material. So the concern is not overwhelming.

MR. NESBIT: Yeah. They actually put this slide in the right place for a change.

Here's a picture, an EPMA image of an unirradiated MOX pellet produced by MIMAS, and this is the unvarnished picture up here, and these are the computer enhanced versions down here.

I'm going to concentrate on this lower picture, and what you see here in the red, these are the plutonium rich particles, also referred to as agglomerates, with significant fraction of the material being plutonium.

Then in the blue phase here, this is the material that's essentially all uranium, and then the intermediate phase, the green shows what's called the coating phase where there's an intermediate quantity of plutonium that's commensurate with the overall average in the pellet.

So the point I guess I'm trying to make with this picture is that while the characterization of plutonium rich particles surrounded by a sea of uranium is not entirely accurate here. The actual structure on the micronic scale, while it is heterogeneous, is not as completely discrete as you might think.

Here's a picture of the plot, a plot of the percent of the plutonium total versus the size of the agglomerates, and all of the agglomerates add up in this case to about 25 percent of the overall plutonium. So the majority is actually in the coating phase, not in the plutonium rich particle phase.

And as you can see, as the size of the particle goes up, there's less and less of the plutonium actually there. In the largest particles, there's relatively little of the total plutonium there.

Some of the characteristics of the fuel. We're talking about sintered oxide pellets, predominantly uranium. In our case it's going to be at least 95 percent uranium and the remainder plutonium.

Material properties are similar to LEU fuel because of the fact that the uranium controls that.

There's lower decay heat from MOX fuel during the time frame of interest for transient accident analyses, and for these four lead assemblies, there's a relatively small impact on global physics parameters. I'm going to show a little bit more about that.

Now, here's a plot of thermal conductivity versus temperature. This is unirradiated, but as you can see, the top line is uranium oxide, and the bottom is MOX at a six percent plutonium concentration. So there is a difference, but it has the same shape, and it's very close.

Heat capacity. We had some discussion of this slide in the subcommittee meeting. Actually it was a different slide. I changed slides because of that discussion.

The other slide showed that when you get to higher and higher plutonium concentrations you can get a significant difference in heat capacity. In this case, we've looked at it with about 4.37 percent plutonium, which is nominal for what we're doing, and the two curves, MOX and UO2 are virtually an overlay.

These don't reflect the discontinuity associated with the phase change at about 2,600 degrees that we talked about some. We went back and looked at the literature. The most recent literature does acknowledge that discontinuity exists, but it recommends using a smooth curve because the magnitude is not significant. So that's what this curve reflects.

In terms of decay heat, what I plotted here is the ratio of the MOX decay heat over LEU decay heat for a nominal fuel assembly at I think a burn-up of 40 or 45,000 megawatt days per ton. Let me see if I get the units right this time.

And so at one they're equal, and that crossover point comes at about three days after shutdown. Before then MOX has less decay heat than LEU.

DR. ROSEN: I only see one line on that curve.

MR. NESBIT: There is only one line. It's a ratio plotted. So, for example, at 40, it's about .99, say.

DR. ROSEN: Oh, I see.

MR. NESBIT: So the MOX is one percent lower than LEU there.

DR. ROSEN: It's a ratio.

MR. NESBIT: Core physics parameters. We looked at a core and substituted four MOX assemblies for four LEU assemblies and looked at some of the key parameters that affect the accident analyses, like delayed neutron fraction, feedback coefficients, et cetera.

The differences in terms of these

coefficients are three percent or less, and as a result, these are the same kind of variations that you see typically in cycle-to-cycle reload design. So there's really no impact of the MOX assemblies on the global core physics parameters.

The lead assemblies. This would be different for batches of fuel with significant quantities.

DR. SIEBER: Delayed neutron fraction though is different than the equivalent energy of LEU fuel, right? It's smaller?

MR. NESBIT: Plutonium has a smaller delayed neutron fraction, significantly smaller than uranium, but when you look at it on a core-wide basis, the impact of the four assemblies is relatively minor.

DR. SIEBER: Yeah, but some days you're going to have more than four assemblies.

MR. NESBIT: Right.

DR. SIEBER: So that will effectively change the transient characteristics of the core.

MR. NESBIT: Yes, it will. Yes, it will.

DR. SIEBER: And I guess for lead test assemblies it really doesn't make a lot of difference, these little changes. On the other hand, you wouldn't be putting them in if you didn't anticipate full core loads.

MR. NESBIT: And we're in the process of doing the safety analyses right now for the full core case. Of course, European reactors have operated with core fractions up to 36 percent mixed oxide fuel and accommodated within the base reactor design.

DR. SIEBER: The current European fuel experience is not weapons grade plutonium.

MR. NESBIT: It is not. That's correct.

Let's talk about the MOX fuel lead assembly description for a second. What we've done is we've taken mixed oxide fuel pellets and put them into an existing United States uranium oxide fuel design, which is the Advanced Mark-BW design, and there's information presented in Framatome topical reports on this and also on the impact of putting the mixed oxide fuel in there.

Here's a picture. This is the Advanced Mark-BW design with the MOX pellets. You can't tell. There's a couple of things I'll point out about this.

This does use M5 cladding for the fuel rods and also for the intermediate grids, and it contains standard state-of-the-art fuel assembly design features like bottom nozzle to trap debris, reconstitutable, et cetera.

DR. ROSEN: Has M5 been used in this country before?

MR. NESBIT: Yes, it has. It's been used pretty significantly in this country. For example, our Oconee units are using M5 cladding right now, and TMI, a number of plants have been using M5, and of course, it has been used over in Europe as well.

DR. SIEBER: It's approved here.

MR. NESBIT: Well, it's approved on a plant-by-plant basis.

DR. SIEBER: Right.

DR. POWERS: I mean, to be clear, that's only because the regulation is written for zero.

MR. NESBIT: Right.

DR. POWERS: So you have to do a plant-by-plant application on it.

MR. NESBIT: That's right, and in fact, part of our application has been an exemption request to go out with the use of M5 here.

Concerning a comparison of the fuel assembly designs, this is the MOX assembly in this column. This is the Advanced Mark-BW assembly in this column, and I'm just going to talk about a couple of differences.

We have a slightly longer rod for the MOX assembly, and this allows to accommodate for greater fission gas release, and our design for batch burn-up is going to be 50,000 rather than the current LEU design is 62,000, and there's actually been lead test assemblies in the UO2 space that have gone up to, I think, 72,000.

But we are planning to take the lead assembly up higher than that.

DR. ROSEN: Higher than 72?

MR. NESBIT: Excuse me. Higher than 50, which is the anticipated batch limit, but we'll take it up to about 57,000.

CHAIRMAN BONACA: You said before that up to 36 percent of European cores have had plutonium MOX fuel. You don't mean just a batch. I mean, it means that also when you get the twice burn, the three times burn --

MR. NESBIT: Looking at the table core --

CHAIRMAN BONACA: -- the maximum number is going to be 36 percent?

MR. NESBIT: -- 36 percent of the assemblies in the total core have been MOX fuel assemblies.

CHAIRMAN BONACA: Okay. And when you load it that way, I mean, do you have to have special planning on how you load it?

I mean, the concern must be probably more limiting fuel?

MR. NESBIT: Well, the information we've gotten from France and Germany -- it's actually German plant that went 36 percent. The French plants go to 30 -- is that there's really no major impact from a plant perspective.

Now, the French did add some control rods. The Germans did not. Our analyses indicate that we're not going to need to.

CHAIRMAN BONACA: Yeah, okay.

MR. NESBIT: I want to talk for a minute --

DR. LEITCH: Steve, before you move on, this right-hand column, is this your more or less standard fuel now, or is this the NGF fuel?

MR. NESBIT: No, this is the Framatome Advanced Mark-BW design. We do not have any fuel this design in our reactors right now. There's some fuel of this design in the North Anna Reactors.

We did use a substantial amount of Mark-BW fuel, which is similar, but did not have a couple of intermediate mixing vein (phonetic) grids, "we" at McGuire and Catawba. So we have substantial experience with a similar fuel design, but the co-resident fuel, I didn't put any information up on that. It's the Westinghouse RFA design.

It is also very similar. I'll point out that the pressure drop difference between the two, the MOX assembly and the RFA assembly, is less than four percent overall. So very similar hydraulically.

DR. LEITCH: And the NGF lead test assemblies?

MR. NESBIT: I didn't provide information on that specifically. The NGF assemblies are similar to the RFA assemblies. They have additional grids and a couple of other design features that really don't affect the hydraulics that much. They have a greater pressure drop than the RFA assemblies, but it's still reasonably close to the RFA and to the mod.

DR. LEITCH: Okay.

DR. SIEBER: I'd like to ask a real quick question about Catawba. Each fuel assembly at Catawba either has a control rod in it, a source rod, or a flow limiting device. Do you have any assemblies that don't have one or those three things?

MR. NESBIT: Actually we load burnable poison rod assemblies in a lot of our assemblies.

DR. SIEBER: Okay, but you have something in every assembly.

MR. NESBIT: Actually, you know, I know that's true of Oconee. I think that's true at McGuire and Catawba, too.

DR. SIEBER: Okay. Because if you don't sometimes folks either break them or they're stuck or they don't feel like putting them in. What it does is it short circuits the flood.

MR. NESBIT: Right. You have to account for any --

DR. SIEBER: So I would feel more comfortable if you had a good balance flow there as opposed to some open holes where you don't have anything inserted.

MR. NESBIT: I believe that's the case, and the MOX assemblies, we're going to put a burnable poison rod assembly in for the first cycle at least, possibly even the second.

DR. SIEBER: Okay.

MR. NESBIT: I'll talk briefly about the MOX fuel experience base. There's been more than 3,700 fuel assemblies delivered by Framatome, both the France part and the part that's formerly Sieman's in Germany by the end of 2003. So there's been a lot of MOX fuel used in Europe, and there's currently more than 30 reactors, easy mixed oxide fuel.

There's a couple of plants currently making MIMAS MOX fuel and one making SBR MOX fuel, are staring up in Britain.

There's been a lot of test programs as well in Europe, hot cell examinations, test reactor radiations, et cetera, looking at some of these things that you might expect, pellet cladding interaction, fission gas release, et cetera.

The result of the test programs in very high level summary is that in many characteristics, the behavior is exactly the same as LEU fuel. As you might expect, the cladding corrosion is not affected by the fuel pellet material. It's the same.

It has been observed there's higher fission gas release than LEU fuel. I'll talk a little bit about that in a minute.

There's a better pellet cladding mechanical interaction reports fuel due to the different characteristics of the fuel pellet, and a lot of this information is summarized in a recent IAEA Technical Document No. 415 if you care to look at that.

Here's a picture, a radial cut of a MOX pellet at 50 gigawatt days per ton, and there's really not anything too remarkable to say about this. It's standard appearance that you might get for, I guess, used fuel.

Fission gas release is primarily attributed to a couple of factors. One is the MOX fuel in Europe tends to run at higher powers and, therefore, higher temperatures towards the end of its burn-up range, and that promotes fission gas release, and there's also the impact of the lower thermal conductivity.

And there's also the fact that, as we talked about before, the micro structure has plutonium rich particles, and there tends to be local high burn-up zones which can lead to the formation of voids with fission gas there.

The differences really manifest themselves medium to high burn-up as indicated by this next slide, which shows some French data for MOX and LEU. MOX is in the green. LEU is in the red, and as you can see, the increase starts at an earlier burn-up, and this is probably due primarily to the difference in the linear power of the rods that are being irradiated and then the MOX is generally higher at the higher burn-ups.

Again, that's something we've tried to

take into account in the fuel assembly design.

Concerning the safety evaluations that we've performed, before I get on with this, I guess I probably ought to address in just a couple of minutes the weapons grade versus reactor grade because I don't have a slide that really goes over that, but let me address what we see as the impact of weapons grade versus reactor grade.

The primary impact is that because you're using weapons grade plutonium with less parasitic Plutonium 240 and more of the good stuff, 239, you have to put less plutonium in the fuel rod to get the same energy out.

As a result, the characteristics of the weapons grade fuel are closer to the characteristics of uranium fuel than would be reactor grade MOX fuel.

Similarly, I didn't bring the slide, but if you look at a plot of reactivity versus burn-up, the performance of the weapons grade fuel is closer to low enriched uranium fuel in terms of how the reactivity let-down curve with burn-up goes than is reactor grade MOX fuel.

So as far as we've been able to tell, every difference between the two is beneficial if you view beneficial as being more like uranium fuel.

Our bases for saying that we can operate safely with MOX fuel -- I should have said lead assemblies up here -- the similarity between the two fuel types, LEU and MOX. There's an extensive European experience base which we've discussed with greater quantities of mixed oxide fuel. We've had U.S. MOX test programs and lead assembly programs here in the United States in the past, as we discussed earlier.

We're using a proven fuel assembly design, and we've done specific analyses and evaluations for the use of the fuel, like Catawba, to be sure we remain within our regulatory limits.

Let's talk about LOCAL analyses. Before I get into what we did, let me just say right off the bat LOCA analyses are primarily about the reactor coolant system and the cladding, and the fuel pellet really doesn't play a big role in the LOCA analysis. When you see what we changed to account for the MOX in the model, that becomes apparent.

We started with Framatome's Appendix K large break LOCA evaluation model, and Framatome did this work, or AREVA, if you prefer. That's based on RELAP 5, Mod 2. We looked at what the MOX impacts ought to be and where appropriate we modified the evaluation model to address them.

We did an apples-to-apples, MOX-to-LEU comparison, and then we did some specific analyses to develop MOX specific lead assembly LOCA limits.

These are the areas that we looked at in terms of does the evaluation model need to be changed to address the thermal conductivity. A small effect, but we're going to use the MOX -- we did use the MOX specific properties. Volumetric heat capacity was essentially no effect. We continued using LEU.

Decay heat, again, we talked earlier about MOX. It's conservative to use the LEU. That's what we did. We used the standard Framatome evaluation model. Again, this is Appendix K, not best estimate. So it has the 120 percent conservatism factor.

Void reactivity and delayed neutron fractions, clear characteristics which for MOX would tend to shut the power down quickly, more quickly than LEU field. So we just assumed the same characteristics for LEU overall.

And then the initial fuel temperature can be different. We used MOX specific fuel temperatures out of the approved Copernic code to get the right initial conditions there.

DR. SIEBER: The delayed neutron fraction is conservative for LOCA, but not for all --

MR. NESBIT: That's correct. I'm only talking LOCA here.

We did a stylized comparison where we just took the same conditions and ran it with the MOX and then ran it next door with the LEU, and what we came out with was a difference of less than 40 degrees in terms of peak cladding temperature for this case.

The next slide shows the peak cladding temperature plot versus time. As you can see, it's a virtual overlay. In LOCA analysis space, this is the same result.

DR. SIEBER: That's a calculated number.

MR. NESBIT: That is calculated.

DR. SIEBER: Does that take into account particles? Particles run hotter than the surrounding. So you're going to get a couple of degrees of temperature.

MR. NESBIT: Well, the particles are in the fuel pellet, and this is a cladding temperature.

DR. SIEBER: That's right, and the pellet is right next to the clad. So if you heat up -- if the pellets themselves are not homogeneous --

MR. NESBIT: That's right.

DR. SIEBER: -- then that will be

reflected in local spots on the clad.

MR. NESBIT: Well, I think you still get a homogeneous temperature distribution within the pellet, despite the fact that they're are very localized. You know, we're talking micron distances here. When you look at the profile across the pellet --

DR. SIEBER: Fifty to 150 microns.

MR. NESBIT: -- most of the plutonium rich particles are less than 50 microns in dimension. So, you know when you talk about the actual pellet temperature profile, despite the inhomogeneities on the very micronic scale, on an overall scale the temperature is going to be smooth.

DR. RANSOM: Certainly the average temperature is what, about six inches to a foot that you've averaged over the --

DR. SIEBER: Right.

DR. RANSOM: -- that's the node length and the core?

DR. SIEBER: Yeah.

MR. NESBIT: Axially.

DR. RANSOM: So this has to be regarded as an average behavior.

DR. SIEBER: That's right.

DR. RANSOM: Or could be.

DR. SIEBER: This is not a LOCA analysis.

DR. RANSOM: Right.

MR. NESBIT: We looked at the other criteria in 10 CFR 5046 beside the peak cladding temperature, and they were all met easily. The small break LOCA is not a limiting transient for our plant, and there's no impact of MOX on this anyway, and then there's no impact of the MOX, adverse impact on the LEU field because the hydraulics of the fuel are so similar, the two field types.

In summary, we did specific evaluations for the MOX assemblies and I'll remind you that mostly the assembly programs don't do specific LOCA calculations, but we did.

Analysis results are fundamentally similar. We did sensitivity studies on plant operating conditions, and these were used to establish peaking criteria for our core designers to make sure that the core designs keep the peaking below what's required to meet the acceptance criteria.

Non-LOCA evaluations, I'm going to be real fast here because I am about to exceed my time.

DR. POWERS: You're actually in pretty good shape.

MR. NESBIT: The non-LOCA evaluations, we looked at all of the Chapter 15 accidents. Most of them are driven by things that are completely insensitivity to the fuel pellet, global core, physics parameters, system thermal hydraulics, stored energy. Now that's affected by the pellet, but we use generally bounding numbers that bound the core stored energy there anyway, and decay heat.

We looked at some events in more detail because they had the potential for localized effects that could require further evaluation. We looked at the control rod withdrawal or drop transient. We looked at the steam line break transient. In both of those cases typically the limiting assembly is a rodded location, and we are not going to load the MOX fuel in control rod locations for the first couple of cycles. So there's no real impact there on the overall accident analysis.

DR. SIEBER: But sooner or later you will

MR. NESBIT: Yes. When we got to batch, we intend to load them in control rod locations.

DR. SIEBER: So you're going to address this again.

MR. NESBIT: The guys that are doing those analyses are currently performing those with the assumption that the MOX will be in rodded locations.

DR. ROSEN: So what is the licensing process when you go to batch? Do you come back?

MR. NESBIT: Yes, we'll come back to the Nuclear Regulatory Commission with a license amendment request for authorization to use Batch 1.

DR. ROSEN: And you get a reading on what you saw here and when you used the lead test?

MR. NESBIT: We're listening as hard as we can, yes, and we'll factor in what we hear here. We'll factor in our experience with lead assembly programs.

DR. ROSEN: Well, I'm more interested in what you'll tell us when you come back about batch, about what you saw in the plants rather than what you heard here. That's the main thing.

MR. NESBIT: Yeah.

DR. ROSEN: With the pool-side inspections and so on.

MR. NESBIT: The timing, our current plans are such that we may not have the first cycle PIE back by the time we come back with a batch license amendment request. The NRC licensing process takes a long time. We're living proof of that.

We can't wait until we have all of the

data from the PIE programs to turn in a batch license amendment request because it will never get done. What we anticipate is that that information will be made available and will be factored in by the NRC during their review.

DR. SIEBER: And I thought we were moving at break neck speed.

MR. NESBIT: No comment.

(Laughter.)

DR. POWERS: The committee is, but we're on the tail end of this process.

MR. NESBIT: Another thing we look at in more detail is control rod ejection. Again, not loading the fuel under a rodded location makes that relatively benign. We actually did specific calculations though for MOX in the core near a rodded location, used 3D kinetics to eject the rod and see what the power response is.

We got peak calorie per gram numbers that were well below 100 calories per gram, which was the conservative criterion that we chose to use.

Last, fuel assembly misloading is something that's localized, but the same measures that are in place for LEU fuel are equally effective for MOX fuel in this area.

In summary, for most of the Chapter 15 accidents, four MOX lead assemblies clearly has a negligible impact, and those with potential local effects were evaluated in more detail, and they also have no significant impact.

Radiological consequences, dose analyses, if you will. First we did some scale analyses to see the different inventories produced by MOX versus LEU. Plutonium fissions have a different production or different quantities, relative quantities, of fission products, et cetera.

The most important one from a typical Chapter 15 accident analysis is Iodine-131. For MOX it can be as much as nine percent higher for a MOX assembly than an LEU assembly, and this is the isotope that drives a lot of off-site dose consequences.

DR. SIEBER: That's Iodine-131 in any form, as opposed to gaseous form, a release form?

MR. NESBIT: Well, the dose calculations we did address the form of the isotope, but this calculation is purely how much is produced in the fuel pellet of any form.

DR. SIEBER: In any form, right. Okay. Because the release fraction is higher than nine percent.

MR. NESBIT: Right, right. This is just --

DR. SIEBER: May be double.

MR. NESBIT: What this means is that for a MOX assembly at a given burn-up, you would have nine percent more Iodine-131 produced than a uranium assembly in the same burn-up, and actually it's less than that for most cases. Nine percent is a bounding number. It's a burn-up dependent quantity.

For accidents that involve a lot of fuel assemblies failing, postulated accidents like LOCA, like rod ejection, like locked rotor, the effects of the MOX assemblies is essentially swamped by the predominant failures in the LEU assemblies.

We looked at that and assessed it and showed that in the application.

For actions that involved one or a few assemblies, there's no dilution effect of LEU. So we looked at those explicitly, and that's the fuel handling accident and the weir gate drop for Catawba.

We performed calculations using the alternate source term methodology, which is the licensing base for Catawba for those particular accidents, and we also did a sensitivity study by increasing the Reg. Guide 1183 gap fractions by 50 percent to account for the possibility the MOX assemblies would have higher fission gas released.

As you might expect, the result of this 50 percent and that nine percent I talked about earlier is to increase the amount of iodine that would reach a receptor off site or in the control room, and although the doses did go up, they're still well within the regulatory limits, which is shown on the next slide.

To summarize, there's a potential for impact on calculated doses, and we talked about why. We did explicit analyses of the ones that had the greatest potential for an impact, and we did a conservative treatment of the MOX LEU differences, and we showed that the results are still well within regulatory limits.

The last part of the presentation is about the environmental evaluation. We submitted an environmental report along with our license amendment request to assess the potential impact of using four lead assemblies on the environment. In normal operations we found there's no impact on effluents and there's a slight, very slight increase in fuel handling occupational dose because the fresh MOX fuel is slightly higher in dose than unirradiated uranium fuel, although the fact that it's weapons grade means that it's much, much lower in dose than it would be if it was reactor grade and had quantities, substantial quantities of americium. So there's another example of how weapons grade works to our benefit.

The accident analyses we've already talked about. We looked at severe accidents as well because that's one of the issues of discussion I guess I would say related to MOX fuel.

In 1999, DOE did an environmental impact statement on the use of batch quantities up to 40 percent cores of MOX fuel, and they did an evaluation of that impact on several severe accident sequences for McGuire, Catawba and North Anna.

We took those results, which were based on the difference in the radionucliide inventories and assuming that everything else about the severe accident stayed the same, and scaled those results by the amount of MOX fuel we were loading, four assemblies versus 76, and the results of that scaled analysis shows that the consequences for the DOE analyses would change. Some of them would go down a little bit. Some would go up a little bit. The maximum change would be less than one percent.

Ed Lyman did an analysis which was

published in 2000 in which he did a similar analysis for the use of batch quantities of MOX fuel. He used different assumptions with respect to release fractions, et cetera from a NUREG versus the IPE that the DOE analyses were based on. He goes somewhat higher impacts, but again, scaled the same way back to four lead assemblies. The overall impact is about 1.6 percent maximum higher impact from before MOX fuel lead assemblies, and that's assuming, as he did in his sensitivity study, that there's a much higher overall actinide release from the core.

In summary, we think that the severe accident behavior is going to be driven by the LEU field, which is a predominant fuel in the core. We note that there's a lot of uncertainties when you're calculating severe accident behavior in light water reactors, to begin with, and to think you're going to get it within one percent is kind of fooling yourselves a little bit to start with.

CHAIRMAN BONACA: So what you're saying here is that when you calculate your global core physics parameter, you expect them to be mostly driven by the LEU fuel?

MR. NESBIT: Absolutely they are. We did that calculation, and they are.

CHAIRMAN BONACA: And so you inspect your Doppler coefficient, moderator temperature coefficient to be reasonably close to the LEU.

MR. NESBIT: That's correct, and in an earlier slide, I actually showed that on a percentage basis, and they were all within three percent.

CHAIRMAN BONACA: Well, that was only for the lead.

MR. NESBIT: That was for lead assemblies.

CHAIRMAN BONACA: For the assemblies. I'm asking about when you're going to go to a full batch loading. What's the experience from the European reactor?

I mean, we know already that they are loading MOX fuel or some type of MOX fuel.

MR. NESBIT: Right.

CHAIRMAN BONACA: Are the characteristics of the core pretty much driven still by the LEU fuel or by the low batch?

MR. NESBIT: The characteristics change somewhat in certain parameters, particularly the effective delayed neutron fraction.

CHAIRMAN BONACA: That's right.

MR. NESBIT: The moderated temperature coefficients get a little more negative.

CHAIRMAN BONACA: Yeah.

MR. NESBIT: The biggest impact is on the delayed neutron fraction. Again, I didn't bring any info on batch. We've done the analysis for batch, and that was actually included in one of our REI responses.

DR. POWERS: To be fair to you, you didn't bring any because we explicitly instructed you not to.

MR. NESBIT: Well, that's true, and occasionally I do listen to instructions, but the impacts, Dr. Bonaca are not extreme, but in terms of delayed neutron fraction, it's kind of interesting. What you see is that the biggest at the beginning of cycle, and at end of cycle there's a relatively small impact because that's when all of the uranium fuel has built up a lot of plutonium.

And, in fact, it actually makes the core much more uniform in terms of physics characteristics over the whole cycle to load MOX in.

To sum up on the severe accidents, we've looked at some other things that people have done with their reactors that have the potential to change severe accident consequences like changing cycle length, power up rates, et cetera, and as far as we can tell, nobody has ever addressed in an environmental report the change on severe accident consequences.

But if you take a power up rate of 17 percent or so, which there has been one, that's a 17 percent change in severe accident consequences. We're in the noise compared to things like that.

DR. RANSOM: Is the implication of this that if you have an entire MOX core and you only get 1.6 percent increase in actinides from a two percent MOX core, that an entire loading would be much greater?

MR. NESBIT: Oh, yes. The actinide concentrations go up substantially with MOX, absolutely.

DR. RANSOM: Is there a reason for that?

MR. NESBIT: Well, you start higher on the isotopic ladder, starting at 239 instead of 238, and so you --

DR. RANSOM: It's just one.

MR. NESBIT: It's a big one. It's got 1,000 born cross-sections.

DR. RANSOM: So the particles that are produced then, the actinides that are produced as a result of that fission are --

DR. POWERS: I'm going to have to

interrupt because we're focusing on the LTAs here, and to go into the full accident analysis gets us into a range of great controversy right now.

MR. NESBIT: But it does make a substantial difference on a per assembly basis if you start with a substantial amount of plutonium in the fuel assembly. You will get more actinides.

Let me rephrase that and then I will move on. You will get substantially higher percentages of the higher actinides, like americium and curium and stuff. There are still very small amounts in an overall basis, but relative to an LEU assembly, you'll see a big percentage increase.

I went the wrong way, didn't I? That's not where we need to go. I"m going to wrap up.

Big picture. I'm going to say this again anyway. I just want to remind people --

DR. POWERS: You're just going to get Dr. Apostolakis histrionic if you say that.

DR. APOSTOLAKIS: What was that?

MR. NESBIT: You woke him up.

DR. POWERS: He will tell you that this has been labeled by at least one commissioner as a canard.

MR. NESBIT: This is a canard. Let me

talk very briefly about my canard.

At Catawba at the end of cycle, we have about 850 kilograms of plutonium in our reactor core, and it's producing about half of the power. Now, we're talking about loading four lead assemblies, which will have about 80 kilograms of plutonium.

The point I'm trying to make here is this is not some unprecedented perturbation and novel use of plutonium we're using it now.

There has been a number of lead assembly programs, most recently one at Ginna, and it's not all that recent, but in the early 1980s, in which they loaded four MOX fuel lead assemblies in a 121-fuel assembly course. They had a higher core fraction of MOX there with their program, and they had no reported problems from that.

DR. SIEBER: That's B.C., before Carter?

MR. NESBIT: It's actually A.C., but not too long after that.

European reactors have demonstrated safety using mixed oxide fuel in higher quantities and for decades. Again, what we're proposing to do and what we're asking regulatory approval for is to use four MOX assemblies out of 193 in our core.

DR. LEITCH: Just a question here. What

we're requesting is four lead test assemblies in either Catawba unit, not both, right?

DR. POWERS: The license application is for either Catawba unit. Our plans are to insert them in Catawba 1 in the spring of 2005.

DR. LEITCH: Now, I guess my question really is: will that be completely transparent to the operator or will there be different operating procedures, emergency procedures, abnormal procedures for the unit with the lead test assemblies versus the unit without lead test assemblies?

MR. NESBIT: Well, we routinely update our simulators to reflect the as built core configuration characteristics. So it will be consistent there, but from a realistic --

DR. LEITCH: That will be consistent with one of the units, but the other unit --

MR. NESBIT: It's Catawba 1.

DR. LEITCH: Yeah, but there will still be training going on for the other units which will be different, if there was a difference.

MR. NESBIT: But in terms of what the operator sees at the console, there is no difference. Once you've got the assemblies loaded in the reactor, the only difference you can see is when you do a flex map, and you look at the in-core entrance. We do that once a month, and the operators don't even do that. The reactor engineers do it.

So from an operations perspective, it's transparent. There are a number of plant preparations we have to put into place and are putting into place with respect to fuel receipt, handling, radiation protection, et cetera. That work is ongoing.

But once the fuel is in the core, it's transparent.

DR. ROSEN: Now, this is a request for loading four MOX assemblies in either Catawba 1 or 2, but not both?

MR. NESBIT: That's correct, either/or, either but not both.

As you're certainly aware, there's some intervenor issues that have been raised. In the interest of time, I haven't tried to address those issues on a point-by-point basis in this presentation. I will note the contentions that have been admitted outside of the security realm address the impact of MOX and LEU differences on LOCA and severe accidents.

There's one related to the failure on our part to fully evaluate the use of MOX fuel at Oconee as an alternative, and then, of course, there's some contentions related to security. We've addressed these contentions in our filings with the Board and in our license amendment request. There's hearings scheduled in June for the non-security contentions, and in September for the security contentions.

I think the fundamental issue at play is how much alleged uncertainty is acceptable to go forward with the lead assembly program. I will absolutely say with no doubt in my mind that people can ask questions faster than I can answer questions, and what we have attempted to do is to show that for this lead assembly program, the four fuel assemblies out of 193, we've bounded the impacts to the safety and health of the public, and they're acceptable.

I guess I'd also add my little commercial here. I think we've done a lot of progress in the last 20 years or so in the nuclear industry in terms of fuel performance and fuel behavior, and a very important part of that is the ability to conduct lead assembly programs, lead test assembly programs at the plants and verify that design changes are appropriate and safe and beneficial and things like that.

And I'd hate to see a situation arise where we're constrained on a lead assembly program by a standard of perfect certainty that we know everything that's going to happen because by definition on a lead assembly program you're doing the program to gather information whether of a confirmatory nature or otherwise.

DR. APOSTOLAKIS: So the challenge is that your calculations are not bounding, right? Is that correct?

MR. NESBIT: I think they are.

DR. APOSTOLAKIS: No, I know that you think they are, but they are challenging you on that.

MR. NESBIT: And they're not even saying that they're wrong. They're saying that we haven't proven sufficiently that they're right.

DR. APOSTOLAKIS: Okay.

MR. NESBIT: And I think that's the wrong standard to apply to a lead assembly program.

The conclusion is what I've been saying for the last 45 minutes or so. We've addressed the impact of MOX fuel on normal ops, design basis accidents, and we've even looked at severe accidents and shown that we've met the regulatory limits, and there's no significant hazard to the health and safety of the public.

That concludes the presentation, and I've had a lot of questions already. If there's any more at this time, I'd be glad --

DR. ROSEN: Just one quick one on characterizing the dose to the handles of new fuel. You said it was going to be higher or different. Can you do better than that?

MR. NESBIT: Yeah, I can. It's about 25 millirem per hour on contact. About half of that is neutron and about half is gamma, whereas for a typical LEU assembly you're less than five MR per hour on contact, and we did a very bounding evaluation of what that would mean for the entire receipt and inspection procedure, and we came out with a total 42 person-millirem for the four assemblies. We think that's grossly conservative as well, but that's the kind of --

DR. ROSEN: With the same inspection standards and so on.

MR. NESBIT: Right, right. So that's the kind of impacts we'd be looking at there.

DR. ROSEN: thank you.

DR. POWERS: If there are no other questions, thank you, Mr. Nesbit.

I'll turn to the staff and Mr. Martin.

MR. MARTIN: Good morning. I'm Bob Martin. I'm the NRR project manager for the review of the use of mixed oxide fuel at Catawba.

We have with us today staff in the principal areas of interest from Reactor Systems Branch and from our folks doing the dose consequences review.

The review also covered several other areas, such as routine effluent releases, reactor vessel materials, and quality assurance as discussed in our safety evaluation.

The licensee's application was submitted about 14 months ago, February 27, 2003. It has been followed by numerous supplements from the licensee, which are detailed in the safety evaluation. We issued the safety evaluation on April 5th of this year. In that safety evaluation the NRC staff found the use of the MOX lead test assemblies to be acceptable on the basis of the evaluations that are included in to.

We made clear that the issuance of that safety evaluation did not constitute the formal licensing approval. Other things will take place, including the issuance of the results of our environmental evaluation and so forth.

A complicating issue which was mentioned at the beginning of the meeting is that shortly after the issuance of that safety evaluation we learned that the licensee's plans for that core, which would contain the MOX fuel assemblies, would also include eight lead test assemblies of what is called a Westinghouse next generation fuel design.

Sine that time a number of actions have taken place. The licensee addressed the issue in a letter dated April 16. We have met with the licensee in a very brief meeting on April 23rd. We've taken a tab at indicating our general areas of interest in this subject in a letter that we just issued last Friday.

We plan to communicate with the licensee further until we understand this issue, and we'll document that in a supplement to the safety evaluation.

DR. SIEBER: A quick question. There is a MOX fuel design report which was referenced in the previous speaker's slides as VAW-10238. Is that part of the application or is that a stand-alone?

I notice it has its own safety evaluation.

MR. MARTIN: It's a topical report similar to quite a number of other topical reports that support the application.

DR. SIEBER: So in order to review the

application, you have to review that, too?

MR. MARTIN: We reviewed that topical report. That's a report on the Framatome MOX fuel assembly design, and we reviewed that and produced a safety evaluation on it.

DR. SIEBER: Right.

MR. MARTIN: There are some details that need to be cleaned up as a result of the licensee's comments on the safety evaluation which we produced, and those will be taken care of in the near future.

DR. SIEBER: Okay.

DR. LEITCH: Are these other lead test assemblies are scheduled for installation into Catawba No. 1, not both units.

MR. MARTIN: The other lead test assembly? The NGS, as we call them?

DR. LEITCH: Yeah.

MR. MARTIN: My understanding is they were loaded into Catawba 1, cycle 15.

DR. LEITCH: Oh, they were already in there.

MR. MARTIN: I believe they started up last fall or early this year with them.

DR. LEITCH: Okay.

MR. MARTIN: In Cycle 15, which does not

include the MOX assemblies. Cycle 16 is the cycle that Duke anticipates putting the MOX fuel assemblies in.

DR. LEITCH: So if perchance the schedule were to slip and MOX assemblies were going to go in Unit 2, this would not be an issue, right?

MR. MARTIN: If the schedule slipped and the core that Duke proposes to put the MOX assemblies in is basically a Westinghouse robust fuel assembly design, plus the four MOX lead test assemblies, then, yes, that's the core design that we reviewed.

DR. LEITCH: Okay. Thanks.

MR. MARTIN: Okay. I think there is a significance to the NGS with respect to Catawba Unit 1 in that it represents something that the staff has not evaluated and was not reflected in our safety evaluation. Whether when we get into that review -- we're in the midst of it now. As we continue it, whether we have concerns about whether we should approve it or not, I simply can't say today. We have not progressed that far into the review.

So that completes my introductory comments. If there are no further comments, I would turn it over to Undine Shoop of our Reactor Systems Branch staff, and she'll discuss Reactor Systems

Branch's review.

MS. SHOOP: Good morning, gentlemen. I'm here today to talk about the SRXB review that we performed as part of this licensing application. As we've alluded to previously, this will not touch in any way upon the NGF fuel assemblies, lead test assemblies, that are currently in the core. We are only going to discuss the review that we performed because that's all we're able to talk to today.

And I'm going to skip around. I'm not actually sure. I've provided a lot of information in the handout. I'm not sure there's actually time to go through that many slides. So I may omit them, some of the slides, but I did want to provide that information to you. That way you have it as you are deliberating this action.

The purpose for us to come here today is to talk about the thermal mechanical design of the fuel assembly, the data collection program that's proposed by the licensee, the nuclear design, the non-LOCA transient analysis, and then I'm actually going to ask Ralph Landry to come up and talk about the actual LOCA analysis that was performed.

And one of th things we always have to discuss is what is the purpose of an LTA. To keep it into perspective, what are we actually doing here?

Recognize that the purpose of an LTA is, first and foremost, to collect data. That is the number one reason that we use LTAs, because in order for us to license something for batch loading, you have to have data that shows that you can use it, and what you say about it is actually behaving.

But the only way to collect data is to allow a limited number of test assemblies, and that's what this application is for. The purpose of it is to collect data to support the behavior of MOX fuel.

And now I'm going to go into the thermal mechanical design. As we've talked about, the fuel assembly design, the lead test assemblies, was licensed using SRP 4.2. SRP 4.2 was originally developed for low enriched uranium fuel, but we do believe that those parameters are equally important for MOX fuel.

The design evaluation was provided in BAW-1023, which is the MOX fuel design report, which Jack has already alluded to. In that report, that provided the analysis, the thermal mechanical design analysis that we require for any new fuel product, and it provided those parameters that were specific to MOX fuel.

Because the parameters were specific to MOX fuel, they labeled that fuel assembly the Mark BW/MOX 1 fuel assembly design. It is the structural equivalent of the Advanced Mark-BW design, but we do differentiate them because they do have some slightly different characteristics that they were approved for, and we wanted to note those differences.

And I'm sure you guys have seen the SRP enough times that I don't actually need to go into what's in the SRP.

Just to give you a really slight touch on what is the difference between the Advanced Mark-BW fuel design, which is proposed for low enriched uranium fuel and the Mark-BW MOX 1 fuel design, the Mark-BW MOX 1 has a longer fuel rod which is to accommodate the fission gas. It has the European dish and chamfer design. What that is because is because for these LTA assemblies, they're going to be produced in Europe and the machines are already designed to produce a certain dish and chamfer, and that's a basis of the machine itself.

And actually using that machine, having the dish and chamfer of the European design will actually make the pellets more consistent with the European experience.

They're also going to use a 95 percent theoretical density. The Advanced Mark-BW is going to use a 96 percent theoretical density. However the 95 percent is currently what everyone is using for MOX. So there, again, the lower theoretical density, which is consistent with current uranium theoretical density is to be consistent with the uranium database.

And of course, the most specific is that it uses MOX fuel instead of uranium.

DR. SIEBER: Now, do you expect these characteristics of dish and chamfer and density to remain the European standard when the process becomes a full batch process in the United States or will we adopt a dish and chamber that we use?

MS. SHOOP: That would actually be part of an application for batch loading because we have -- I should actually back up. One, oh, two, three eight requested approval for both batch and LTA. We're approving it for LTA only because we believe that the information contained in there was more specific to the LTA, and we have enough information to approve LTA. The jury is kind of out on some of the things for batch loading, and so that's the purpose of the LTA, is to collect the data to be able to demonstrate that it's good for batch.

At this point I can't really project out what they'll do for batch because I do believe that that is a decision that Framatome will be making as they --

DR. SIEBER: But you are suggesting that I would just wait and see.

MS. SHOOP: Yeah.

DR. SIEBER: Okay. Thank you.

CHAIRMAN BONACA: But since you're collecting mechanical performance, if you change dish and chamfer design, wouldn't that upset the results of the lead test assemblies?

MS. SHOOP: Actually the dish and chamfer primarily is just to take down the hourglassing of the pellet, and so actually I don't believe that even -- because it's a very, very slight change, the European to the U.S., anyway. And I do believe -- and Framatome can correct me if I'm wrong -- but I do believe that the dish and chamfer for the MOX is the same one that they use over there for their uranium.

CHAIRMAN BONACA: Yeah, right.

MS. SHOOP: So it's everything that they use.

MR. NESBIT: If I can interject, we plan to keep it the same for batch.

DR. SIEBER: But the only purpose for that is to keep it from chipping around the edge of the pellet.

MS. SHOOP: Well, to keep it from chipping and then that's for the chamfer, but the dish is actually to reduce the hourglassing.

DR. SIEBER: Make it look like a cylinder when it's --

MS. SHOOP: Yeah, which of course, you know, reduces the stress on the cladding during irradiation.

DR. SIEBER: Right.

MS. SHOOP: Okay. Mixed oxide fuel. You know, it's depleted uranium matrix with weapons grade plutonium fissile material. The significance, of course, is that you have fewer absorber isotopes, and you have increased fissile isotopes.

As Duke has already presented, what they're doing between the MOX and the uranium fuel, they're doing a reactivity equivalence because they know that in order to be able to have this much reactivity in this part of the core, you need this much reactivity.

So then when they went back and calculated what type of plutonium enrichment they would need in order to get that equivalent reactivity.

Okay. One of the topics that has come up a lot when you talk about weapons grade MOX fuel is the use of gallium. Gallium primary is part of the plutonium in order to stabilize the weapons grade plutonium.

People have hypothesized that it has the ability to migrate to the cladding and to embrittle the cladding material. Because of this, DOE has sponsored two tests which are being performed out in the advanced test reactor in INEL, and they tested two fuel compositions, one of which was treated to remove some of the gallium, and that was removed to a 1.3 ppm level, and then they used an untreated pellet which was 2.97 ppm.

The irradiations have gone up to 40,000 gigawatt days per metric ton, and so far they have shown that the gallium does not migrate at those levels.

Duke has proposed using a 300 ppb limit, which is much lower, and so we do not expect that that will migrate to the cladding in any respect either.

We will get results from the ATR at 50,000 gigawatt days before the LTAs go in. Of course, if there is any difference seen between the 40,000 to the

50,000, the staff will have to reevaluate that.

Okay. Now, I would like to quickly discuss the data collection program. The purpose of the data collection program is basically because these are tests. You want to check both the neutronic and the fuel behavior of the LTAs, and this information will be information that they need to support a batch loading application.

And basically this will be able to demonstrate that the Casmos simulate suite of codes (phonetic), as well as the Copernic code, is actually predicting as we expect it to.

DR. ROSEN: I thought I heard him say that we would not see the post irradiation examination results before they came in with a batch.

MS. SHOOP: I've read that, too, which is kind of interesting.

PARTICIPANT: Can you clarify that?

MR. NESBIT: The neutronic information is gathered in real time. So when we take a flux map we've got it. We've got the information.

When I say post radiation examination, I'm referring to pool-side examinations. When the fuel assembly has been discharged, you measure things like corrosion levels, growth, et cetera, and then hot cell exams, when you actually cut open a fuel rod and look inside of it. That's the kind of information that's not going to be available immediately.

DR. POWERS: You can see, Steve, once again it's the metallurgist that slow us down.

(Laughter.)

MS. SHOOP: Well, when we start talking about the neutronic, as Steve has already told us, the LTAs are going to be instrumented locations. Actually all of them are, but Duke had previously committed that at least two of them would be in instrumented locations so that they could run the transversing in cores and be able to get actual cycle specific measurements on a monthly basis. And that would be used to verify the Casmos simulate.

And that would be done both for the first and second irradiation cycles.

Oh, and they're also going to be doing a start-up physics test plan, and that plan conforms with ANS 19.6, which is the PWR start-up physics test program, and they have committed to continue using that program throughout the use of the LTAs.

DR. ROSEN: So let me come back to this. Now, how long do we end up waiting before we hear what the pool side PIE is on the lead test assemblies after the batch has been licensed, which is, I think, what you're saying?

Is it a year, two years? I mean, has the batch been operating for several years before we get the PIEs from the LTA assemblies?

DR. SIEBER: They won't be here.

MS. SHOOP: The batch loading is 2000-and something. Steve, when do you have that planned for?

MR. NESBIT: I think a best guess would be 2010 or thereabouts. You know, we're looking at putting a batch application in next year, but that's not, you know, an absolute guarantee to give plenty of time.

So, I mean, by the time the NRC would get around to acting on that application, there would be a couple of cycles of complete assembly data I would think.

DR. ROSEN: Let me see if I can restate what you just said. We would have the results from the PIE from the first lead test assemblies in 2010.

MS. SHOOP: No. Actually, Steve, there's -- actually let me go over my PIEs first so that you can understand what the PIEs are and how they all interrelate because there's actually three different types of PIE.

MR. NESBIT: The first will be available in 2006.

MS. SHOOP: Yeah, the first pool side PIE are performed between cycles, between the first and second irradiation, between the second and third irradiation. You actually take it out, and during that time you would do visual inspections of the fuel assembly and fuel rods. You would check the fuel assembly group, fuel rod group, and fuel assembly bow to make sure that all of those parameters are within specs and it's operating as --

DR. ROSEN: And that's before the first batch.

MS. SHOOP: Absolutely, absolutely.

DR. ROSEN: Maybe I'll let you go ahead and maybe I'll get a sense of this better.

MS. SHOOP: Okay. Because then actually after the assembly discharge, which they will be discharging at least one assembly after the second cycle of irradiation. You would then do measurements on grid width, fuel rod oxide thickness, grid oxide thickness, the RCCA guide force, the guide thimble plug gauge, and the water channels which checks for fuel rod bowing.

And so you would actually do that between the second and third, and then actually after you take the assemblies out, which Steve had already discussed, we're going to be getting some after the second cycle, some after the third cycle. You would perform hot cell PIEs, and that's where we're going to send it down to Oak Ridge. They do the rod puncture test to check the fission gas. They do metallography, serametography (phonetic), which is where they check for oxide and hydrides, and they also check for the structure of the plutonium amoglomerates (phonetic) after it had been irradiated. They check the cladding mechanical test for ductility. They do burn-up analysis, and they will also do the burn-up distribution to see how the amoglomerates change and how that compares to the prediction.

So all of those tasks will be performed, and we will have that information for --

DR. ROSEN: I don't doubt that for a minute. I just am trying to understand the sequence and time between when you get all of that information and when the first batch goes in.

DR. POWERS: Steve, the difficulty we have is one of time, and this doesn't relate to the LTA approval. I mean, it's an issue you can pursue when we get to the batch.

DR. ROSEN: Okay.

MS. SHOOP: Now, I would like to go on to the nuclear design and just touch on that.

As Steve has already said, you have four LTAs and 189 other fuel assemblies. Therefore you have an insignificant impact on core-wide neutronic behavior.

How are they actually doing this? Duke's core design loading strategy is to use a checkerboard pattern, put the LTAs in symmetric locations where they can run the transversing in cores, put them in unrodded locations, and also so that the LTAs are not in a limiting location of the core, but they are in prototypical. That way the data is consistent with what we expect the behavior of MOX fuel in a Catawba or in a standard PWR to be.

And now this is going to be a bit more challenging because I have two different graphs here. These are my core key physics parameters, and what you'll really look for here is that Duke did core sensitivity studies. They actually did a core of all LEU and then they actually put the four MOX assemblies in to actually see what the impact and actually ran it through simulate Casmos, to investigate how the core parameters that were really important would change.

The ones that you really want to note are the critical boron concentration, the control rod worse, the moderator coefficient, and the fuel temperature coefficient.

And as you'll notice here, you don't see a substantial change, but there really is an insignificant impact on those core-wide parameters by inserting four MOX assemblies into the reactor.

There are some assembly physics parameters that are slightly different, one of which we've heard previously is the reduced delayed neutrons. However, that's why Duke is not putting these in rotted locations. Therefore, for the LTAs this will also be insignificant.

I'd now like to turn attention to the non-LOCA transient for just a moment. First of all, I would like to point out that this was a deterministic licensing. Therefore, they were only required to do Chapter 15 analysis. They were not required to go into severe accidents in their accident analysis, non-LOCA transient portion.

They used a normal reload process, which has already been licensed and approved by the NRC, and during that process, they would confirm that all the physics parameters fall within the reference values previously calculated.

And if you look at Table 30-1 of the November 3 REI response, you can actually see the table where they went over all of the transients, what the parameters were that they were already analyzing for, and what the impact of MOX would be, and demonstrated that the impacts were already within their current analysis.

Steve has already talked about some of the ones that are most important. So I thought I would actually just put up your favorite one, which is the control rod ejection, and for the control rod ejection, they're not putting it in a rodded location. Therefore, the impact on this particular code with four MOX LTAs will be that the peak LEU assembly enthalpy is 54 calories per gram, and the peak MOX assembly because the MOX isn't in a rodded location, but the one that would be closest to it, the maximum that the MOX will see is 30 calories per gram, which is below any of the test values for any of the studies that have been performed so far.

And that's all I have on the non-LOCA transients. Do you guys have any questions before I turn it over to my colleague, Ralph Landry, who will go over the local analysis.

MR. LANDRY: Okay. My name is Ralph Landry from the staff in the Reactor Systems Branch, and I'd like to talk a little bit this morning about the review we performed of the MOX LTA LOCA. Okay. The slides that I've given out are basically the same slides that I used with the subcommittee two weeks ago.

However, I have added a couple of slides to help clarify a couple of points, but I don't want to spend ten minutes on ten slides. I know that that's not quite possible. So I'm going to try to move through these slides rather rapidly this morning.

In the staff review, we looked at two LOCA analyses. This morning Steve Nesbit presented results that Framatome performed of an Appendix K calculation for the LTAs. Now, when staff did the review, we looked at two analyses, the analysis of record and the MOX LTA LOCA analysis.

The analysis of record was performed by Westinghouse with the W Cobra track realistic large break LOCA code. That was done when Catawba was due in a transition from Framatome fuel and Mark-BW fuel assemblies to the Westinghouse robust fuel assembly, the RFA fuel.

The analysis included sensitivity studies which looked at the effect of Mark-BW fuel on the RFA fuel. That sensitivity study came back and said, okay, with the pressure drop of the Mark-BW assembly, this is going to be the effect on the RFA fuel.

The box assembly, the Mark-BW MOX 1 or Advanced Mark-BW whatever exact name is being used, the assembly has a pressure drop that is much closer to the pressure drop of the Westinghouse RFA assembly than it is to the Mark-BW assembly that was resident at the time of the transition to RFA fuel so that the effect of the Mark-BW MOX 1 assembly on the RFA peak cladding temperature would be less than the effect of the at that time resident Mark-BW assembly.

Now, the Mox LTA LOCA response, as you heard from Steve this morning was calculated using the Framatome ANP Appendix K code RELAP 5 Mod 2-BNW. This is an approved model. The approved code also includes the property of the M5 cladding.

The one question that the staff had during the review, or the more significant question, I believe, was on the decay heat model that was used. I've included a curve which you can't read on the slide. So I added an extra slide with a large blow-up of the decay heat curve.

The decay heat curve that was used by

Framatome for the MOX analysis is actually taking the 1994 decay heat curve which is predominantly a curve for fission of plutonium, adding in the actinides, applying that curve by 1.2. This is taking the 95th percentile decay heat curve, increasing it by 20 percent to 1.2 times the 94 curve, which then ends up bounding the 1971 curve multiplied by 1.2.

So the curve that was used for decay heat by Framatome not only bounds the 95th percentile 94 curve by 1.2, but bounds the Appendix K specified 71 curve when it is multiplied by 1.2 also.

So this is a very conservative decay heat curve.

DR. SIEBER: The rule tells you what curve to use.

MR. LANDRY: The rule tells you to use 71 times 1.2.

DR. SIEBER: And what you're saying is they didn't, but they bounded it.

MR. LANDRY: They used a curve that bounds that, that is even more conservative than the rule specifies.

DR. SIEBER: Thanks.

MR. LANDRY: This is because these assemblies are MOX plutonium assemblies going into the core. So we agreed with the analysis that was submitted that using a curve that is more appropriate to plutonium and then increasing with a factor of 1.2 meets the intent of the rule and is conservative.

Now, the results, let me skip up to another slide I added from the subcommittee discussion. To try to clarify the results and put these into perspective, what I've given is the fuel assembly type, what the pellets are that are loaded in that fuel assembly and the computer code that was used for the analysis.

The analysis of record performed for the RFA fuel, which is low enriched uranium with a realistic LOCA model is also a peak clad temperature of 2,056 degrees Fahrenheit and a total maximum LOCA oxidation level of ten percent.

The model that was used by Framatome for the MOX LTA is using the Mark-BW MOX 1 assembly model with MOX loading, and the Appendix K analysis methodology results in a peak cladding temperature of 2,018 degrees for the MOX hot rod and a total maximum LOCA oxidation level of four and a half percent.

As Steve said this morning --

CHAIRMAN BONACA: These are Appendix K calculations.

MR. LANDRY: These are Appendix K. That's what I'm trying to make clear here.

CHAIRMAN BONACA: Yeah.

MR. LANDRY: These are Appendix K. This is realistic. This is the 95-95 value of PCT. When the MOX 1 assembly is fueled with low enriched uranium instead of MOX, everything else is the same about the assembly. We then end up with a peak cladding temperature of 1,981 degrees and a maximum local oxidation of four percent.

This shows the effect of comparing MOX with LEU at the non-limiting position in the core. Now, we have to keep in mind that the reason these are less using an Appendix K model is this is at the non-limiting location, a more restricted peaking factor than is used in the analysis of record value.

CHAIRMAN BONACA: What about the LEU to the right? Is it also? I mean is that the limiting location in the core?

MR. LANDRY: No, this is the non-limiting. This is the same location as the MOX.

CHAIRMAN BONACA: Okay, all right. What this ends up with, this ends up with a peaking factor of 2.5 total, and I believe these come up with a total peaking factor on the order of 2.4. It ends up about four percent lower total peaking factor.

So on that basis the staff concludes that the MOX LTAs will comply with the requirements of 10 CFR 5046 when inserted into a core of Westinghouse RFA LEU fuel.

Now, there have been questions raised about the effect of the MexGen fuel, and as has been said, we are looking into that effect, and we will be visiting Duke next week to look at all of the calculations which they have to assure ourselves that this effect is not going to influence the MOX.

But we have already heard Steve explain that the MOX and the NGF fuel assemblies will not be in a position where they will be adjacent. They will not be in a position where they are in a direct line. As he showed you this morning, there may be a MOX assembly. There will be two RFA assemblies and then the NGF assembly offset from that so that none of these assemblies will even be in a direct line with each other.

CHAIRMAN BONACA: The question that I have is that you showed us three cases. One is a best estimate and two are Appendix K in the no limiting location. Did they use the same decay heat curve you presented us before for all three cases?

MR. LANDRY: No.

CHAIRMAN BONACA: No?

MR. LANDRY: But for these two, yes.

CHAIRMAN BONACA: Yes.

MR. LANDRY: The Westinghouse analysis is using the W Cobra track uses a 95th percentile decay heat curve. So this is a 95th percentile curve raised by 20 percent from the Framatome analysis.

So that's why I put this chart together. When we went to the subcommittee this caused a lot of confusion trying to explain these different cases because we're missing apples and oranges, and then applies and pineapples.

So what I tried to do is put together the different analyses that have been performed. So it tries to make it inscrutable as much as possible what has been done and why the staff concludes that the MOX LTAs will not affect the analysis of record.

DR. SIEBER: You'd better quit while you're ahead.

(Laughter.)

DR. POWERS: Are there any further questions?

(No response.)

DR. POWERS: Mr. Martin, are you

continuing on to discuss any of the source term analysis?

MR. MARTIN: If the committee wishes, yes.

DR. POWERS: Please.

MR. LaVIE: I apologize. The agenda didn't have me speaking. So I'm going to be winging this from what I remember from what I did at the subcommittee meeting.

In reviewing the consequences of putting the four LTAs into the LEU core, the staff considered three main aspects of the use of the MOX fuel. First was the increase in the core inventory and the possible shift in isotopes due to the MOX having fissile material of plutonium rather than U-235.

The second aspect was the potential increase in the gap fractions. The open literature, of course, discusses the fact that there is, because of the higher temperatures in the MOX pellet compared to an LEU pellet, there would be a higher diffusion of gases. So the staff wanted to consider that.

Associated with that higher diffusion of gases would be the rod pressurization which would have an impact on the fuel handling accident.

As you may be aware, we allow licensees to credit for removal of iodine from the gas being released from the drop fuel assembly at the bottom of the pool. The rod pressurization would have an impact on that credit for decontamination.

In order to resolve these issues, the staff looking for the source term, looked at some work done by Sandia Labs on MOX fuel and also the licensee's effort.

The staff also ran their own scale calculation runs to develop their own source term. The primary reason the staff did this is that the licensee had run his calculations to maximize the amount of Iodine-131, a conservative approach for the scaling analysis.

The staff, however, was interested to see whether or not other nuclides might rise to concern. So the staff did the source term calculation for all three cycles, picking the maximum concentration for any isotope regardless of which cycle it fell in.

Our work confirmed the work by the licensee. Actually our fraction turned up slightly higher -- excuse me -- slightly lower, the ratio. With that in mind, that satisfied the source term issues first.

With regard to uncertainty in that, I'd like to point out that the scale code module we used in that was the SAS 2H module. This is a code module that calculates based on the user's inputs the cross-sectional libraries that would be used by the origin model to generate the actual source term.

This is particularly advantageous because it allows the licensee to do the same thing. It allows the licensee and the staff to actually model the fuel isotopics, various ratios of plutonium and the actual fuel configuration in doing the calculation.

We then had a look at the gap fractions. As the licensee pointed out, they assumed a 50 percent increase over that previously documented in staff guidance.

Well, the staff felt that the 50 percent was probably adequately conservative. There really was no -- the 50 percent number was largely arbitrary, and we wanted to go after and find out and make sure that that was adequate. We requested the research folks to perform some work for us, and they contracted with the PNNL to run a series of FRAPCON code runs to evaluate the fission gas release.

The FRAPCON code had been modified with the conductivity correlations for MOX fuel as part of the revision to 3.2 of the code. The licensee provided as their projected power history, which was also inputted into the code along with some proprietary fuel parameters.

The result of that effort, PNNL generated gap fractions that indicated that the licensee's 50 percent assumption was bounding for what we actually saw in the data. In addition, they also showed that the rod pressurization was below the threshold for our assumption.

Our assumption of a decontamination factor of 200 is based on a rod pressurization of less than 1,200 psig. They were able to show that.

With that done, we then were able to plug that information into the calculations. Since the fuel handling accident involved a single LEU assembly, we looked at that one and did a confirmatory calculation, confirming the licensee's conclusions that that would not be inimical to the public health and safety.

The licensee did a scaling approach for the lock rotor accident, the LOCA analysis, and the rod ejection accident. We felt that the scaling analysis was appropriate given the small fraction of LTAs in the core versus the amount of LEU fuel involved.

For example, in the LOCA we assume all 193 assemblies are affected by the core melt. The LTAs only represent 2.1 percent of that. Since we had confirmed their ratio of a nine percent increase in inventory and also the 50 percent gap fraction increase, we were able to confirm their scaling.

We did consider the possibility that some of the other nuclides may have had an impact, and we looked at the noble gases because some of the noble gases had increased substantially between the MOX and the LEU.

However, when we did this, when we conducted a scaling analysis for the impact on the whole body dose, we found it was inconsequential and that the licensee's assumption that the iodine dose would be a good surrogate was valid.

We do not analyze ground contamination or ingestion pathway in design basis analyses. So the nuclides that have the biggest impact on that plume exposure period is the noble gases and the iodines.

Based on our review of the licensee's efforts, the staff was able to conclude that putting the MOX LTAs in the core would continue to meet our regulatory requirements for design basis accidents.

DR. POWERS: Thank you.

Now we have some words from Mr. Lyman with the Union of Concerned Scientists.

MR. MARTIN: While Dr. Lyman is coming up, there's one other thing that I should have mentioned, and that is with respect to physical security plan, both the licensee and the staff have recognized the need to enhance the physical security plan for the time of proceed of MOX fuel assemblies. That's a part of our review. We understood the committee had not planned to go into that area.

We did issue a supplement to our safety evaluation yesterday addressing our finding on that.

DR. POWERS: Thank you.

DR. LYMAN: Well, once again, I appreciate the opportunity to come to this committee and talk about MOX fuel and my favorite subject.

I'm with the Union of Concerned Scientists, and we're assisting the Blue Ridge Environmental Defense League, or BREDL, in its challenge of Duke's LTA license amendment request and the associated security exemption request.

We submitted both security related contentions, which have been argued so far in a closed proceeding because of the safeguards information they contain, and also a number of non-security related contentions involving the safety environmental issues.

The outcome is that the board has accepted one security related contention and certified another which is now before the Commission, and it also accepted three safety and environmental contentions by consolidating and rearranging some of BREDL's original contentions, classifying them in a very logical way.

Now, one point I'd just like to make is that the process is being driven by Duke's request, which stems from the Department of Energy's request that this amendment be granted before the Department of Energy ships plutonium to France for fabrication of the lead test assemblies, and that is simply an administrative request. There's no technical reason why that approval has to be granted by August, which is the projected date for shipment, but that's what's driving the time table, and the Atomic Safety and Licensing Board is attempting to accommodate that request, and the result is a very highly compressed, adjudicatory proceeding where we're all rushing at breakneck speed.

So Duke may be complaining about the pace of certain things. They shouldn't have any problem with the pace of this proceeding.

DR. APOSTOLAKIS: Just for information,

you said before the plant shuts down. That's the French plant, right?

DR. SIEBER: The Cadarache.

DR. LYMAN: I didn't want to get into that, but the Cadarache plant is the older MOX fuel fabrication plant in France, and it's not seismically qualified. It actually was shut down last year, but they are keeping it alive partly due to this one last mission, which is fabricate the MOX LTA --

DR. APOSTOLAKIS: And if they don't do it there, is there another place where they can do it?

DR. LYMAN: Yeah. I mean, the Melox plant is the newer plant that the fuel rods are actually going to be shipped to Melox after they've been fabricated for assembly and the actual assemblies, but there's a time limit.

I believe that the licensing approval would be necessary to process weapons grade plutonium in Melox when provided would have been a burden to the current operation of that facility, and so the preference was to do it in Cadarache so that you wouldn't have any other mission, and they have also fabricated breeder fuel in the past.

If I'm wrong about that, someone correct me.

DR. SIEBER: Cadarache makes the rods, right?

DR. LYMAN: Right.

DR. SIEBER: Up to the rod.

DR. LYMAN: Right.

DR. SIEBER: So what you're shipping is rods.

DR. LYMAN: And then it will be shipped to Melox.

DR. SIEBER: Right.

DR. LYMAN: For packaging and sending.

Now, my version of the big picture is only a few points, but I think it has come up several times, but any issues that are resolved in this proceeding by virtue of the small number of LTAs in the core are going to have to be reconsidered when the application is received next year.

DR. SIEBER: Right.

DR. LYMAN: And although Duke made it seem as if even the batch loading isn't going to be much of a problem, obviously there are many serious issues which will require a much more careful evaluation when we come to that, including rod ejection accidents, when it's going to be impossible to avoid rodding certain MOX assemblies.

So in our view, all of these issues should have been worked or at least could have been started to be reviewed years ago when the NRC knew that this process was in the pipeline. It seems like waiting again for the next application before taking on the hard issues is only going to increase the potential for further delays. So we don't see why we shouldn't start talking about those at this point, and this amendment process provides an opportunity to do that.

Another issue which I'm personally concerned about is that the U.S. approval process is supposed to be setting an example for the Russian counterpart. We know that this entire program is focused on getting rid of Russian plutonium and the U.S. symmetrical attempt to do it in a bilateral way, but really focuses on Russia.

NRC is training Russian regulators in how to license the MOX program, and we are setting an example, and I think that it's in everyone's interest to make sure that the Russian regulator doesn't cut any corners and considers all safety and security issues adequately in their own review.

And so for these reasons, I think a thorough review should take place now.

I'm going to briefly touch on the security exemption, which I haven't discussed yet, but I thought in my view it's at least as important as the safety issues, and the rationale for Duke seeking an exemption from some of the Part 73, 45, and 46 security regulations are that they are, quote, impractical and unnecessary to assure the security of any MOX fuel assemblies, unquote. That's from their non-safeguards cover letter, that original request for the security exemption.

The sections, if you look them up, pertain to the physical protection systems for protecting Category I quantities and strategic special nuclear material, which these MOX assemblies are since each assembly will contain many times the formal quantity on consignment from the design basis thread to sabotage, and the details are mostly safeguards information so that we're not going to talk about them.

But Duke has gone on the record and appear in the press that its basic position is that because it's hard to divert plutonium containing bulky fuel rods, that that's really the basis for why it believes the Category I physical protection requirements are unnecessary in these cases.

NRC provided its own guidance in the memo, which I urge you to look at, from Joseph Shay (phonetic) and Clem Tracey (phonetic), January 29th, 2004, which provided NRC's plan for how it's going to approve the security exemption, and again, it seems tha the staff's view is already quite close to Duke's, and a MOX fuel assembly somehow much less attractive to terrorists or adversaries because they're large, heavy assemblies, and I'm not going to go into this. It's in my handouts, but we are contesting really the notion that there's something intrinsic about MOX fuel assemblies that makes them less attractive or less vulnerable to certain types of terrorist attack than separated plutonium.

And there's also inconsistency with international guidance, and I would urge you to look at my written material.

Now, to get into the safety issues, our contention one, which is reframed by the board, focuses on LOCA and other design basis accidents, and the contention is that Duke has failed to adequately account for differences in MOX and LEU fuel behavior with regard to design basis LOCAs and other design basis accidents.

BREDL actually is concentrating on the loss of coolant accidents. In our view, the other design basis accidents are not as significant in our view, and so our focus is on design basis LOCAs in this case, and the issues involve fuel related phenomena that may affect compliance with the emergency core cooling system criteria for the MOX LTAs that have not been adequately accounted by Duke's application or the staff's review.

And also M5 cladding related phenomena that may also affect compliance, in particular, from the MOX test centers, and we can also look at the fuel cladding interactions in a synergy between them in considering the impact on the loss of coolant accidents.

The fundamental problem is that the experimental database for the behavior of MOX fuel under LOCA conditions is very spotty. There are great uncertainties, and in fact, the French Independent Safety Agency, IRSN, came to NRC a few months ago with a proposal for a series of tests at the reactor, including a design basis LOCA test for MOX fuel to reduce some of these uncertainties.

To go into some of the issues that IRSN highlighted, one of the most important appears to be fuel relocation during a design basis LOCA, and this is during the clad ballooning phase, the collapse of the pellic column into a rubble bed, which can have an impact on ECCS compliance, such as the peak cladding temperature and the local oxidation responding to that temperature.

Fuel relocation is not considered an Appendix K, and it's now regarded as one of the non-conservatisms in independence K, but NRC's position is it's balanced by the conservatism for independence K. So it still may not be worth worrying about, but there seems to be some internal issues with the staff, whether or not fuel relocation is a significant impact.

According to IRSN, it certainly looks like it could have a significant impact. If you consider fuel relocation, it could lead to an increase in the peak cladding temperature by anywhere from 30 degrees Celsius to 180 degrees Celsius depending on the filling ratio, and that is how densely packed that rubble bed is after the collapse, which increases the local decay heat.

That increase in peak cladding temperature can increase the local clad oxidation by up to ten percent.

Now, relocation is not considered now for either LEU or MOX, but to the extent that the margins to the ECCS criteria are smaller for MOX fuel, taking relocation may be more important because of the reduced conservatism with MOX. There's a small margin of MOX to the peak cladding temperature limits. We saw that in a previous slide. If you replaced an LEU assembly with a MOX assembly at the same location, you're going to end up with a somewhat higher temperature, a peak cladding temperature.

Also, M5 cladding because it's more ductile, it forms bigger balloons. The bigger the balloon, the more opportunity and space there is for relocation, and that's considered to be an important time than on the likelihood of relocation and its consequences.

DR. POWERS: Ed, could I ask you a question about that ballooning used? Is that a conjecture or do we have data on the ballooning of MOX fuels?

DR. LYMAN: Well, this is strictly a cladding related issued, and so it's just a matter of fact at higher burn-ups M5 is more ductile so that it is more plastic. It gets drained and doesn't rupture or blows up to a larger balloon that will rupture.

I'm not sure I have much experimental data, operating with cladding.

DR. POWERS: I understand. Thank you.

DR. LYMAN: Now, an issue which I raised a few weeks ago and there seems to be some uncertainty is the impact of the MOX fragmentation behavior on the filling ratio. The filling ratio is very important, as we see from this range between 30 and 180 degrees Celsius based on IRSN calculations which have been available to us during our discovery phase of the proceeding.

And it's not clear whether, in fact, a different micro structure in LEU will have an impact on the filling ratio and in which direction. In general, my intuition would be that to the extent that the plutonium agglomerates and MOX fuel achieve higher level burn-ups than occur in LEU fuel, so for the same average fuel burn-up you have these regions of high burn-up. I mean, if they start looking like high burn-up LEU fuel sooner than LEU fuel does and develop a core structured with fission gas, that in an energetic event like a LOCA where there is a rapid heat-up, if that causes fragmentation of the clusters, it might lead to more fine fragments.

And I know, again, there's some issue about what will happen. I went back and I looked at the PIRT that NRC conducted in 2001 on LOCAs. That's the phenomena identification ranking tables process, expert elicitation on LOCA, and the expert panel was not sure. They had some disagreement of what direction this would be in, whether it would be important, but clearly there was some concern that MOX fragmentation was going to be different than LEU, and that could have a different and potentially worse impact if relocation specific.

And so the issue was really when you're talking about helium burn upset is 45 to 50 gigawatt days per ton, the LEU fuel may not experience the most severe high burn-up effects that MOX met.

Another issue that has to do with the interaction between the fuel is that the bonding apparently is another very important issue in relocation. Obviously if there's a greater bonding, it might help to pull the fuel apart during the ballooning process, but again, it seems that this is an area of uncertainty, and this is why IRSN thinks that integral tests on actual high burn-up fuel is warranted.

Just to show, if you look at the Appendix K calculation, it doesn't consider relocation effects. We see that the simple substitution was one of the MOX assemblies for LEU assembly in the same position, leads to a somewhat higher temperature, looking at an average increase of 105 degrees Celsius, which is just the average of that range I showed you, would bring the MOX PCT well over the regulatory limit of 2,200 degrees Fahrenheit and also have an impact on LEU, but to the extent the large and small MOX, we have to worry about it more if we're going to ignore and say that MOX is okay.

Now, M5 cladding issues, although M5 was approved by the staff back in 2000, it seems that there are still some technical issues associated with MOX, with M5 cladding, both LEU and for MOX. Right now Research is trying to obtain high burn-up fuel with Zircaloy M5 cladding as part of its cooperative agreement with EPRI, and from the tone, it looks to me like they're not having success in obtaining the samples yet.

A letter was sent April 21st, 2004, from Research to EPRI, again, urging EPRI's cooperation to provide these samples of irradiated fuel, and this letter points out that parallel testing at Argonne in unirradiated Zircaloy M5 cladding has shown significant differences in Zircaloy.

And this could have something to do with tests that are done at Argonne to try to understand the differences between Alloy E110, which has nominally the same metallic composition as M5 cladding, but yet has considerably different observation behavior and poor performance in design basis LOCA conditions.

Apparently Argonne did some tests on M5 samples by etching them, which is not the current preparation for M5, but then found that that led to a potential similarity to the outside characteristics of Alloy E10, and this raises questions regarding M5 with respect to the changes that might occur during radiation, and this, again, is why Argonne agreed to seeking these samples for testing and not receiving them yet.

But I don't think the M5 cladding issues are going to go away, and to the extent that there are interactions between M5 and MOX that might pose a problem, that's a concern.

I'd also like to point out that Mr. Nesbit did mention that in a previous subcommittee meeting that out of all of the MOX fuel assemblies irradiated in Europe, in France, in particular, virtually none of them used M5 cladding. Only a couple of experimental assemblies so far were MOX fueled; M5 cladding was preserved. So there's very little radiation experience with MOX cladding.

Moving right along, contention two related to source term issues and alleges that Duke is not adequately accounting for differences in MOX and LEU fuel behavior with respect to cladding releases during four disruptive accidents which the board has defined to include both design basis accidents like the Part 100 type event and also beyond design basis severe accidents.

To this end, there are suggestions from the limited amount of testing that's been done with MOX fuel in Europe that there are different radionuclide release characteristics of MOX fuel compared to LEU. These have not been taken into account by Duke's analysis or the staff's review.

In particular, because of the MOX microstructure, not only is there a greater fission gas release to the gap during normal operations, but under LOCA or severe accident conditions, there appear to be enhanced release rates with some radionuclides from MOX and go to LEU, presumably because of the different matrix structure, and degradation behavior of MOX fuel in severe accidents may be different than the different timing during the core slumps, and any of these things could affect source term and consequence analysis.

Also, current source terms apparently underestimate tellurium and ruthenium isotope release patterns, and these are two other categories in addition to iodine, in which actinides could have substantially greater in MOX fuel. So to the extent that the source term doesn't use realistic release fractions with tellurium and ruthenium, it means we are not fully accounting for the differences in inventory very sensitive to MOX fuel characteristics.

So, again, there are uncertainties due to gaps and experimental database for MOX under core melt conditions. IRSN has proposed a MOX source term test for severe accidents again for THADE-related events. We believe those tests are also warranted.

So in conclusion, we still think there's a lot of research needed to reduce the uncertainties in M5 cladding and MOX fuel performance during LOCAs and severe accidents. There are a series of tests that are proposed or in the works, but if Argonne does get irradiated M5 clad LEU fuel to run LOCA, that will provide some information.

Walden is in the midst of preparing for and may have even begun a fuel relocation test on high burn-up LEU fuel, and again, under the proposed tests, which are, as far as I know, not financed yet, and NRC didn't show much interest in providing assistance at the meeting that I attended in October.

Again, some more uncertainties introduced by this latest indication that Duke is going to be loading another type of experimental fuel at the same time the MOX LTAs are. I haven't had time to assess that.

So in sum, we just don't think the experimental database is sufficient to support approval of the LTA power out at this time unless we can start to close some of the gaps, especially for performance of MOX fuel during design based LOCA.

Now, as far as risk calculations go, we don't think Duke has demonstrated adequately that the introduction of the four MOX LTAs will have only an insignificant impact. The question of what is significant is ill defined in NRC parlance, as we all know, but the first thing Duke should do is its own risk calculation, which it hasn't done yet. Duke only incorporated by reference the Department of Energy's calculation from several years back from NEIS.

We've pointed out many places where that calculation was inadequate, and we just think before coming to a conclusion Duke should do a design analysis and evaluate some of the uncertainties and sensitivities associated with the issues that I've discussed.

Again, four LTAs is a small fraction of the core inventory. We understand that, but before debating whether or not that's significant, we need to know, have a good handle on that number, and we just don't have that yet.

As far as Duke's comparison of the increase in risk to that associated with other license amendments such as power-up rates, I don't believe that these comparisons are valid because the benefits are different in each case. You're talking about a power up rate. Obviously that is going to be substituting for another source of electricity generation and the risks and benefits associated with that, but it's different than this particular application of using MOX LTAs.

To conclude, BREDL is not seeking absolute certainty in this proceeding, but we are only seeking reasonable assurance that this program is going to provide adequate protection of public health and safety. We don't want to shut down every retest assembly program and every fuel qualification program in the world. We just think that the MOX LTAs are significantly different from LEU in U.S. experience, but it's warranted to try to understand some of these issues a little bit better than Duke has done.

And with that, I'll take your questions.

DR. POWERS: Are there any questions for Dr. Lyman?

(No response.)

DR. POWERS: We now have a presentation from Mr. Killar of the Nuclear Energy Institute.

MR. KILLAR: Good morning, gentlemen. My name is Felix Killar. I'm the Director of Fuel Supply and Material Licensees from Nuclear Energy Institute.

In my position one of my responsibilities is for following the weapons disposition program, both the ATU program and the plutonium disposition program, and I have a very brief statement this morning.

First off, our policy. We certainly support the plutonium disposition program. We feel it's very similar to the high risk uranium program as we're taking a very high, very reactive material, diluting it down to a grade that could be used safely with the power plants and dispositioning this material so as not to be a hazard or potential threat to the American public.

My second point is that we support the LTA process for verification of fuel types and new fuel types. This is just another iteration as similar as they were talking about the other LTA program they have at the Catawba reactor. This is another application of the same process, and therefore it is consistent with the use and safe operation of plants to assure that we do have good prototypes, that we are very happy and content with the safety of these things going through the power plants in full batches.

And then the last point is the history of the MOX LTA program internationally as well as here in the United States we believe can be accomplished very safely.

One of the disadvantages of being the last speaker is that sometimes your points are taken. I was going to refer to the Ginna experience as well sa the experience at the end of cycle with most of the enriched reactors here in the United States were reactors here in the United States. When you get to the end of the cycle, you are basically running a MOX reactor.

Now, there also is good experience with Dairy Land reactor that had a number of MOX fuel assemblies that ran a number of years as a demonstration project and was a very successful program.

In fact, one of the benefits of that program is that when they had an assembly that had some problems that was a low enriched uranium assembly, typically they would pull out one of the MOX assemblies and use that as a substitute for the LEU assembly for that cycle to get through the cycle.

So that's the three points I wanted to raise this morning. I'm just basically talking in support of this program going forward, and this program going forward with the LTA program.

DR. POWERS: Could I ask you have you or your colleagues done independent analyses of the performance of these mixed oxide lead test assemblies?

MR. KILLAR: We have not done independent analysis. We have reviewed the programs they've gone through and to see that it is consistent with a typical program, but we have not gone into any independent analysis.

DR. POWERS: And you are satisfied that they have taken appropriate steps?

MR. KILLAR: Yes, we are.

DR. POWERS: Thank you.

Any other questions?

(No response.)

DR. POWERS: Thank you very much.

With that I'll return it to Mr. Chairman.

CHAIRMAN BONACA: Okay. Thank you for the presenters.

And we'll take a break until five after 11.

(Whereupon, the foregoing matter went off the record at 10:47 a.m. and went back on the record at 11:05 a.m.)

CHAIRMAN BONACA: We'll get back into session.

And the next item on the agenda is risk management technical specifications, and Professor Apostolakis, you have the lead.

DR. APOSTOLAKIS: Thank you, Mr. Chairman.

On Subcommittees on Reliability and Probabilistic Risk Assessment and on Plant Operations held a meeting on March 25th of this year with representatives of the industry and the NRC staff to discuss risk management or risk managed technical specifications. The purpose of the meeting was to hear an overview of the status of the risk management technical specifications, the so-called Initiative 4(b), risk informed completion times.

The effect of this initiative is to extend the completion times from a nominal or current completion time up to a predetermined backstop or maximum using configuration risk management programs.

This initiative will require real time capability and cumulative and configuration risk matrices. The challenging part is the demand of a high technical capability and scope of PRA, and this will be a central theme to the discussion, whether PRAs are up to the task.

And without further ado, I'll turn it over to the staff. Who's starting?

MR. BOYCE: Yes, good morning. My name is Tom Boyce. I'm the Section Chief in the Technical Specifications Section of NRR.

With me today is the lead staff reviewer for the risk management tech specs, Bob Tjader who will be presenting; Mark Reinhart of the PRA Branch of NRR. I also have Deputy Division Director for Division of Inspection Program Management, Cindi Carpenter, and various reviewers in the audience. So we've come armed to bear here.

We're also lucky to have industry presentations on some pilot programs, some of the pilot plants: South Texas is with us, and you'll be hearing from them. That's Wayne Harrison and Bill

Stillwell over here. Also Biff Bradley of NEI will make a presentation.

As was previously stated, we last presented to the full committee in November 2002, where we covered the full gamut of the risk management tech specs, and there are eight initiatives in the risk management tech specs which you'll hear briefly about.

But what we are here today is to focus on Initiative 4(b), and that's what we talked last month to the joint subcommittees on. The reason we wanted to focus on 4(b) this time, it's the most aggressive of the eight initiatives. It's the most heavily reliant on a high quality PRA, and we think it's a significant change in the way we've approached tech specs.

As was stated, the current tech specs are what I'll call static. If you have some equipment that's inoperable, you start a plant shutdown at a predetermined time, and that predetermined time is a result of a review as part of the licensing process. You know, you will start shutting down within six hours, for example.

The change here is that this would allow a more real time use of a licensee's PRA, and so what they do is they take a nonconforming condition, and they would put it into their PRA and say, "Well, we should be able to tolerate this nonconforming condition or the equipment out of service for a certain period of time," and that would constitute the allowed outage time for that system before they entered a shutdown process typically.

That's a significant change in the way we license. It's a significant change in the way plants are operated, and it would be a significant change to the way we provide oversight of plant operations.

We're still early in this review process. So we're not going to have all of the answers. We're developing as we go.

We are looking for comments and feedback, not a letter per se unless you're going to include comments in a larger letter on risk for, say, the staff's response to the recent SRM from the Commission on balance of operational flexibility and PRA quality or Reg. Guide 1.200, which you're going to hear this afternoon or maybe 5069.

So as part of a larger mosaic, comments on this might make stage. We intend to come back to the ACRS as we get further down the road.

Any opening questions?

DR. LEITCH: I've heard the term "risk informed" and "risk based." Now we come across the term "risk management," "risk managed tech specs." What significance should I interpret those words to be?

MR. TJADER: We use tech specs to manage the plant, and plus we're -- excuse me. The idea is that we're managing the risk, and it's just a slight nuance or change in terminology, nothing terribly significant. We risk inform some of the specific details in the tech specs, but when we perform a risk assessment, then per (a)(4) or through the risk management process that we're going to have with 4(b), then we are going to manage the risk. We're going to take compensatory actions and things like that.

So it's not that we're using a risk informed approach. We're managing.

MR. BOYCE: Yeah, I'd like to expand on that just a little bit. It's a similar approach to what we've got in Reg. Guide 1.177, which says if you've got equipment out of service, you wouldn't do things that would add additional risks. So you might shut down any maintenance in the switchyard. You may not take out of service or do maintenance on equipment in the other train.

You wouldn't do something that would raise the possibility of another problem keeping that equipment out of service for a longer period of time, and that's what I would call the management part.

But I think it's a terminology issue in general.

Did you want to add something to that?

MR. REINHART: Yeah, just the thought along with what Tom and Bob have said. If you look at tech specs today, you're looking at one train, one component. Looking at a risk management tech spec, you're looking at the combination of the status of all equipment at a given time. If more equipment was out of service when, say, you lost a component, the AOT may be actually shorter than what a tech spec would provide, unless you put in place compensatory measures or put some of that other equipment back in service.

If, on the other hand, there was no maintenance going on, it might be a little bit longer or a lot longer so that you could take your time and perform your maintenance in a very orderly manner.

So again, what these two gentlemen said: it's really a management -- it's part of risk informed, but it's a managing the plant at the same time.

DR. APOSTOLAKIS: Are we going to discuss this issue of whether equipment were already out, what happens?

MR. TJADER: We could get into that detail if you'd like to discuss it.

DR. APOSTOLAKIS: Right now or later?

MR. BOYCE: Later, please.

DR. APOSTOLAKIS: Okay. I'm a little puzzled by your request that we shouldn't write a letter unless we comment on this in a letter that addresses bigger issues. Why is that? Why wouldn't we write a letter, you know, and say this is what we think about what's going on here?

MR. BOYCE: Oh, I didn't mean to imply that we wanted to preclude a letter. If you thought that there was something that we needed to consider, please, write that letter.

I had thought really that to make it clear, we weren't explicitly seeking a letter.

DR. APOSTOLAKIS: You're not requesting a letter.

MR. BOYCE: Right.

DR. APOSTOLAKIS: Yeah, that's fine. That's fine.

CHAIRMAN BONACA: Why don't we proceed

then?

DR. APOSTOLAKIS: Yeah.

MR. TJADER: Okay. I'll provide an overview of Initiative 4(b), and as I proceed in doing that, if you desire more detail, some of the specific details with inoperabilities come up, feel free to ask that. I know with the subcommittee we discussed some of that.

I'll also discuss it in the context of the other risk management tech spec initiatives.

You've previously received some of the submittals that we received from industry, the risk management guidance document, which is basically the process which will be utilized to implement Initiative 4(b). Biff Bradley later will present an overview of the risk management guidance process, and South Texas will discuss their pilot proposal later. We have Wayne Harrison and Bill Stillwell with us today as Tom mentioned to discuss their proposal. Opening and closing comments.

Risk management tech spec Initiative 4(b) is dependent upon PRA quality. Initiative 4(b) requires a quantitative risk assessment to determine the appropriate risk informed completion time.

Communication with and training of the

headquarters staff and regions are essential for successful implementation of Initiative 4(b). Initiative 4(b) is currently participating in the NRC's risk informed environment initiative, which is related to the communication, education, and acceptance by the staff of the risk management tech spec initiatives as well as other regulatory risk initiatives.

We're early in the Initiative 4(b) process. Initiative 4(b) is in a proof of concept stage, and we're going to learn as we proceed through the process.

DR. APOSTOLAKIS: Whose comments are these?

MR. TJADER: The feedback?

DR. APOSTOLAKIS: You say opening and closing comments.

MR. TJADER: Well, the direction was that we should provide conclusions of --

DR. APOSTOLAKIS: From us?

CHAIRMAN BONACA: Yes.

DR. APOSTOLAKIS: Okay.

DR. SHACK: That's how they're supposed to make presentations, George.

DR. SIEBER: Yeah, we aren't supposed to

ask questions.

CHAIRMAN BONACA: That's right, which we already have. All right.

MR. TJADER: Dr. Apostolakis mentioned on the 25th of March we met with Reliability and PRA and the Plant Operations Subcommittees, and they provided us some feedback, and I have synopsized those here, and feel free to correct me if I didn't get any of them complete or totally correct.

In general, the comments were that it's a good idea to risk inform tech specs, and in general the structure of Initiative 4(b) as it is right now is a good start.

The issues that were brought up, roughly in descending order of importance, are with respect to configuration risk monitors and assessment tools that are utilized in the risk assessment process, we need to know the extent of the PRA incorporation into those monitors and tools, and we need to be assured that there's adequate QA and QC of the software and the updating of that software that is utilized in the monitors.

We need to be aware of what's in the PRA and its impact on the completion times, and we need to design metrics to provide licensees incentive to fix the problems within the existing completion times in addition to the existing incentives that already exist in the maintenance rule as it exists now, in other words, the availability and reliability of equipment.

It was also mentioned that we need perhaps front stops were not adequate, potentially not adequate, and while my gut feel is that front stops as they are right now -- now we'll get into detail of what a front stop is and a backstop, but basically the front stop is the current completion time of existing tech specs. My gut feel is that they are adequate for, in general, four single system inoperabilities and haven't seen any cases where they aren't yet, but in the event that there may be one, perhaps a review of front stops ought to be conducted to insure that Initiative 4(b)'s structure is sound.

There was some discussion with regard to times. In other words, it's proposed that 24 hours be given to perform risk assessments when subsequent configuration changes occur in the plant, and you're already in tech specs, and we recognize that 24 hours is a long period of time, and that it can be done in significantly shorter period of time than 24 hours. Twenty-four hours, I think, in general is to get the approval process through.

DR. KRESS: There was also some discussion of what zero time was.

MR. TJADER: Oh, what the zero entry. If you need to go into that further, basically it's when you enter the spec. That's time zero.

DR. KRESS: Even though it may have been some time down the road when you enter a new configuration due to a --

MR. TJADER: Yeah, until the LCO time zero is consistent and time zero is the time of entry of the spec.

MR. BOYCE: Right, and you thought that was conservative.

DR. KRESS: Well, it definitely was conservative, I thought, yeah. You know, you enter into the tech spec and you're at time zero, and you've got a given risk configuration. Then something happens down the line and you merge into a new risk configuration.

In order to calculate the acceptability of this, you start it all the way back at time zero again. So it is definitely --

MR. TJADER: Well, it just seems to me there's a cumulative risk that may be invoked, and if you're using cumulative risk limits, then you've got to take it into account from time zero.

DR. APOSTOLAKIS: And when are we going to talk about these limits? You will cover that? Because I'm a little confused there about the limits. So tell me when would be a good time to raise the issue.

MR. BOYCE: Maybe during the example, when we get to the example slides because that's where it came up in the subcommittee presentation.

MR. TJADER: And not only that. I think that South Texas and NEI have some specific slides that address, you know, the limits and the accumulated risk and how it's conducted and things. So utilizing some of their expertise in slides would probably be a good time to do that, too, when they make their presentations.

DR. APOSTOLAKIS: Very good.

MR. TJADER: And then finally we need to maintain oversight of changes to the PRA after approval of Initiative 4(b) to insure that we are aware of the effects of the configuration rather than from the program and process.

Principles for risk management tech spec to the development --

DR. APOSTOLAKIS: Let's stop what we're

doing here because I'm a little confused.

MR. TJADER: Okay.

DR. APOSTOLAKIS: Okay. You listed the comments that you received from the subcommittee, and you will address how you're going to resolve these or did you already give your answers?

For example, when you say on Slide 4 there is an issue of QA of software in the updates, I mean, are you planning to do anything about it or you're just acknowledging that the committee --

MR. TJADER: Yes, we are definitely planning to address that.

DR. APOSTOLAKIS: And when will we hear about it?

MR. BOYCE: Not at this meeting.

DR. APOSTOLAKIS: Not at this one. Okay.

MR. TJADER: We are not prepared to resolve some of these issues.

DR. APOSTOLAKIS: Now I understand.

MR. TJADER: We are early in the process.

DR. APOSTOLAKIS: I understand. Something is wrong with this meeting. You seem to leave me behind all the time. Okay. I'll pay more attention.

MR. TJADER: It may be that you're way ahead of us is what the problem is.

DR. APOSTOLAKIS: Okay. Now it's clear. Thank you.

MR. TJADER: These are feedback. These are things that the subcommittee brought up last meeting. You brought up the configuration, risk monitors, and we fully agree that these are things that we need to be aware of and how we affect the configuration of risk management process.

DR. APOSTOLAKIS: As a side remark, the committee may be briefed on one or two risk monitors soon because remember we were supposed to go to an office some time ago. Now they're going to come here, maybe SE or somebody else. Ms. Weston is working on that, and that may happen fairly soon.

DR. POWERS: How come you can never get us there?

DR. APOSTOLAKIS: I don't understand that.

DR. POWERS: I mean, you just never make the case very strongly.

DR. APOSTOLAKIS: I never make the case?

DR. POWERS: You never make the case very strongly. You aren't persuasive.

DR. APOSTOLAKIS: I made it.

Okay. So the committee may -- will actually, not may -- will be briefed as to what the risk monitor does, what the issues are. We're going to see nice figures, pictures, and so on. So that will happen soon.

Okay. Thanks.

MR. TJADER: Okay. Principles of risk management tech spec development in addition to following Commission guidance in the development of the risk management tech specs initiatives, we seek to achieve coherence with other risk informed regulatory developments such as the maintenance rule which we utilize in our process; PRA quality, which we're dependent upon; and 5069, which may affect some of the later initiatives, like Initiative 8.

We take credit for and build upon existing 5065, A(4), maintenance rule, configuration risk management programs, and the risk management tech specs initiatives. We must insure that licensee's risk submittals must be standard for quality and comprehensiveness. Submittals must meet Reg. Guide 1.200, ASME, and other standards.

We must involve the NRC staff with cognizance for operation training, inspection, maintenance, the regions, the SDAs, and risk assessment staff.

We must involve the staff to insure a

quality product and to insure overall support by the staff.

DR. APOSTOLAKIS: With respect to quality, is this now the beginning of the era when PRA will be used in real time do you think?

MR. BOYCE: Yes.

DR. APOSTOLAKIS: Are we getting there?

Has anybody thought about whether the existing PRAs which were developed for, you know, assessment purposes without any pressure of time, whether they are actually adequate for this thing?

Maybe they are, but is that something we ought to look into, Mark?

MR. REINHART: I think we're looking for a very substantially improved or higher quality PRA than most plants have today to support the Initiative 4(b), and I think we've communicated that to industry, and they're hopefully going to come back and demonstrate to us that they have that.

If you look at the staff requirements memorandum that has this on a phased approach, we're saying this is a proof of concept which is really parallel to that phased approach, and for a 4(b) plant that would be an accelerated development of a high quality PRA. There will be areas where there aren't standards. So we're going to have to come to grips with what are we going to do to review that. What are we going to do to make sure that the content is where we are wanting to go and that we're not out in left field from where we go when this standard is developed.

At the same time, we don't want to say, "Well, it's good enough for now and we'll fix it later." To have a plan, go out and manage their configuration based on PRA information, along with the deterministic also, we need to have a substantial confidence in that PRA.

DR. APOSTOLAKIS: So this PRA then, as you said, clearly will have to do more than just what the available standards dictate.

MR. REINHART: Yes.

DR. APOSTOLAKIS: And you will not give the review of those low priority, will you, of the extra work?

MR. REINHART: No. We've talked about this, and we're saying obviously we can't look at that, the low priority as defined under the SRM. We have to have a separate approach here.

DR. APOSTOLAKIS: Okay.

MR. TJADER: And in general, the existing

PRAs out there are not adequate to implement Initiative 4(b). There may be a South Texas, may be a San Onofre that that are close to being adequate or are adequate, but most aren't. Fort Calhoun has volunteered to be a pilot, as I'll bring up later, as has Hope Creek plants, to be a pilot for Initiative 4(b).

In both cases, for them to be pilots will require them to upgrade their PRAs and make adequate, and the reviews currently under Reg. Guide 1.200 for quality, we recognize that that's just a starting point for assuring quality and that eventually Reg. Guide 1.200, when it gets addenda and things like that that are coming in, may be adequate for it, but it has got to be Reg. Guide 1.200-plus at the moment to insure the quality.

MR. BOYCE: And just one more point. If these pilot plants do upgrade their PRAs and make them as complete as we'd like, the PRAs for this application, and we reviewed it and it was approved, the PRAs would probably be more than adequate for other risk informed applications without further review.

So we think this is a very challenging application.

MR. TJADER: Okay. Just a quick status of the other initiatives. This is to give you an idea where Initiative 4(b) fits in with the other initiatives.

Basically the initiatives fall into four general categories. The first category include the two initiatives that have already been approved. Initiative 2, missed surveillances, and Initiative 3, mode change flexibility, they rely extensively on existing A(4) type configuration risk management programs. They are in most respects the least risk significant of the initiatives.

The net set require prior analysis of specific plant configurations, and they are the next ones that are soon to be approved. We hope within the next year. They include Initiative 1, modified end stage, that is, shutting down to full repairs to hot shutdown rather than going all the way to cold shutdown when it's risk informed to do that for specific plant configurations or specific inoperabilities.

Initiative 6, entry times into shutdown and entry times into 303 action statements for specific equipments and configurations. There can be extended times. Rather than just allowing one hour preparation to enter shutdown, they may be risk intelligent to provide additional time.

Initiative 7, non-tech spec support systems' effect on tech spec systems, i.e., snubbers, hazard barriers, and it isn't always the smart thing to do to automatically declare the supported system inoperable because the snubber is inoperable. That's in general what that issue is.

And those three, as I said, we have proposals in house for all three of those and for certain vendor types, we are ready almost to go forward and approve some of those.

The third category requires quantitative risk assessments. They require extensive quantitative PRA based risk assessment, and they are Initiative 4, the flexible risk informed completion times, which is a major concern today, and Initiative 5 is surveillance frequency programs.

And then the final category is somewhat in the future. That's an Initiative 8, and it requires or it involves potentially relocating non-risk assessment systems from tech specs. It will involve rule-making because it will require replacing the existing 5036 deterministic criteria in the tech specs with a risk based criteria for determining what should be in specs, and that's some time down the road.

Initiative 4, risk informed completion times. The effect of Initiative 4(b) is to extend the existing completion times and tech specs from a nominal or current completion time value up to a predetermined backstop maximum using a configuration risk management program. This is under development. Initiative 4(b) involves applying a process which will be defined in the risk management guidance document, which you have the first rough draft of in it so as to use this risk management guidance document process to determine the risk informed police time.

The process will require PRA technical quality and adequacy which will be addressed to some extent as I already mentioned by Reg. Guide 1.200 so that a real time quantitative capability will exist in order to realistically implement 4(b).

In addition, it will require configuration of cumulative risk metrics so that we can determine what the risk informed completion time should be as plant configuration evolves and also to evaluate the overall process as time goes on.

The current status --

DR. LEITCH: Do you visualize a preestablished set of plant conditions, many different conditions, where this has all been worked out in advance?

MR. TJADER: That's the South Texas way of doing it. There are two ways of doing it. There are --

DR. LEITCH: Or more on-line training that now we find ourselves in this particular situation. We'll immediately do a --

MR. TJADER: Do an on-line configuration risk assessment utilizing an on-line monitor, such as possibly San Onofre might do. There's a couple of ways to do it, and perhaps a blended type approach between the type that could be utilized to get the end result.

DR. LEITCH: So if you did the former, that is, if you had the preestablished scenarios, would they require NRC approval in advance or it's the methodology in the PRA that you're approving?

MR. TJADER: You have to have confidence that the methodology -- it's primarily the methodology --

DR. LEITCH: Yeah.

MR. TJADER: -- that they utilize to get to those. We have to be confident in their PRA and that their means of getting those cut sets and those configurations determine -- and South Texas will go into their process a little bit. They have approximately 20,000 pre-configured plant configurations. We certainly can't I don't think in a realistic time go in and approve each and every one of those.

However, we're going to take and review a set of those.

DR. LEITCH: But say they come to number 1,502 and they now find themselves in this situation. Can they just go ahead and do that?

MR. TJADER: Once we approve it.

DR. LEITCH: Once you approve it, but I mean, you're not going to approve each one, but you're going to approve the methodology and approve the PRA quality and the QA aspects of it and so forth.

MR. TJADER: And of course, South Texas requires extensive updating of their sets as they update the PRA and things. It seems to me to be rather work intensive.

DR. APOSTOLAKIS: So a predetermined backstop maximum is not the 30 days that you're putting there for defense in depth purposes. It's the calculated.

MR. TJADER: No, there's three things.

There's the front stop and there's the risk informed completion time, which could extend the front stop up to the backstop, which would be the 30 days, which is -- 30 days, I might add, is what the proposed backstop is at the moment.

DR. SIEBER: Right.

MR. TJADER: It seems like a reasonable period of time, but --

DR. APOSTOLAKIS: But the flexible time --

MR. TJADER: The risk informed provision.

DR. APOSTOLAKIS: -- doesn't have to be predetermined.

MR. TJADER: No, it does not.

DR. APOSTOLAKIS: They can do it in real time.

MR. TJADER: That's right, yes.

DR. APOSTOLAKIS: Now, if they choose for certain common configurations to have predetermined it, that's fine.

MR. TJADER: That's correct.

DR. KRESS: The backstop could be less than the 30 days if the risk configuration says it should be less. If you just say that's a maximum --

MR. TJADER: I mean, what is proposed now is a standard 30-day backstop. In other words, no system should have more than 30 days to be inoperable or be in an action statement, in general, and if you perform a process, a risk assessment process that determines that the appropriate completion time is less than 30 days, that then is not a backstop. That's the risk informed completion time.

DR. KRESS: That's when you have to do it then.

MR. TJADER: That's what you have to deal with, not the backstop. In other words --

DR. KRESS: It's only if that determination exceeds the 30 days. then you would go ahead and use the 30 days.

DR. APOSTOLAKIS: Right. In fact, I saw in the Westinghouse document there were several figures. For a lot of these actions or configurations the risk informed limit is much larger than the 30 days. There are several others that is lower. So they stop there.

MR. BOYCE: And just to come back to the risk monitor issue, the South Texas project approach is to use what we'll call a database type approach of pre-analyzed conditions, and so that constitute their risk assessment tool. the other risk monitors would be a subset of what we're calling a risk assessment tool, a real time risk monitor, a database approach or a blend of the two is what we're struggling with is how do we approve those in advance, and what we're looking at is as a pilot this is supposed to be a generic approach. so that's why it's important whether we approve the database approach or risk assessment tool approach in general or some sort of risk monitor. We're not clear.

DR. KRESS: Well, in genera the South Texas approach can make use of a much higher quality PRA, it seems to me like, than the risk monitor. Well, they've got plenty of time to sit there and so all of their scenarios and include every -- you know, make the cut sets different and so forth.

DR. APOSTOLAKIS: Yeah.

DR. KRESS: But if you've got a risk monitor, it's more of an abbreviated PRA in my opinion.

DR. APOSTOLAKIS: Not anymore.

DR. KRESS: Not anymore?

DR. APOSTOLAKIS: We'll find out. We'll find out.

DR. KRESS: We will find out.

DR. APOSTOLAKIS: But the down side of it is if you don't pre-analyze the configuration --

DR. KRESS: If you've got one you haven't pre-analyzed, you have to do something, yeah.

CHAIRMAN BONACA: The question I have is these plants also do on-line maintenance, and so say that you have a component in tech specs that is pushed close to the backstop. They still can't take out the components of the service and do maintenance on those. I mean, right now you have control on the tech spec portion because you have communication coming to you that the components of the service and determine that 20 days is acceptable. Okay?

How do you -- I'm sure that the plant has to now take into consideration still all the other components that are being taken out of service simultaneously, right?

MR. REINHART: Oh, absolutely.

CHAIRMAN BONACA: Is there a process to deal with that? I mean to control it or --

MR. TJADER: Right. In the process and when we get to Slide 9, which is just actually -- I think we're just about there. I mentioned the pilots, the proposed pilots. Here's the positive: front stop, which is the current completion time, configuration risk management proposed program based completion time, the backstop proposed is 30 days.

Here is what we're talking about.

This is a typical tech spec condition, typical example. This exists in the risk management guidance document. It's taken out of that, their proposal. A typical condition might be one subsystem inoperable, and under existing specs, the required action would be perhaps B(1), restore subsystem to operable status. The completion time is 72 hours.

What the risk management tech spec process and the risk management guide proposes is adding required actions B(2)(1), B(2)(2), and B(2)(3). B(2)(1) is to determine -- in other words, you're restoring, attempting to restore the subsystem to its operable status within 72 hours. You then at some point determine that you're probably not going to be able to do that within 72 hours.

So within that existing 72 hours, within that existing completion time, you determine -- you perform your risk assessment and you determine what is the appropriate extension beyond 72 hours and what is acceptable at that threshold.

Okay, and then you will utilize that risk assessment time, and then B(2)(2), which is verify that completion time beyond 72 hours remains acceptable, and then if you say in parentheses, i.e., within 24 hours, 24 hours is proposed. Hours of a subsequent configuration change; any time there is a subsequent risk significant configuration change to the plant, the risk assessment must be re-performed and to verify that the completion time is accurate for the existing condition.

And then B(2)(3) then is restore the subsystem to operable status at a maximum 30 days or the completion time that's determined, whichever is less.

DR. KRESS: And now I can see for an emerging condition that you weren't expecting that the 24 hours might be appropriate, but it seems to me like for -- take this one example, the HPSI subsystem inoperable. You could already predetermine a backstop for that, assuming no emerging condition.

So why should you have this 24 hours there? You could already have a -- they have another line there that says "or extend to such-and-such a level," number of hours, if it can't be completed in 72.

Can you predetermine that one?

MR. TJADER: Oh, absolutely, and in fact, that is the case. I mean, under the CE proposal, they have pre-analyzed a lot of different --

DR. KRESS: So it would already have -- they would already have the backstop, assuming nothing happens that they hadn't anticipated.

MR. TJADER: They pre-analyzed some of those situations, and plus --

MR. REINHART: Can we jump in?

MR. TJADER: Yeah.

MR. REINHART: One of the questions that has to be determined: what is the integration of programs? For instance, if it's just one component here and it's predetermined, it's really done like you say, or if it's just one component, maybe they could take some time.

But under the maintenance rule, every time a configuration changes, you have a much shorter time to run an analysis, and so we have to come to an agreement with the industry and then get that put in the process: really what is an appropriate time, given an emergent condition, once that configuration changes to make the determination? Because what if it's much less? You know, that emergent condition --

DR. KRESS: What if it's less than the 24 hours?

MR. REINHART: Exactly.

DR. KRESS: That should be the

determinant, and we don't know that ahead of time.

MR. REINHART: Yes, you're right, and so we need confidence that that will be quickly brought to light and an action taken appropriately.

MR. BOYCE: If I could generalize your questions, why don't we reanalyze all of the front stops using a risk approach?

And that seems to make sense technically from a licensing standpoint. All of those front stops were put in place with a lot of thought, deterministic type of thought, and a lot of them have conditions that were place on the plant as part of safety evaluations and amendments in the past.

And so what would happen is we would end up doing two reviews, one for a risk based approach and one to research the licensing history to make sure we completely understood it.

DR. KRESS: That would be a pretty big task.

MR. TJADER: It increases the scope of the review, and I guess Fort Calhoun is -- Bob has actually tried to move in the risk based direction on the front stops, but that's the internal process we have to go through to make sure that's right.

MR. REINHART: And, again, I think we

really have to come to grips with what does this front stop mean because that can't be just a buy time where you do nothing.

If configurations emerge that we need action and analysis before that front stop, the program has to clearly articulate when and how that's taken, and I think that's one of the things we need to work out.

CHAIRMAN BONACA: You've got to have those front stops. Many of them are just historical. I mean, you're put there, and there wasn't much of a meaning, and then they became important because everybody always saw 72 hours. So 72 hours seems -- but in reality there wasn't much behind that.

MR. REINHART: And another way, say, looking down the road, when some of these systems become very flexible and very usable, what's the point of having the front stop. I mean, the plant is going to be analyzing their condition as they go along, and as soon as something changes, they'll be able to see what that does to the risk and take appropriate action. That's managing the plant using --

MR. TJADER: With respect to that 24 hours with regard to the completion time of B(2)(2), Fort Calhoun is the proposed pilot for the CE generic submittal, which is the HPSI, single system HPSI pilot, and they recognize the 24 hours is probably more than is necessary for this initial risk assessment.

But we have discussed various things, such as maybe having one hour to do a predetermination that it is acceptable, and then to do a more thorough PRA based review and approval, management approval that the 24 hours would be utilized for that.

But 24 hours is not yet approved or hard and fast.

DR. KRESS: Yeah, I think that's going to be a problem, and the basic concept is you don't want to subject this surrounding population around this plant to a given risk over a given amount of time, and it's cumulative. It's a cumulative risk that needs to be added up over that time.

And you know, you're not ever going to manifest that risk, hopefully, but the concept is you don't want to subject them to an unacceptable level of risk, and which has time in it. It's an integral, risk times time or integral CEF time to time or LEU time to time.

So the 24 hours is something that if you enter into a condition where that 24 hours would have subjected them to a higher level that its acceptable risk, then the 24 hours is not appropriate, and it seems to me like you could almost predetermine some configurations where that 24 hours would not be acceptable, like so many subsystems out of operation at the same time.

And these conditions where the 24 hours is no loner acceptable, then you have to shut down or something. That would be the only way to me to accept some value for this reconfiguration calculation. You have to have some predetermination that some configurations are just not acceptable over that 24 hour period.

MR. REINHART: I just want to add, again, while the 24 hours is proposed, we need to work out what's really reasonable and accomplishable here.

DR. KRESS: Yeah. It may be that 24 hours may even be, you know, -- it might even be longer is acceptable.

CHAIRMAN BONACA: One thing that comes to mind here, you know, let me take the example of the HPSI system. The value of the 72 hours as a front stop is to set some kind of urgency that one knows that this is maybe a system that you want since in the tech specs you would like to restore it as soon as you can.

On the other hand, you can determine that you can live with it for ten days or whatever, and so you can demonstrate that 30 is a part of that. But I'm thinking about just, you know, the example of a HPSI system. I have the four trains. So I go to the Option B, and now I determine that my trains are not individually this significant. So already I'm doing less about those systems.

Then I have this evaluation here that says, well, I've got four and very likely I can stay 30 days with the situation down. I guess where I'm going is you may have a situation where on a risk basis and with some justification, you have a lot of systems maybe that are not fully operable for some extent of time.

I don't think that that's what the plants want to do.

MR. REINHART: No, n.

CHAIRMAN BONACA: So how do you prevent that kind of situation from evolving? Because, I mean, you may have 103 plants doing it right, and then somebody abusing that process by having, in fact, a lot of systems out.

MR. REINHART: The intent is that when a

piece of equipment becomes inoperable, the plant starts right then their preparation to repair that and restore it to operable.

The bigger picture is to focus on accomplishing that and not go through a plant transient unnecessarily. It's not to get a relaxation. One caveat could be if there's three pieces of equipment out, you use your risk assessment to tell you which is the most important to get back first. You get that back, and which is the second most important.

CHAIRMAN BONACA: So you really are working out the issues, yeah.

DR. APOSTOLAKIS: It's conceivable that you should have three pieces of equipment and say for each one you had a 72-hour front stop, but because you have three, many you have to do it in 30 hours.

MR. REINHART: Yes, exactly.

DR. APOSTOLAKIS: How is that done? I mean, is that allowed? Is that mandated here that you do that?

MR. TJADER: No, the risk management guidance document, which will be the guidance or the procedure, the process to be utilized, we envision. It's not in there yet, as you can see, but we envision requiring that as soon as the second piece of risk significant equipment, whether it's tech spec or not, becomes inoperable, that you are no longer in front stop space.

You're in front stop space for single system inoperability.

DR. APOSTOLAKIS: Okay, okay.

MR. TJADER: But as soon as the second one becomes inoperable, you are then in the risk assessment space, risk informed completion time space determination.

MR. REINHART: I think there's three periods of time that we need to look at. It's a planning time, a real time when things are actually happening and a post evaluation. I think all of the pieces have to fit together here, and particularly in real time that licensee has to be tuned to do what's the safe thing to do right now.

DR. APOSTOLAKIS: Well, yeah, but I mean we could say the regulations do the safe thing.

MR. REINHART: Well, I mean as far as managing the risk, but then you have the cumulative after a year or a cycle. You can go back and evaluate your program and say, "How could I have done it better? How can I approve it?"

There's different ways to use that risk to evaluate and manage your plan.

DR. KRESS: Let's say you're operating alone with one system map and you've got a risk informed front stop and you move along and you still haven't got it back in operation yet and then just a similar chain goes out of operation, and you've got two of them now. And you calculate the amount of time it takes to reach your reach acceptance criteria, but that's too short to get both of these back in operation or get either one of them back in operation. Now, what do you do? Do you have to shut down when you reach that?

MR. TJADER: Yes, right. That's a typical action.

DR. KRESS: That's a typical action to shut down?

MR. TJADER: Typical action.

DR. KRESS: Okay.

MR. REINHART: Or go to an appropriate mode. It might be --

DR. KRESS: It may be a hot shutdown or some --

MR. BOYCE: Three, oh, three says, you know, shut down to hot standby and then cold shutdown, and then it continues walking till you get down.

DR. APOSTOLAKIS: Mario, what time do we have? We started 20 minutes late.

CHAIRMAN BONACA: The backstop.

(Laughter.)

CHAIRMAN BONACA: Twelve, forty-five because then we have the meeting with Mr. Paperiello who's coming.

DR. APOSTOLAKIS: We have more presentations. So maybe, Bob, can you speed it up?

MR. TJADER: Okay. I'll try to run through this if I can here.

Potential implementation structure. Basically we envision that program requirements will be stipulated in the tech spec admin. control section. In other words, the PRA quality Reg. Guide 1.200 will be referenced and required, and there may be Reg. Guide 1.200-plus.

Essential guidance documents, such as Reg. Guide 1.177 and the risk management guidance document, which is the process there, would be, we envision, would be referenced in the admin. control section of the tech specs.

There will be licensee and industry program --

DR. APOSTOLAKIS: That's an interesting point. One, one, seven, seven refers to permanent changes, right?

MR. TJADER: Correct.

DR. APOSTOLAKIS: So here, huh? Blast. Oh, so what --

MR. TJADER: We envision that possibly 1.177 has to be enhanced to allow for guidance on how to approve, you know --

DR. APOSTOLAKIS: Even temporary.

MR. TJADER: -- limits for approving certain forms --

DR. APOSTOLAKIS: But the existing one is for permanent change.

MR. TJADER: That's right.

DR. APOSTOLAKIS: Okay. Now, if we go the South Texas way where they predetermine everything, then 1.177 applies because this is a permanent change. Whereas Southern California using a monitor is not under 1.177 because it's not change.

DR. KRESS: No.

DR. APOSTOLAKIS: Why not? It's not permanent. They recalculate all the time.

MR. REINHART: I think we have to --

DR. APOSTOLAKIS: Excuse me. Are they

correct or not?

DR. KRESS: No, they're conceptually the same.

DR. APOSTOLAKIS: Your no refers to the fact that we're not going to allow that.

DR. KRESS: NO, they're conceptually the same.

DR. SHACK: You're allowing a certain amount of cumulative risk, and whether it's rising from a permanent change or a temporary, you know, what you want to fix is the amount of cumulative risk you're permitting.

DR. KRESS: That's right. That's right.

MR. REINHART: I might put some words into South Texas' mouth here, but if I'm understanding what they're saying, they will predetermine a large number of configurations, but if they have one that's not in their repertoire, they also have the capability to handle it --

DR. SHACK: I think we need to invite them up here.

DR. APOSTOLAKIS: I understand that, but I mean, everything in 1.177 assumed permanent changes. So I don't see why Southern California Edison should have to comply with this if they're recalculating all the time. We're making an additional assumption.

MR. TJADER: Well, if it doesn't apply to them, then obviously we wouldn't put that in the admin. control center.

DR. APOSTOLAKIS: The incremental core damage probability was determined having in mind permanent.

MR. REINHART: We will need additional guidance whether it's a modification to 1.177 or an additional reg. guide. Somehow we have to account for both of these.

DR. APOSTOLAKIS: This is the plus then.

MR. TJADER: That's the plus.

DR. APOSTOLAKIS: Okay. Let me start there. Okay.

MR. TJADER: There will be licensee industry program guidance for implementing Initiative 4(b). That may or may not be required in tech spec admin. controls section, and plus oversight guidance must be established.

Initiative 4(b) relies on PRA quality, use of real time PRA results to determine completion times we discussed. It's significant change to the current usage of licensee's use of PRA and will entail a significant change to NRC review and oversight.

Therefore the PRA modeling configuration, risk management process and tool must be of high quality and show acceptable results.

Pilots for PRA quality and Initiative 4(b) are being implemented in parallel at the moment. Four of the five, Reg. Guide 1.200 PRA quality pilots involve tech spec amendments. There's SONGS, which is a batter of OT chains, Columbia Generating Station DG, diesel generator, OT changes, South Texas Initiative 4(b), and the preliminary condition of Initiative 5(b). One I don't have there is the non-tech spec one which is Surry, which I think is 5069 change.

Risk management 4(b) pilots or South Texas, Fort Calhoun, Hope Creek. At the moment I think we're going to get another one, but it's not yet -- their proposal -- these three pilots unfortunately at the moment are not standard tech spec plants, and we're interested in getting a standard tech spec plant. We think there might be one on the horizon, but it's not yet.

DR. APOSTOLAKIS: Yeah. Are you reviewing the EPRI interim report as a part of the --

MR. TJADER: Yes. That's the risk management guidance document.

DR. APOSTOLAKIS: Yeah. What is the

meaning of a quantitative/qualitative risk assessment? And how does one use RG-1.200 to review a qualitative risk assessment?

MR. REINHART: I'm not sure what you're --

DR. APOSTOLAKIS: Page 3-3, if you have it with you, but you take my word for it. They use it. They use those words.

MR. REINHART: I think that's one of the things that's going to have -- in the 1.200 arena and as the pilot goes I'm sure there's going to be some places where we're going to say, "Well, what does this mean? How do we do it?" And we need to clarify that.

DR. APOSTOLAKIS: And then it goes on and says -- it's the top of the page -- "In addition, the assessment may credit compensatory actions established during the period being evaluated."

How does one do this?

MR. BOYCE: I don't want to directly answer because I probably won't get it right, but what I'll tell you is that where we are in the review of this document, we did an acceptance review and provided higher level comments, and then this document is going to be resubmitted to us, and we'll do a more detailed review of it.

DR. APOSTOLAKIS: So we will have another meeting at some point in the future.

MR. TJADER: Oh, for sure.

MR. BOYCE: Right, but I don't think we've really engaged it at the level you're asking.

DR. APOSTOLAKIS: But you will at some point.

MR. BOYCE: I certainly hope we do, and I'm looking at the reviewers in the audience who I'm counting on to do that.

MR. TJADER: In general, this is going to be a PRA quantitative assessment. However, that is impossible to perform necessarily 100 percent of the time, and so there could be qualitative bounding considerations for some inoperabilities and things like that.

In other words, to the extent that it's possible, there will be some all out qualitative assessments.

With respect to the second part of that -- what was the second part of the question now?

DR. APOSTOLAKIS: The assessment.

DR. KRESS: Compensating actions.

DR. APOSTOLAKIS: Yeah, I mean, we're making a big deal out of the quality of the PRA, and then we're throwing a sentence like this there which opens up gates now to do whatever you like.

MR. REINHART: Maybe a high level answer to your question is that based on our initial look at that proposed risk management guidelines we think some work needs to be done.

MR. BRADLEY: I just wanted to speak to that briefly because I was somewhat familiar with why the guide was written that way.

Biff Bradley, NEI.

Generally plants, even if they're using quantitative methods, also are looking at qualitative insights on top. I mean, they're not just taking a risk metric. You're also looking at what are the insights coming out of the PRA. It really wasn't intended to say you can do this strictly qualitatively, but there may be a blended method, you know.

And with regard to compensatory measures, some of those are quantifiable. Others are not. I mean, you know, if you rope off the other train or limit maintenance on the other train, then that pretty much means you don't need to, you know, take your averaged unavailability for the other train into account.

On the other hand, if it's compensatory

action, it's something like, you know, notifying management or whatever. Obviously you can't quantify that. So it depends on which measure you're taking whether you can quantify the credit for it.

DR. APOSTOLAKIS: Well, there should be some more detailed guidance.

MR. BRADLEY: Yeah, and I think as Tom said, we're in the early stages of evolving that guidance and ultimately there will be considerably more detail on these types of things as we go through the pilots and learn and incorporate that into the document.

MR. REINHART: Hopefully the next revision will be more detailed.

MR. TJADER: And then the pilots will test these things that we're discussing about today. In other words, quality, scope of PRA, configuration risk management, and the process.

These are the big picture issues currently reviewing, big picture review issues. Reliability, the results are accurate. Repeatability, similar plant configurations will result in similar completion times. And it must be enforceable, and there must be adequate oversight. Must have a quality PRA.

And that basically concludes my comments, and I think with respect to some of the detail as far as limits and cumulative risk and determining what the AOT is, I know that in NEI and subsequent South Texas ones there are specific graphs that will discuss some of those details, and that might be the appropriate time to address some of that.

DR. LEITCH: How do we prevent the abuse of the system? For example, how do we prevent licensees from selectively managing the maintenance or the out-of-service time on certain systems so that they're bumping into the backstop?

MR. TJADER: I think the cumulative risk metrics that we come up with and goals that are established for the plant, and plus existing maintenance rule, availability, reliability goals for equipment will be an incentive not to abuse the system. I'm not exactly sure what abuse the system is. You abuse the system and it seems to me that if you attempt to abuse the system, you will run into high risk levels and therefore short completion times, and it will tell you you shouldn't do that.

DR. APOSTOLAKIS: Unless you take undue credit for compensatory measures.

MR. TJADER: Well, as Biff just said, and that was the other thing I wanted to say in the second part of that compensatory measures, they have to be able to assess them quantitatively in the PRA or they have to be strict restrictions on what other systems or equipment cannot subsequently become inoperable.

It's not just, oh, I'm going to station a fire watch and therefore I can go another five hours. No, there has got to be definite quantitative judgments on the completion times should be and if there are other Tier 2 type requirements that are determined in 1.177, such as systems which should not be inoperable, that would then be a hard and fast determination and require then the resulting shutdown action or whatever, getting out of the operability of the tech spec.

MR. REINHART: It might be good to go back and look at the different time periods again. Real time on a given configuration, the plant may be able to go to a backstop, but on the evaluation period when you look at the cumulative risk accumulated over the year, if that plant has abused it, it's certainly going to show up.

DR. KRESS: I don't think you ought to view hitting the backstop as an abuse because it's more of that for a defense in depth and actually, you know, if you hit it and shut down, why, it's a good thing. I don't think you ought to view that as an abuse.

DR. APOSTOLAKIS: That's not tan issue of hitting the backstop. The issue is coming up with -- oh, yeah, you have the 30 days. Well, but you should have done it in 20 hours, and you actually claim, you know, 45 because you take dubious credit.

MR. KRESS: Yeah, I agree with you on the compensatory.

MR. TJADER: And, you know, from our standpoint, we want our goals to have the plant in the full-up configuration to the fullest extent that we can, and so I'm looking to rather than call it abuse, we are looking for ways to incentivize the licensee to get to that point.

The technical way we were talking about doing it was using the cumulative risk metric. What I'm concerned about is because cumulative risk can act over such a long period of time, it may not be enough of an incentive. Okay?

And so if you have a 30-day backstop that you're allowed you may leave the equipment out of service because you can't get a contractor on site within a week. So, you know, you just let it languish.

That's the scenario that is of my concern, and so I would like to have some better way to incentivize, something like as low as reasonably achievable approach to risk, and it's something that may come out of this pilot, is how best to do that.

I think an ALRA approach to risk makes a lot of sense. Whether I can get rulemaking or not is an entirely different question.

DR. LEITCH: It seems to me, too, that there might be a distinction, a forced outage of a system and a scheduled outage of a system. In other words, what concerns me is like the HPSI system there. You're talking about during that period of time a voluntary decision to take a diesel out of service, for example.

It seems to me it's a little different if you're scheduling a diesel out of service versus a diesel that breaks down, if that distinction is recognized.

MR. BOYCE: Well, the Commission tried to make a distinction for us in the SRM saying there's a tradeoff between operational flexibility and PRA quality, and like the 30 days, the reason we have that backstop there is that's the most we can conceive of for operational flexibility that you need to fix equipment in.

Typically we would expect it to be done faster. So even within that 30 days of operational flexibility we'd still like to incentivize if possible.

So I think the Commission is trying to tell us to make that kind of judgment if we can.

MR. TJADER: Well, it's certainly the most we can conceive for plan maintenance.

Let me, if I could, invite Biff Bradley up to do his presentation. I think what we ran into unfortunately with the subcommittees and we're running into here, too, is that unfortunately we're eating up all of the time.

DR. APOSTOLAKIS: Okay. So shall we move on?

CHAIRMAN BONACA: George, if you could end at 20 of one, it would be helpful because this will give us five minutes to go to the head before we get Paperiello here.

DR. APOSTOLAKIS: Oh, we've got time for him to come later.

CHAIRMAN BONACA: And then we have to have lunch, too.

DR. APOSTOLAKIS: I think we are already

into the details. So do we really need the foundation and the objectives? I mean, it's up to you, Biff. Jumping to Slide 4 or something, five. It's up to you. It's up to you.

MR. BRADLEY: Okay. Thanks.

Let me go ahead. I'm Biff Bradley of NEI. I also have at the table Wayne Harrison and Bill Stillwell from STP, who is one of our pilot plants of 4(b).

In the interest of time I'll try not to repeat anything that the NRC staff said, other than to say I generally agree with most of the comments that were made, and the areas that need additional work I would agree.

DR. APOSTOLAKIS: You put the word "most" as a defense in depth measure?

MR. BRADLEY: Yeah.

DR. APOSTOLAKIS: In case you disagree with one, but you --

MR. BRADLEY: It's possible, but generally speaking I'm in general agreement with the staff's presentation.

Okay. The only comment I wanted to make here is just all plants are required by regulation to have a configuration control program right now, even though we have the existing tech specs. That's (a)(4), the maintenance rule that went into effect in late 1999.

All plants use PRA. All plants use their internal events at power PRA as part of their (a)(4) program.

We have a considerable amount of experience doing this industry-wide already, and basically what we're talking about here is increasing the rigor of what we're doing as a tradeoff for getting additional flexibility in the deterministic tech specs.

I did want to mention also it came up earlier. Industry is ready whenever ACRS is to come in and give you a detailed technical presentation on the tools that we're using, the safety monitors and the other types of tools we're using to do this. This came up at the subcommittee meeting, and EPRI has a considerable amount of activity in this regard.

And just to reiterate, we have already done some preparation for that and just need to have a date set. We will be happy to come talk --

DR. APOSTOLAKIS: Are you talking about the full committee or subcommittee?

MR. BRADLEY: Whatever is your desire. We can do either, but as much detail as you want. We're ready when you are.

DR. APOSTOLAKIS: Okay.

MR. BRADLEY: On the objectives, just a couple of things I wanted to mention. With regard to the second bullet, one of the reasons we wanted to try to preserve the front stops in the existing format and content of tech specs was operators have been using these documents for, you know, 20 or 30 years, and we don't want to do something that just radically changes what the operators in the control room are having to deal with.

So there was an incentive there to try to maintain the existing form of tech specs, but at the same time allow this option to go to the configuration risk management AOT.

Also, it's not one of our objectives to either increase overall unavailability of systems or plant risk through this program. All we're trying to do is optimize the way we take equipment out of service and get flexibility where currently we're constrained by tech specs.

Over time this should not result in increased unavailabilities. There are a number of mechanisms out there that would preclude that, such as the other elements of the maintenance rule, the oversight process, particularly if we go to MSPI where you're having to track and maintain the availability and the reliability of your key safety functions systems.

So, again, it's not our intent to generally change the risk profiles.

I think the staff touched on all of the comments here. So I'll go on.

Pilot plants. We have South Texas here. Additionally we have Hope Creek, which is a BWR; Fort Calhoun, which is a small Westinghouse plant that's doing the HPSI -- either the two or three loop; I forget -- but they're doing the HPSI specific CEOG method.

We also have a number -- for some reasons we've got a lot of plants coming out of the woodwork showing interest in being a pilot. We have two additional plants that are seriously interested in being a pilot. I guess at some point we're going to have more pilots than we can work with here. So --

DR. APOSTOLAKIS: Can older plants be pilots?

MR. BRADLEY: I don't think so. That's NRC's decision as to how many pilots you can have, but there is certainly a lot of interest in this.

The risk management guidance as we discussed is developed by EPRI, and it basically builds on the existing (a)(4) guidance. That was our starting point.

As we talked about earlier, there's much work that remains to be done on this. We're not trying to claim this is the final form of the guidance. You mentioned a couple of areas where those are the kinds of areas where we have to flesh out a lot more detail in terms of things like credit for compensatory measures or qualitative/quantitative methods, blended methods, and how those could be used.

What we've discussed with the NRC staff is taking the existing version of the guidance and moving into the pilot phase and actually using the pilots to flesh out the additional detail.

PRA scope and quality obviously important for this initiative. Obviously internal events at Power and LERF will be a 1.200. We envision it as the capability Level 2 of the ASME standard as endorsed by 1.200.

We also believe you need to have a PRA for external events, including seismic, as well as fire.

One challenge for this initiative is that standards for fire, in particular, are a couple of years away, and then there's the time necessary for NRC to endorse that through a subsequent revision to Reg. Guide 1.200. So these plants are going to be ahead of the curve with regard to fire and possibly external events, and we will be in that box, the infamous box where plants would theoretically get low priority.

It was discussed that that won't happen here, but this is a good example of why that low priority thing doesn't always work.

Another thing, clearly you have to be able to quantify configuration risk. That's what your tool, your safety monitor, your pre-assessment database, whatever you're using; you have to have that capability, and that's going to have to be demonstrated, and to some degree we'll have to work with the NRC on the level of detail.

Another important aspect of this is the ability to determine and track aggregate or cumulative risk. Again, it's not our intent to increase risk over time. So we have to have a threshold and some trigger there to keep that from happening, and obviously you'll have PRA updating requirements as well.

Maybe STP will. I wasn't planning to actually show any numbers here, but I did want to discuss just in general the metrics that the EPRI guidance will be using.

One issue is whether you need -- and we've been through different versions of this so far, and I don't know where we'll ultimately settle out, but one question is do you need separate guidance for planned maintenance versus emergent conditions. Should you have a smaller window and then a little wider latitude if you have an emergent condition?

DR. POWERS: Excuse me just a second.

MR. BRADLEY: Sure.

DR. POWERS: Steve, do you have to take over? We have a conflict; we've got a problem. The Chairman just walked out of the -- oh, George is chairing. That's okay.

Sorry, George.

DR. APOSTOLAKIS: I'm -- okay.

MR. BRADLEY: There are three things that we're looking at, and these are exactly the same approach that's in the existing (a)(4) guidance. One is the temporary risk increase, that is, the integrated or the incremental core damage probability. Of course, this will be the same for LERF, and that's the integral of the risk increase over time that you have the equipment out of service.

Right now what we have in the (a)(4) guidance, it allows you to have an ICDP of up to ten to the minus five as long as you're incurring risk management actions or whether we'll maintain that same thing going into this remains to be seen.

DR. KRESS: That's each time you --

MR. BRADLEY: Yeah, for a specific configuration, ICDP is limited to ten to the minus five.

Now, obviously the question becomes how do you define a configuration, and one way is the way STP does it, which is to roll it up on a work week basis.

DR. KRESS: Is there any thought that those guidance acceptance criteria should be different for different plants?

MR. BRADLEY: Yes. I think it is possible that one size will not fit all plants because of significant differences in baseline risk values.

DR. KRESS: Yeah, yeah. So there is some thinking along that line.

MR. BRADLEY: Yes, yes.

DR. APOSTOLAKIS: Also, again, the EPRI document, two concepts that I don't know where they belong. One is that there will be a nice EDP of ten to the minus six, and that will be a target value, and then a ten to the minus five ICDP which will define the maximum.

So which one are you referring to here?

MR. BRADLEY: Well, I think that comes from the first bullet you're seeing here where you would plan to a ten to the minus six ICDP, but for an emergent condition you could go higher.

DR. APOSTOLAKIS: Oh, I see.

MR. BRADLEY: I think that's how those --

DR. APOSTOLAKIS: Aren't these numbers very low? Ten to the minus six, for heaven's sakes, is a way down there.

MR. BRADLEY: Well, an ICDP, for a configuration it's not. It's not what I would call really low. That's typically, you know, we're using numbers in that range right now in (a)(4).

DR. APOSTOLAKIS: This would be the mean value of something, I suppose.

MR. BRADLEY: Right. The second thing is what we call the speed limit in this slide, but basically that's if you were at the condition you're at. If you were there for an entire year, what would your CDF be, you know, and right now that's a ten to the minus three limit in the (a)(4) guidance.

And finally the cumulative risk. That's the over time, over an operating cycle or year or what have you. What is the delta risk that you've incurred through this?

And the (a)(4) guidance right now states that the permanent change criteria of 1.174 would be used there. So that was the small change criteria of 1.174 is ten to the minus five. A very small change is ten to the minus six. Again, we haven't gotten into the down and dirty discussions with the numbers yet with NRC, but this is generally how we have tried to do it.

The other important aspect of this is after you've assessed risk and determined what the risk of the configuration is, it's how do you manage the risk. You know, we talked about calling this risk management tech specs. Well, the big, important element of this is managing the risk, and there are many ways that can be done, and I've just listed some examples here.

One is take the existing action that's in tech specs, if it's shut down or whatever.

A real important one is planning and sequencing. For planned maintenance, obviously you want to plan your maintenance out so that you're not incurring risk spikes or, you know, you want to do that the smart way. That's really the whole point of (a)(4).

You can train and pre-stage to speed up maintenance activities and limit your time duration. So that will also limit your risk; can provide for rapid recovery; actually set the maintenance up so that you can get the equipment back to functionality quickly.

Another classic risk management thing is to prohibit maintenance on the opposite train, and then, of course, shut down the plant. That's the tech spec, and one of the challenges for our risk management guidance is factoring in, okay, when do you shut down.

Right now the (a)(4) guidance says one of the things you can consider is shutting down, but it doesn't tie that to any threshold, and ultimately for 4(b), we may need to tie it to a threshold.

So finally, in conclusion, it says challenging from the standpoint that it does clearly require a high quality and a fairly full scope PRA, and again, we're still working on the risk management guidance. We want to flesh that out through the pilots.

And NRC wants this to be exportable, to use Tom Boyce's phrase, to other plants beyond the pilots. So their challenge is to what level of detail do we capture all of this risk assessment and management in the EPRI guidance and in the tech specs itself to the point where we can export it to other plants.

So unless there are any questions I'll go ahead and turn it over to STP.

DR. APOSTOLAKIS: Go ahead, please. You have quite a number of slides here.

MR. HARRISON: A lot of them are review stuff that --

DR. APOSTOLAKIS: Can we do that in real time or is it a predetermined? Predetermined?

MR. WAYNE HARRISON: Absolutely. Okay. Let's go ahead and go to Slide -- well, I'll introduce this.

I'm Wayne Harrison, South Texas project, and Bill Stillwell from our PRA organization.

I'll go quickly over what our pilot application is.

Next slide.

As we said, we're an industry pilot. I

think the main thing I want to address here on this slide is that we've been doing this for a while, and the risk informed technical specifications, the question was asked about what's risk management. We looked at risk informed technical specifications as one part of risk management.

We apply configuration risk to a number of different things at STP, and this is just one aspect of trying to safely operate, safely operating the plant through risk management.

Okay. Next slide.

I think we've talked about all of those between Biff and the NRC. So let's go ahead on the next slide.

The scope and content of our technical specification pilot application is shown here. These are the components and functions that are covered in what is a pretty broad scope application. I'd like to point out that these are all covered and only covered in most one through four. None of these are in the shutdown modes of five and six.

And these were selected on the basis that they're all quantified in our PRA so that we can use the PRA to quantify the extended allowed outage time. That's how we selected this population of technical specifications.

Next slide.

This is our draft technical specification 3.13.1. This is our corollary of the comparable specification to what Bob Tjader showed on the standard spec. We're not an ITS plant. So this is what we were proposing, and each of those technical specifications you saw listed on the previous slides will have words that invoke technical specification 3.13.1.

Once we have determined that we're planning to go beyond the what is called the front stop time or what is the existing allowed outage time for any system we could apply technical specific 3.13.1. Now, as the configuration changes, we have the capability to requantify and reevaluate what the allowed outage time would be and manage to that.

Once you invoke 3.13 or once you're applying it for any technical specification, you would continue to apply 3.13.1 until no technical specification system is beyond its front stop time. In other words, you're back into your existing allowed outage time. Nothing is beyond its time.

Biff talked about when do you go to shutdown. This one, if you look at the last action here, the way we've structured this is our criteria is 1E to the minus five incremental core damage probability, and if we encounter a situation where we are above that threshold, then we would declare the action or the LCO not met for the technical specification that put us here and take the required actions of that technical specification, which would likely include the shutdown.

So that's our hook at this point, and that still, of course, will be under staff review. We plan to submit this next month.

The next page is just a sample specification. I'm not going to go through that in any detail. I'm just going to use this as an opportunity to introduce Bill and tell you that he's going to talk about or touch on the PRA quality. We understand that that's going to be discussed with ACRS this afternoon.

But he's going to give you, I think, some valuable insights into implementation. We already use risk metrics, as I said, for managing our work weeks, and we briefed our Operations Department, our operators, our licensed operators on this risk informed technical specifications. They're enthusiastic about this. They're accustomed to working in this kind of environment, and they're looking forward to using these.

So without any further discussion, I will turn it over to the man who knows the real story here.

MR. STILLWELL: I hope.

My name is Bill Stillwell. I'm the PRA supervisor at South Texas project.

Can we have the next slide, please?

DR. APOSTOLAKIS: No one is going to talk about this?

MR. WAYNE HARRISON: That one?

DR. APOSTOLAKIS: Let's go to eight.

MR. WAYNE HARRISON: You want to go through that?

DR. APOSTOLAKIS: Well, I'm trying to understand B.

MR. WAYNE HARRISON: Okay. Let me. B is an STP specific thing. Remember STP has three trains. B is a new action for STP.

Right now this only -- by the way, this only shows the LCO of this technical specification. We're not proposing to do anything to the surveillance requirements. So I'm not showing the surveillance requirements.

But right now we only have action alpha in this technical specification for essential cooling water. If we don't meet -- if we have more than one train of essential cooling water inoperable, we're in technical specification 303. However, because of the redundancy in our system and the capability of our systems, STP does not lose safety function with more than one train of ECW inoperable.

So it's appropriate for us to have an allowed outage time for more than one train of ECW inoperable.

DR. APOSTOLAKIS: But is B the result of an evaluation that involves the incremental core damage probability or is it just a safety, I mean, a deterministic thing. As you say, you know, we have three trains. We can do it with one.

MR. WAYNE HARRISON: Right. There's two answers to that. The answer to both those questions is yes. The one hour time frame is deterministic because right now that's consistent with the one hour in 303. So we're not going to debate the staff on what the allowed outage time should be for two trains.

DR. APOSTOLAKIS: So that's a front stop.

MR. WAYNE HARRISON: That's a front stop.

DR. APOSTOLAKIS: Okay. So where is the risk informed?

MR. WAYNE HARRISON: The risk informed part would be within that one hour we can either restore it or you see, we have the option to go apply the requirements of technical specification 313, which is this, and Bill --

DR. APOSTOLAKIS: Oh, 313 is a quantification?

MR. WAYNE HARRISON: Right.

DR. APOSTOLAKIS: Okay, okay. Go ahead.

MR. WAYNE HARRISON: And determine what an appropriate --

DR. APOSTOLAKIS: But where does it say that? Where does it say go to three -- oh, yeah, yeah, yeah, yeah. Okay. Go ahead.

MR. STILLWELL: Next slide.

Okay. I guess Reg. Guide 1.200 is going to be discussed this afternoon. As part of the risk informed technical specifications, we're also a pilot on implementation of Reg. Guide 1.200. As part of that, we are going to be making a submittal the middle of August that will discuss how we feel that we satisfy the requirements of the ASME standard and Reg. Guide 1.200.

As I understand it, in October the NRC will come and review the PRA quality, and at the end we will evaluate how well we think we did and how well the NRC thinks we did and are there any recommended changes to Reg. Guide 1.200.

At the same time we're going to define the quality that's necessary in the PRA to support risk informed technical specifications.

Everybody has mentioned that we've been doing this. We've been doing this since 1996. We use the program to satisfy the requirements of 10 CFR 5065(a)(4). In the program, we apply a non-risk significant threshold of one times ten to the minus six incremental core damage probability for our maintenance week.

The program also has a higher limit, one times ten to the minus five that's a potentially risk significant threshold. These thresholds are the same as those we were talking about for risk informed technical specification. In a couple of slides, we'll see what's the effect or what we have seen over the past six years.

We've had extensive experience applying the configuration risk management program. We routinely use it to manage weekly work, and we've effective applied that process to a recent extended diesel generator allowed outage that we'll talk about in a couple more slides.

I'm going to see if I can answer some of the questions and concerns that came up in earlier discussions. We are a precalculated configuration risk management program. At the same time we're also real time. It takes us eight minutes to do a calculation to support a change in maintenance configuration.

We have an on duty risk management person that gets a phone call within 15 minutes. If a configuration develops that's not covered by the existing precalculated, we have almost consistently gotten an answer back to the plant staff within an hour, no matter what time of the day or night.

Backstop. Just for information, all of our backstops are pre-analyzed on the system basis already. That will be part of the submittal that Wayne was talking about. In the submittal we looked at individual component or train configurations and all possible configurations on a system level. So we would look at Train A, Train B, Train C, and all combinations of those three.

The tool that we use and most tools that I've seen, I have the capability to reprioritizes and return to service. Arturo (phonetic) will give you a ranked list of components to return to service saying, "Do this for the biggest bang, this other one, and finally this last one."

You had a question on Reg. Guide 1.177 and whether this would be a 1.177. My opinion, and it's my opinion, Reg. Guide 1.177 would be used if we wanted to change a front stop limit rather than a pre-analyzed configuration. So Reg. Guide 1.177, the submitted would say apparently we have seven days to the front stop. We want to go to 14 days as a front stop. That would be Reg. Guide 1.177.

DR. APOSTOLAKIS: Any permanent change.

MR. STILLWELL: That would be a permanent change. These are not permanent changes.

DR. APOSTOLAKIS: Well, if they're predetermined though.

MR. STILLWELL: They're not permanent. We're only going to be there for a limited amount of time. We just happened to calculate a large number of --

DR. APOSTOLAKIS: What do you mean by "permanent"? Permanent means for the rest of the licensing basis.

MR. WAYNE HARRISON: I think what you find though is that the number of times that you will actually go in and apply risk informed technical specifications will be relatively uncommon per time per year. It's not like every time I --

DR. APOSTOLAKIS: No. I think the way I see, you know, the subcommittee we had didn't really go into details, right? It was a fairly high level overview of what's going on, and I think when we take up Mr. Bradley's offer and maybe organize another meeting where we're actually going into details like this, because we really don't have time today to get into that and the quality issues and this and that.

I really like Slide 11. How many utilities have done this? How many utilities have considered zero maintenance CDF and then added the CDF due to on-line maintenance?

I mean, this is a very interesting slide. It's not to scale, I hope.

MR. STILLWELL: It's not to scale.

DR. APOSTOLAKIS: Okay. Bill, what do you want to tell us about this?

MR. STILLWELL: Basically this is an example of one of the presentations the operators give. As we change the configuration, you'll see that we actually will present the speed limit, as it were. What is the absolute change of core damage frequency if you assume you're going to be here for a year?

So that would be equivalent to the ten to the minus three that's proposed.

CHAIRMAN BONACA: So the limit is what, two?

MR. STILLWELL: Two is, in this case, two times the face cord and frequency.

CHAIRMAN BONACA: I'm sorry? I didn't hear you. If you could speak.

MR. STILLWELL: The two is normalized. It's normalized to --

CHAIRMAN BONACA: So it's not a limit.

MR. STILLWELL: It's not a limit.

CHAIRMAN BONACA: Okay. The limit would be the lower.

MR. STILLWELL: The limit in terms of this scale would actually be higher.

CHAIRMAN BONACA: Higher?

MR. STILLWELL: In terms of the limit is ten to the minus three. That would be a factor of 100 for us.

CHAIRMAN BONACA: Wow.

DR. APOSTOLAKIS: No, no, no, no, no. Okay. So this is a time history, I suppose.

MR. STILLWELL: Right. This would be a

time history for an average maintenance week, as an example.

DR. APOSTOLAKIS: Okay.

MR. STILLWELL: And this is one presentation tool that the operators have.

CHAIRMAN BONACA: You said the factor of 100?

DR. APOSTOLAKIS: Yeah, because they're a very low CDF.

MR. STILLWELL: Our baseline core damage frequency is --

DR. APOSTOLAKIS: Three ring.

CHAIRMAN BONACA: I don't quite understand.

DR. APOSTOLAKIS: No, he didn't say that they were going to go a factor of 100, but the speed limit, if it were ten to the minus three, it's about a factor of 100.

MR. STILLWELL: You couldn't stay there long, you know, because you're going to hit your other metrics. You other metrics are going to quickly become controlling if you spend much time up in that vicinity.

DR. APOSTOLAKIS: In fact, on 13 you have the CDF, right? Slide 13. Look at that.

MR. STILLWELL: Let's go to Slide 13 if you can.

DR. APOSTOLAKIS: You see, it's on the order of ten to the minus five.

MR. STILLWELL: This is six years' worth of history of South Texas Project. Both units represented, and you'll see that maintenance actually goes up and down throughout the year for the plant. These are cumulative annual. So the '04 is weekly, and we track it on an annual basis. Annual core damage frequency modified week by week.

MR. BRADLEY: Is that the diesel outage on the --

MR. STILLWELL: The far right is the diesel outage that we just completed. We've been doing this since 1996.

The ten to the minus five average annual core damage frequency is actually based on our current model. It's not the average of the lines. So we calculate an average based on our current PRA and then it has just dropped down slightly. So the blue line is actually not an average.

CHAIRMAN BONACA: Now, you said that spike is due to the diesel outage? You don't have their own tech specs, or it allowed to take one out? You have three diesels?

MR. STILLWELL: We have three diesels.

CHAIRMAN BONACA: So you do have an ability to take it out even before you have this implemented.

DR. APOSTOLAKIS: I would be careful here using the word "spike." I mean, look at the scale.

CHAIRMAN BONACA: I understand that.

DR. APOSTOLAKIS: One, point, two; one, point, four.

CHAIRMAN BONACA: Yeah, but the spike gets back to the thread.

MR. REINHART: If it was a log scale you wouldn't even see it.

DR. APOSTOLAKIS: Yeah.

CHAIRMAN BONACA: He mentioned it. He used the word "spike," and that's why I referred to that.

DR. APOSTOLAKIS: I know, but Bill --

MR. STILLWELL: I'll clarify it.

DR. APOSTOLAKIS: -- I know him very well.

MR. REINHART: This is Mark Reinhart.

When you asked about that diesel outage, Mario, South Texas came in for an amendment request to have a one-time extension to do that.

CHAIRMAN BONACA: Okay.

MR. REINHART: So they used the 4(a) approach, but on an one-time extension.

MR. STILLWELL: And we'll talk about that in the last two slides.

DR. APOSTOLAKIS: Looking at the clock, you really have to wrap it up. So tell us what is the most important thing you wanted to tell us.

MR. STILLWELL: The most important thing. We have been doing this for six years.

DR. APOSTOLAKIS: Right.

MR. STILLWELL: We have been controlling maintenance in accordance with the limits that we're trying to establish or that we're working toward in the EPRI and NRC code. The intended one is ten to the minus six.

In the course of the six-year history, we have exceeded the ten to the minus six limit two times.

DR. APOSTOLAKIS: That's interesting. That's it?

MR. STILLWELL: That's basically it.

DR. APOSTOLAKIS: Well, gentlemen, I have to apologize for cutting short your presentations, but we will do what Biff offered in one of these months.

I guess you are coming to Washington quite a lot.

MR. STILLWELL: Right.

DR. APOSTOLAKIS: We're going to have a more detailed presentation. Maybe at some point when the staff will have had the chance to review that EPRI document and have detailed comments and so on, then it would be appropriate perhaps.

When do you think? What time frame are we talking about? The fall?

MR. BOYCE: Probably.

DR. APOSTOLAKIS: Probably the answer was.

MR. BRADLEY: We can certainly support that.

DR. APOSTOLAKIS: No, I know you can, but the staff. I would like the staff to have reviewed, to have had some time to review it.

MR. BOYCE: Yeah, I'd like to say the fall. As I understand, the submittal is going to come in next month. What we probably need to do is actually do a site visit, and we need to engage some of our inspection oversight type of people.

DR. APOSTOLAKIS: Okay.

MR. BOYCE: Because that's where we think the risk management guide really needs some of that inspection experience. So if the schedule holds, the fall would be pretty --

DR. APOSTOLAKIS: Maybe in the October-November time frame we can have a day subcommittee meeting.

MR. BOYCE: All right.

DR. APOSTOLAKIS: Very good. Well, do you gentlemen want to say anything else as a parting remark? Biff.

MR. BRADLEY: I think not. We've had a positive, constructive working relationship with NRC staff on this, and we hope to continue it, and we recognize it's probably a multi-year thing to get this in place. It's not a simple thing, but there's a lot of enthusiasm for this effort, and I think now that we have PRA standards and Commission direction on scope, I think it enables these kinds of things in a better way than we would have had in the past.

DR. APOSTOLAKIS: Very good. Back to you, Mr. Chairman.

CHAIRMAN BONACA: Thank you.

That was informative and a good presentation.

We will recess now until 1:45, and --

DR. APOSTOLAKIS: Two minutes?

CHAIRMAN BONACA: What?

DR. APOSTOLAKIS: Oh, 1:45.

CHAIRMAN BONACA: I said 1:45.

(Laughter.)

DR. POWERS: He's a PRA type. He came within an order of magnitude.

CHAIRMAN BONACA: So we don't need to be on record until 1:45.

(Whereupon, at 12:41 p.m., the meeting was recessed for lunch, to reconvene at 1:45 p.m, the same day.)

AFTERNOON SESSION

(1:59 p.m.)

CHAIRMAN BONACA: We're back into session.

And now we have on the agenda Reg. Guide 1.200 and SRP 19.1, and Professor Apostolakis.

DR. APOSTOLAKIS: Okay. We wrote a letter in September of 2003, in which we recommended that Regulatory Guide 1.200 be issued for trial use with a number of pilot plants. So the staff is here today to brief us on the status and findings so far from the five pilots, I believe.

So Ms. Drouin.

MS. DROUIN: Okay. Thank you.

I'm Mary Drouin from the Office of Research, and with me is Donald Haroldson from the NRR.

Just one quick correction. We haven't actually started any pilots. So we don't have any lessons learned at this point. So we're going to try and give you a status of where we are and what lessons we hope to learn from implementation of the pilot.

DR. SHACK: What lessons you should have learned.

DR. APOSTOLAKIS: Have you selected the pilots?

MS. DROUIN: Yes, yes. So we're going to get into that.

Okay. The first viewgraph.

Okay. So we're here just to inform you about where we are today, what the current activities are, what the pilots are going to be, the schedule for the pilots, what the actual applications for each of the pilots are. We're going to walk through that today.

I'll give you a little bit of background, go back over to remind you what were the objectives of the regulatory guide, the purpose of the pilots, what is the scope of the pilot applications with our staff review. This is a very important item here that Donnie will get into, and the schedules, and ultimately our conclusions.

Go ahead.

Okay. If you remember, back in April, I believe, of 2002, ASME published the standard for Level 1 internal events, full power, also including a limited Level 2 LERF. They also ultimately came out with an addendum about almost a year after that because there was a lot of interchange with ASME and the public in terms of our endorsement in the objections that we took in our draft guide of 1.200.

And we came to resolution on most of the objections. There are still some clarifications that we hope to resolve during the pilots.

Also there's NEI 0002, which is the PRA peer review process guidance that we have up there that most of the utilities have used. It's really much better than most. It's all of them except San Onofre have used this guide.

Also, in Regulatory Guide 1.200, we give our staff position on what NEI calls the self-assessment process where they have gone through the peer review criteria and compared it to the ASME standard and identified where there's discrepancies, where they're the same, and then for the discrepancies of the differences, they have some guidance, some self-assessment that the licensee has to do to bring themselves up to the standard.

In some of those we agree that the criteria was the same as the standard, but in some places we don't feel the peer review adequately addressed the standard, and so those we hope to also work out during the pilots.

SONGS did do a peer review, but it was following the ASME standard, and a lot of lessons came out of that. We actually made changes to Reg. Guide

1.200 based on some of those lessons learned. And we hope to work through more of those during the pilots.

Then we had a consensus plus, you know, the letter from your committee that said move forward; implement this for trial use for the pilots, which is where we're starting out. We're putting together the guidance for the staff reviews and scheduling out the pilots.

Next one, please.

Going back through and just reminding again what were the objectives of, you know, the regulatory guide, basically it's to address the question of PRA quality; that when we look at risk informed activities do we have the confidence in these base PRAs, the insights and the results that are being lifted from them in the decision making process. Do we have confidence in those?

DR. POWERS: Mary, I'm seeing your struggling enormously again to remember how it is that we declare a PRA to be adequate. I know that we can certainly look and see if the scope is sufficient, and we can certainly look at the databases that have been employed.

But how do we know that it's adequate? For instance, if it comes back and says, "Well, the reliability of this system is such that it fails ten to the minus third times per demand," and the system in question fails. We don't know anything, do we?

MS. DROUIN: I guess I don't understand your question because I would answer your question with another question. How do you know that you have any confidence in any engineering analysis, that it's adequate enough to support the application?

So my question is why is this question being -- it looks like you're asking it unique to PRA.

DR. POWERS: If I do an engineering analysis and it says that the member will stand up here and support the train that runs over it, and if the train runs over it and it doesn't support it, then I know it was inadequate.

MS. DROUIN: Well, that's one way.

DR. POWERS: I mean a lot of these things you've got pretty good proof one way or another. If I predict that two things are going to react together and put them together and they don't react, my analysis was not adequate.

And so I'm struggling here to know how do I know when a PRA is adequate or are we in this situation that Professor Apostolakis decried so eloquently that all we can adjudge is process, that we really can't judge product.

MS. DROUIN: I think personally that you can judge the product because we're not in a situation where we don't have any operational experience, and I think that when you go back and you look at your operational history of the plants, and you look at the data there and look at it in comparison to what your PRA has said, they aren't saying different things.

And I think those two together --

DR. POWERS: Yeah, but I mean that's -- the difficulty I have with --

MS. DROUIN: That's not any different than your train scenario.

DR. POWERS: Well, the trouble is that when I do deterministic analysis, I'm saying yes or no. When you give me your probabilistic estimate, if I ask you, in particular, you as an individual for the probabilistic assessment, you're knowledgeable enough that you're not going to give me a point value. You're going to give me a distribution, and then when I go and compare it against the data, the changes are it's a fair probability that it's consistent with the data.

MR. DONNIE HARRISON: And if it's not consistent with the data, that tells you something also.

DR. POWERS: Then you've got an answer. I mean, she's right about that.

MR. DONNIE HARRISON: Right.

DR. POWERS: I mean, the point was right. I'm just trying to think of the practicality of it. Do I ever come up with an answer or do I always come up with I can't -- I suspect I can only conclude that it's not inconsistent with the data is what I come up with most of the time, which is actually a pretty good conclusion.

MS. DROUIN: Yeah.

DR. POWERS: Okay.

MR. PARRY: Excuse me. Can I maybe add something here?

This is Gareth Parry from the staff.

I think in this context the assessment of whether a PRA is adequate is really more related to whether it conforms to good industry practice. I don't think we can --

DR. POWERS: I mean, that's George's process evaluation,a nd sometimes you get stuck there.

MR. PARRY: And there's the additional element of this that there will be a peer review also as part of this assessment. So in a sense it's whether it's in conformance with what your peers think is good practice.

DR. POWERS: Well, suppose that I'm Professor Wallis for a second and I worry enormously about the feelings and sentiments of Shakespearean scholars who know little or nothing about PRA, but they said these people have done this analysis and they're knowledgeable people and whatnot, and they declared it adequate, but I can't understand the thing they produced, and I can't understand the peer review, and I can't understand the assessment demonstrate to this poor Shakespearean scholar that it's, in fact, adequate.

And what Mary says is, well, you can't do it on the CDF, but you can look at the component data, the second tier of data that go in this and compare the predictions and whatnot against what you observe, and you get a conclusion that by and large is it's not inconsistent with the data; is that right?

MR. PARRY: At that level, yes.

DR. POWERS: One of the things I worry about enormously is the nuclear PRA community is of finite scope. They all know each other. They all go to the same conferences. They all sing from the same textbook, and they can all delude themselves in the same way.

MR. PARRY: This is true of any analysis that can't be directly --

DR. POWERS: Compared against it?

MS. DROUIN: Well, I hope we're smarter than that. I like to think we are, but maybe I'm deluding myself.

DR. POWERS: Oh, the capacity for the profession to delude itself is enormous. I mean, look what's been going on in stress corrosion cracking for the last 50 years.

(Laughter.)

MS. DROUIN: Well, why don't we go ahead and go to the next slide and get into the staff reviews? And at this point I'm going to turn the presentation over to Donnie.

MR. DONNIE HARRISON: I think as you all are aware, under the current way we review risk informed license and actions, there's a heavy reliance on the knowledge and expertise or experience of the reviewer to make sure he's looking at the right things and tracking to find where the problems are to deal with in the license application.

And during that, there is also a reliance on prior reviews, the peer reviews the industry has done, the IPE, IPEEE, the research reviews of those IPEs and IPEEEs, and then prior applications by that licensee.

Those all kind of feed into how the staff reviews a current risk informed licensing action. There's not much guidance beyond that.

As well, there's not that much guidance for what is expected of a licensee to submit to show that they've got PRA technical adequacy. So that's also part of the point of needing these standards and needing this implementation trial phase.

Go ahead.

DR. POWERS: You're looking at this reg. guide and whatnot, and the industry has this peer review that they swear by, and it's being widely used. I mean, just about everybody is using it and using it repeatedly. Every time they refine the PRA they do it a little more detailed or another application and they go through another peer review and get this assessment.

Which one is controlling? Is the reg. guide to be? I mean, your standards that you're setting up are to be kind of the minimum, and the peer review process that the industry has set up goes beyond that where it can.

Do you have any idea?

MS. DROUIN: I'm not sure I still follow your question when you talk about minimum. The standard does have a minimum in it, but when it comes down to looking at the peer review, you know, you're going to have to do it in concert with the application. So what you need for that application may not be the minimum or what we would call Category 1.

MR. DONNIE HARRISON: And the peer review itself may actually, if you follow the NEI guidance, you may get a range for different areas, different grades, and so it doesn't necessarily give you a minimum or a maximum. It gives you a score, if you will, for each of the different areas, and then you have to look at those areas in the context of the decision you're trying to make and say is that area important and is it influencing the decision I'm trying to make.

And if it's not, then you can tolerate, if you will, a lower quality analysis or maybe even a bounding analysis in that area. Whereas if it's important, you may want to say, no, I've got to have a good analysis here to be able to buy off on this decision.

So it's highly dependent, and I don't think a peer review establishes a minimum. Like Mary has said, I think that the standard actually has three levels, and --

DR. POWERS: Which I'll transparently admit that I've quite understood, but that's okay.

MR. DONNIE HARRISON: That's fair.

DR. POWERS: This is not the forum to try to explain it to me.

MR. DONNIE HARRISON: And believe me, I wouldn't try to explain it. One of the things that I think we're trying to do in this trial phase is look at the standard and look at the reg. guide and see if we stumble over problems, interpretations, and especially things that go across levels.

Is it really true that, you know, some of these areas truly go across capability categories or are there some of them that you should have a demarcation that distinguish one level of quality from another within a certain area?

But that's part of the pilot. That's part of what we're trying to do.

DR. POWERS: One of the things that the rotations in the regulatory field worry about is the distinction between compliance with a regulation and self-policing; that when you create a standard with a regulation, people come up and meet that standard, and there's no incentive really to go beyond that.

Whereas without a standard and putting reliance on this peer review process that's employed to decide whether something is qualified creates an incentive for innovation and improvement. Have you thought about that?

MS. DROUIN: I agree that the peer review is a mechanism for creating innovation because as you look at things, you learn more. You find out, oh, well, it wasn't quite the way I thought it was or you think of a better idea or you notice something is wrong or whatever.

I think using a peer review as a mechanism to determine what you have done, how you've gone about doing it meets the intent of what you wanted, is an efficient way to go. It has its disadvantages, but I think it has more advantages to it than disadvantages.

DR. ROSEN: Having seen one fairly close up, I can say that it creates a lot of peer pressure to improve. That's a partial answer.

MR. DONNIE HARRISON: And I think if you look at some of the experience during the peer reviews, there were cases where licensees in the early phases of this process thought they had good PRAs. The peer review came in and actually kind of surprised them with lower grades than they expected, which put the licensee into, if you will, a fairly aggressive --

DR. ROSEN: Walking around smug and complacent, and they come in and you end up with 72 action items.

MR. DONNIE HARRISON: Right.

DR. ROSEN: Holy mackerel.

MR. DONNIE HARRISON: And I think what that did at least for a couple of licensees is it kind of woke them up and made them go off and actually end up with a second peer review because they wanted to show that they were actually not as bad as they thought they were good, and they wanted to get that finding.

So I think the peer review process if done correctly can do that, and it brings the whole industry up by doing that, recognizing there's flaws in the process whenever you do that.

If we can move on to the purpose of the pilot, there's listed here about six different items. The first one is just saying that there's things within the reg. guide and the SRP that make observations or clarifications to the ASME standard.

There were some things where if you will I guess I would characterize them as disagreements between the standard writers and the staff when it comes to the term "significant" and how you define "significant."

And so we want to use this pilot to get at that, and we want to look at the interpretations of the requirements and see if we both, us and the industry interpret things the same way.

And then there was a question early on about documentation needs. I know in a meeting we had in November of last year with the industry they pointed out that the reg. guide in its documentation section could be misinterpreted in some places, and if you will, I'll count that as a lesson learned. We corrected that before we published the reg. guide. So we took that feedback in the November time frame and changed the documentation section of Reg. Guide 1.200 so that it was a little clearer for the industry to understand.

Some of the other things that we're trying to do here is we're trying to assess the licensee self-assessment process to see how effective that is. This is the self-assessment they do between the NEI 002 review and the ASME standard. So they have to look at the difference between those two things.

They did a peer review. Now they've got a standard and they need to bridge the gap. So we want to look at that and see how they do that. It's an opportunity to look at the scope and level of detail, the licensee application specific submittals and the scope and level of detail of our reviews.

Part of the efficiency that is expected out of the standard is that we will have more efficient reviews and more focused reviews, and they won't have to go as detailed in certain areas. So that's a hope. That's one you pursue.

In the process of doing this, I'm sure we'll identify things that need to be changed or revised or clarified within the reg. guide, within the standard review plan, even in the standard, the ASME standard or the self-assessment guidance that NEI has developed.

We're also going to gain some insights into how many resources, how much effort is involved in doing one of these reviews, and I think the licensees are going to learn a great deal of how much does it take to develop a license application that meets the standard, that meets the reg. guide.

And then these insights that we gain during this pilot I think will be helpful in the development of the other standards and how we handle those and implement those. So the ones on fire, external events, low power and shutdown that follow, we'll learn from that.

Okay. Now, the scope of the pilots. There's five pilots. The first one that's coming in is Columbia. It's a risk informed tech spec. They're doing a diesel generator AOT. They call it a loud completion time extension. Its intent is to extent the allowed completion time to 14 days, as long as they've established some risk management actions, what we'll refer to as compensatory measures.

The way their tech spec is laid out, during the first 72 hours, which is their traditional time, they have to put these compensatory measures in place and have them ready, and after they do that, then they can extend the outage to a 14-day outage. Otherwise they have to follow the way they do things now.

DR. POWERS: On this particular piloting, they will, of course, have an extensive seismic PRA?

MR. DONNIE HARRISON: No, no. The scope of this pilot -- maybe that's in my next slide or one of my earlier ones. Yeah, we'll just jump to there -- the pilots are actual risk informed submittals. Okay?

So we have to write an SE that talks about the submittal, to approve the submittal of which a small piece of which is PRA quality for technical adequacy, but the pilot is only focused on the standard that we have endorsed in Reg. Guide 1.200, and that standard is a full power Level 1 PRA plus LERF.

The other aspects, the external events, lower power shutdown will still be reviewed as part of the application, but it will be reviewed like we review applications today, because we don't have an endorsed standard that's been approved and issued in the reg. guide.

DR. POWERS: I mean, if somehow a plant within 200 miles of Mount St. Helen's, it strikes me as one that seismic can be a fairly important determiner and how long it can have its emergency diesel generators out.

MR. DONNIE HARRISON: I'm sure that will be a topic as part of the review. I'm just saying that it's not part of the pilot. So that issue will have to, just like lower power and shutdown, has to be dealt with just like fires has to be dealt with.

So you're right. You have to deal with it. It's just that it's not within the scope of the pilot. It's in the scope of the application.

And one of the points I have on here is when we have the future standards are developed and endorsed, then I would expect we would go through that process, a pilot process or something like that as well, where we would test them out or could do that, but at this stage we don't have that. So we're doing what we have with what we have.

The other aspect, and I'll just hit on this while this slide is up here, is that because these are pilots and we're trying to exercise the entire standard, use the entire reg. guide even though, for example, Columbia is a diesel generator AOT extension, we are going to look at things that are unrelated to that application that are in the PRA standard.

So the SE will be on the standard, but the pilot will actually go beyond the application because we want to exercise the full breadth of the reg. guide.

DR. ROSEN: I assume the people who are submitting this understand that.

MR. DONNIE HARRISON: They understand that very well, and if I'm incorrect, Biff will correct me.

MS. DROUIN: Let's put it this way. We tried to make it clear, and we have verbalized it numerous times.

DR. ROSEN: Maybe they'll listen.

MR. DONNIE HARRISON: Well, as an observation, I think I would say we've already seen one lesson is as licensees have gone out to develop the documentation to support PRA quality or technical adequacy, they're seeing it as a -- I think they're coming to realize it's a bigger thing to do than they thought originally. It's taking longer to develop the submittal and to do the evaluations than they originally thought.

So one of the reasons why we haven't got moving too fast on this to start with is because the submittals have not yet shown up. That's going to change next week.

Limerick is a risk informed tech spec. It's a 5(b) initiative. This is where they're moving the surveillance test intervals to a licensee control document. I just put on here that they're not moving surveillance requirements. The test intervals are going to be based on a risk informed process. So it's a process review.

SONGS will be coming in a risk informed tech spec as part of a batter replacement, and they're going to reconfigure their DC power system. What it's going to try to do is to allow an on-line cross-tab of DC subsystem within a train for up to 30 days for maintenance and replacement of the batteries.

DR. ROSEN: A temporary change, not a permanent change, right?

MR. DONNIE HARRISON: The battery replacement is temporary, but the tech spec will be permanent. This will be --

DR. ROSEN: The tech spec will be permanent, but you said they're going to reconfigure their system.

MR. DONNIE HARRISON: They're going to reconfigure it permanently.

DR. ROSEN: That reconfiguration is permanent?

MR. DONNIE HARRISON: That's a permanent reconfiguration. What they're doing is they have four batteries, and the way the tech specs are laid out, they want to split them in the trains so you'll have an A train and a B train with two batteries each, and they're going to gain, again, the idea of being a three-day AOT because they can take a battery out and still have train DC.

DR. ROSEN: Well, they're making a design change under a pilot of a reg. guide?

MR. DONNIE HARRISON: Well, no. Again, this is a real application, a risk informed application. So we're going to do a safety evaluation of that application. It's just that it's a piloting of the aspect of the PRA technical adequacy.

DR. ROSEN: Okay. So you're going to do a safety evaluation for the change. It's going to be judged against Reg. Guide 1.174.

MR. DONNIE HARRISON: Right.

DR. ROSEN: In terms of delta CDF?

MR. DONNIE HARRISON: Right, and --

DR. ROSEN: For a permanent change.

MR. DONNIE HARRISON: For a permanent change.

DR. ROSEN: Okay, I guess.

MR. DONNIE HARRISON: And, again, that's the point of all of these. These are all license applications. I would say the only one that is probably pseudo not a license application is the next one, surry, which is a 10 CFR 5069 application. We don't have the rule yet. So it's hard for them to have a license application. They're piloting the industry guidance on 5069. And hopefully once the rule goes out it would be a fairly quick turnover if they had done this and we've accepted it to actually implement it then.

DR. ROSEN: And what's the scope of their 5069 application?

MR. DONNIE HARRISON: It's only for a couple of systems, but within 5069, if I can regress, it's a process review. So even though they may only do it for a couple of systems --

DR. ROSEN: It's a process.

MR. DONNIE HARRISON: -- we're approving the process. Once the rule goes out, it would be a process approval. So the systems are just to demonstrate how the process works.

DR. ROSEN: But they would still have to comply with the rule when the rule would come out.

MR. DONNIE HARRISON: Right, right. You would have to send in a license amendment.

MR. DONNIE HARRISON: Right, exactly, a license amendment. We would review the license. Again, I would assume if we're part of the pilot, at least on PRA on technical we'll be ahead of the game when that pilot comes in.

And the last one you heard this morning at least briefly from South Texas, their 4(b) initiative. So that's the five applications we're actually looking at.

I'll skip that one.

I put this slide in here because I think we needed to understand some of the -- when we're trying to schedule these pilots, some of the things we had to think about, trying to do this within a one-year period, and as we move along we're kind of doing it in about seven months.

We have been having regular meetings and we plan to continue to have those meetings. We've held two general public meetings with the industry and the pilots. We've also had for the first three applicants, we've had individual meetings with them to talk about their application and in that context talk about PRA technical adequacy within that context.

We plan to continue to hold regular meetings about every couple of months while the pilots are going on so that we can feed back lessons learned to the other pilot applicants, and they can feed us what they're getting out of this as well.

The second bullet just recognizes we're doing multiple -- there's multiple licensees involved. We're doing different kinds of applications. We're using multiple staff reviewers, and we need to make sure we get efficiencies in those reviews such that we don't end up affecting all the other work that we have to do.

So there's other risk informed licensing actions and rulemaking that's going on, and we need to make sure those things aren't impacted during this process.

And as much as possible, because of all that, the trial application reviews are going to overlap. So we're going to gain efficiencies from one review and move it to the next and just have an overlapping process going on.

And as an example, here's the near term schedule for the pilots. Like I said, next week we expect to get an application from Columbia. I think by the end of May right now at least we're supposed to be getting something from SONGS and Limerick. We're going to go out to Columbia the week of June 7th. We're supposed to get a trial application submitted from Surry. I think that's been postponed, that one, as I heard this morning, that it's been postponed a few months.

The status meeting we'll hold at the end of June to go over what we learned during the Columbia visit. I think Columbia is going to be a good trial for everyone. It will help the staff to go out on a visit to learn about how they conducted the visit and what maybe to change in future visits to do these reviews.

The week of July 12th we're supposed to go to Limerick. The week of August 9th, we're going to go to SONGS. At the end of August we're supposed to get the application or some time in August; I think it's mid-August actually we're going to get an application from South Texas for the 4(b) initiative.

DR. ROSEN: Go down there. It's a lovely time in South Texas.

MR. DONNIE HARRISON: Well, we're planning actually not to go there until October, see.

MS. DROUIN: At the earliest.

MR. DONNIE HARRISON: At the earliest, yeah. Mary is in control of that schedule.

MS. DROUIN: And as somebody who was born and raised in Houston, I know you don't go down there before October.

MR. DONNIE HARRISON: And then we plan on having another status meeting at the end of August.

DR. POWERS: You've got to suffer when you work for the NRC, and you've got to love it.

MR. DONNIE HARRISON: And in this case we can kind of control our own destiny.

And the last one I'll leave off her and

pass on to Mary. Appendix C of Reg. Guide 1.200 was to be issued by the end of August, and that appendix is for the external events, ANS external events standard. So with that I'll pass on to Mary.

MS. DROUIN: Yeah, I just want to go over the overall schedule of 1.200 because as we look to next year of when we're going to publish it as Rev. 1, you know, there's other parts to 1.200 than just Appendix A and Appendix B.

We do have Appendix C, which will have our endorsement of the standard. That standard came out. We're in the midst of reviewing it. We've gotten various comments from the different offices in the agency and comments from the regions. So we're pulling together our staff comments right now and trying to sort through them.

We hope to go through some public meetings through the summer and discuss it and then finally go with formal public review and comment by the end of August on Appendix C.

Go through that process so that ultimately as we go through the pilots we are looking to have all of our lessons learned from the pilots by December, the end of December.

That doesn't mean that we would wait till the end of December to start modifying the reg. guide. You know, as we learn something we'll do it, but to try and have all of our lessons learned and our changes made to the reg. guide by the end of December so that we would go out on public review and comment for Rev. 1.

So what I'm saying is we're doing two public review and comment periods, one in August, but that will just be on Appendix C of the reg. guide, and then we will go back out on public review and comment on the entire reg. guide in January with issuing it at the end of April. So in between there, you see, I have some question marks there for ACRS. We were thinking of coming back to the ACRS in November of this year where we would talk both on the external events and also what lessons learned we've had on the pilots to that date.

Then go out for public comment I said in January. We would ultimately want to come back to the ACRS in March because in order to issue Rev. 1 of the reg. guide we will need a letter from the ACRS approving that publication.

We'd also have to go to CRGR also in that time period, and we've interspersed public meetings through the process.

So I kind of jumped around in trying to explain the schedule, but there it is. Now, Donnie, do you want to wrap up?

MR. DONNIE HARRISON: Yeah, I'll do the first two and you can do the last two.

MS. DROUIN: Oh, okay.

MR. DONNIE HARRISON: I'll make a point before we conclude though. Again, the focus here is on the PRA technical adequacy guide. So in these applications when they come in, conceivably our source of the pilot is broader than the application. So we could find PRA technical adequacy issues that may have nothing to do with the application, and we would identify those, but it wouldn't stop the application. So the application may still be approved even with that, in that situation.

Likewise, you could have an application not succeed for deterministic review reasons, and yet the PRA technical adequacy part of it would move forward. So that's just a recognition of what can happen in the process.

And just to conclude, we're just now embarking on the trial implementation phase really, and it's going to involve some actual license risk informed applications.

MS. DROUIN: And as I said earlier, you know, we have a lot of things that we're looking toward in the pilots to help us on some outstanding issues to revise in the reg. guide. Donnie mentioned probably the most significant one is coming to a determination of what should be the definition of the term "significant."

And then just looking at, you know, how are these requirements being interpreted. Hopefully there will be some resolution on places where we still have objection. I mean, my personal goal is I'd love to have an appendix that says no objections so as we can resolve all of these and come to an agreement on them, it would be ideal.

I'm also hoping that as we go through these pilots that we get some good lessons learned that will really help us as we implement the next set of standards. You know, this has been a very challenging piece of work to do, and hopefully we aren't going to repeat some of the same mistakes and make the process a lot more efficient as we endorse and implement the external events and as we go into, you know the internal fires and low power shutdown, that those will go a lot smoother from what we've been through on the ASME standard.

DR. ROSEN: What do you think about the idea that the term "significant," the context around it, that something is significant if it would impact the decision making process. If it's not going to change the decision or have an impact on the decision making process for the context, it's not significant.

What do you think about that?

MS. DROUIN: That is one explanation you could use, but I think that can be difficult to use that kind of definition when you're getting into a requirement that says, you know, "Don't do this. Only do this for your significant ones."

How you write that into the standard when you don't know the application.

DR. ROSEN: It's only good after the fact. It's not good as an a priori.

MS. DROUIN: Yeah. But you know, it could be that as we go through the pilots that we become creative enough to write something of that order. I mean, I don't know. I mean, I feel as though it has to be quantitative, but we're certainly open to try and find a qualitative definition.

DR. ROSEN: Well, see, something like that would be consistent with the history of development of the standards. It has always been application driven.

You know, here's how good a PRA you need to do this, not just how good a PRA you need, period. Because you don't need a PRA at all.

MS. DROUIN: I wouldn't agree that when we wrote the standard that it was application driven. I mean, when you decided to write what the requirements are, for example, on your systems analysis or your initiating event, we certainly didn't think, "Oh, we'll write this requirement because of this application."

We wrote the requirement because that was needed to achieve the objective of that technical element.

MR. DONNIE HARRISON: But if I can maybe agree with you, there's two different things going on here. There's things that are significant to a decision and then things that are significant within an analysis.

The problem we have is we're using the analysis and making a decision, and if you separate the two, then you end up with different definitions of what's significant. You have to have different definitions because you don't know the application, and that's part of it. It's not a problem, but it's part of the issue with the word "significant" within the PRA technical ASME standard. It's just what is a good PRA, and what are the elements that it has to have.

DR. APOSTOLAKIS: Well, we are a regulatory agency. I mean, we make regulations.

MR. DONNIE HARRISON: Right.

DR. APOSTOLAKIS: So that ultimately has to support regulatory decision making.

MR. DONNIE HARRISON: Exactly. I agree with you. It's just that within the context of writing what does a PRA need to have, you would write one thing, and then how you use it in making a decision is different.

DR. ROSEN: Right. I know. I'm not so sure that that's separable. You know, I could hold a good tennis racket in my hand, and you could look at it and say, "That's a pretty good tennis racket," with the thought that you have in your head that I'm going to use it to play tennis.

But if my intention is to go hit Noland Ryan's fast ball, it's probably not good enough.

MR. DONNIE HARRISON: I agree, but what you would say in that case is that that is quality tennis racket. Its implementation is not good, but yeah, I can agree with you.

DR. ROSEN: I'm not convinced of that. I think it's context driven.

MR. DONNIE HARRISON: Fair enough.

DR. APOSTOLAKIS: Are you done with this?

MR. DONNIE HARRISON: Yes.

DR. APOSTOLAKIS: So any discussion?

That's what it says here, and it also says that Donnie would do that.

(Laughter.)

MR. DONNIE HARRISON: I'll do a forum. Everything is wonderful. The staff is doing great.

(Laughter.)

MR. DONNIE HARRISON: They all need bonuses.

MS. DROUIN: I like that part.

DR. SHACK: Okay. We'll add to your work load.

DR. APOSTOLAKIS: You don't know where you're starting?

DR. SIEBER: He's starting from scratch.

MR. BRADLEY: I don't have a presentation. I'm going to be quick. I'm going to get you guys back on schedule today, hopefully.

We have the five pilots that have put a tremendous effort into this project. This is an important effort for the industry. We spent over five years developing the ASME internal events at power PRS standard; spent nearly two years working on the reg. guide to endorse it, and I think that speaks to the challenge of trying to write a standard for PRA.

And now we're at the most important part of all of that, and that is taking that and taking it out of the office building and putting it out in the field somewhere and trying to make it work out in the plant.

And I guess it's safe to say there's some trepidation about this. We now have hundreds of PRA requirements, the level of detail, and the need for a more systematic consideration of every element of the PRA is evident, and we expect this to be a fundamental change to the way applications in the past have been performed and reviewed.

So we don't see this as a minor change. This is really a step change in the regulatory process and in the evolution of getting risk methods into regulatory space.

The Commission wrote an SRM to the staff on PRA scope and quality, and this is the first step of moving in the direction of that SRM going into the Phase 2, as the staff calls it, of the implementation, and it's not a baby step. this first step is a big, three foot step we've got to get over. The internal events at power is the -- all of the PRAs are important, but this is the central one, the most important.

So I think so far this has gone well. We've had good interactions. I think we understand where we are, what our expectations are for each other, and the plants have certainly put a huge effort into this. The plants do not want this to fail. They do not want this standard to become a reason for protracted reviews or problems. We all want this to succeed.

The ASME standard and the Reg. Guide 1.200 do set a high bar, capability Level 2. What's evolved is a PRA described there. There is really no plant that the U.S. currently has, but it can be achieved. Much of that is in the area of documentation, and it's reasonable to expect you should have good documentation.

The plants that have -- the pilots that have been working on this have put in some cases, you know, man-years into documentation, trying to come up to the standard.

You know, despite the fact there is some trepidation about this, I think at the same time we all hope that this will enable more significant applications. I think applications like 5069 probably just wouldn't have been feasible absent standards. We all recognize we need standards to move forward.

There are issues of interpretation in the standard. I was at the San Onofre peer review, as were some here, and plants have interpreted elements of the standard differently.

The real interpretation that matters is what is NRC's interpretation. What is the regulatory expectation? That is the only interpretation that the vast majority of plants out there care about, and that's what's going to emerge from this pilot process.

Right now we have a standard, you know, but at the end of this process, we're going to have a much better understanding of what is the expectation for that requirement. What does the regulator think that you have to do to meet that?

And that's what we'll get out of this. We're going to have to communicate this to the industry at large before the reg. guide becomes final next year because at that point this will apply to every application and every plant going forward, and so we have a major communications job once we're done with these pilots, taking everything we've learned and getting it out into the rest of the plants.

So I think that's pretty much all I have to say. As Donnie said, the real rubber meets the road starting next week when we get the Columbia 200 page on the docket application, and we hop that's just a pilot thing and that doesn't set a precedent for what every plant will have to do forever. Certainly I don't think we want that.

But we recognize the pilots are going to have to have more submitted, and that's just what's on the docket. We have archival documentation that probably exceeds that by an order of magnitude or more.

So, again, you know, this isn't a minor thing, and so far so good, but the real part is just now starting. So it should be an interesting the rest of the year. We're going to be really busy.

It's a very aggressive schedule for the plants and for NRC to get through these five pilots over the next year.

Any questions?

(No response.)

DR. APOSTOLAKIS: Okay. Thank you very much, Biff.

MR. BRADLEY: Sure.

DR. APOSTOLAKIS: Well, Mr. Chairman, we're back to almost ahead of schedule.

CHAIRMAN BONACA: You are very valiant.

DR. APOSTOLAKIS: I run this with an iron hand, I'll tell you.

CHAIRMAN BONACA: You pressure these people so hard.

DR. KRESS: Valiant.

DR. POWERS: There wasn't enough interest to actually have this session is what you're trying to say.

CHAIRMAN BONACA: Well, I think we have 25 minutes before --

DR. KRESS: Sort of like stress corrosion.

CHAIRMAN BONACA: -- our break. So we'll do two things. One, we'll take the break, longer than normal.

Let me just before we -- first of all, I think we should go off the record until the next presentation, which comes at 3:30.

Second, I would like to just make a head count of the reports that we can work on tonight.

(Whereupon, the foregoing matter went off the record at 2:50 p.m. and went back on the record at 3:28 p.m.)

CHAIRMAN BONACA: We are back into session.

And the next item on the agenda is good practices for implementing human reliability analysis, and Dr. Apostolakis.

DR. POWERS: What is this, the Apostolakis day?

DR. APOSTOLAKIS: Yeah.

CHAIRMAN BONACA: Yeah, today is his day, although --

DR. POWERS: My didn't you assign him MOX and then he could have a clean sweep.

CHAIRMAN BONACA: That's a good idea.

DR. APOSTOLAKIS: We had the subcommittee meeting where we discussed the good practices document, and we also had another presentations, but today we will just talk about the or we'll hear from the staff on these good practices document. It is supposed to be a general document, not tied to a particular model for human reliability analysis, and eventually it will be part of Regulatory Guide 1.200, right?

MS. LOIS: Supporting regulatory --

DR. APOSTOLAKIS: Supporting acceptable

approaches for determining the technical adequacy of PRA. So --

DR. SHACK: Another appendix?

DR. APOSTOLAKIS: Another appendix.

DR. SIEBER: This will be Appendix K.

MS. LOIS: I don't think it will be an appendix to regulatory. It will be a supporting document.

DR. APOSTOLAKIS: A supporting document?

MS. LOIS: On how to perform human reliability.

DR. APOSTOLAKIS: Okay. So we can start with Dr. Lois, I guess.

MS. LOIS: Thank you.

Good afternoon. My name is Erasmia Lois. I work for the Office of Research, Probabilistic Risk Assessment Branch.

And with me today is John Forester of Sandia Laboratories, and Alan Kolaczkowski will not be able to be with us today physically. However, he is available through the phone. He is the primary developer of the good practices.

Also I would like to recognize the contributions of Gareth Parry, who recommended to do the good practices document, and he has been helping out with working closely with Gareth and Alan in general.

And Susan Cooper, who is not with us today, but she is also part of the staff.

What we'll do today, I thought it would be good if I provide a broad overview of the HRA activities so that the committee recalls what we're doing there, and then as Dr. Apostolakis said, discuss in detail the HRA good practices.

We intend to release it for public review and comment in July, and we would like the committee approve and agree with and go ahead and release the document.

DR. APOSTOLAKIS: So you are requesting a letter.

MS. LOIS: We are requesting a letter.

In general, what issues we tried to address by the HRA research program, the first issue is the HRA implementation. As a matter of fact, this HRA quality issues, PRA/HRA quality is an important activity at the NRC, and as part of that, we're also putting our efforts, but also we have developmental activities. Later development is one area that we're focusing a lot.

The NRC has new needs. For example,

applications for materials and waste or new reactors, therefore. We're focusing on expanding or developing new knowledge base for human reliability, and also we're addressing specific regulatory issues.

And the next chart is a viewgraph, you know, graphic representation of our activities. The HRA guidance reference documents are on the bottom. this is probably the bulk of our research program currently.

However, we're also, as I said, developing data. Data is one of the important limitations of the HRA state of the art. HRA state of the art has not matured at the level of detail, has not reached the level of maturity or some other areas in PRA. Probably the primary limitation comes from the fact that we don't have exact data in terms of number of failures versus the number of demands.

What we tried to do here is collect information that exists regarding human performance and develop methods that would help us use the less accurate data, but informative data.

We are developing a repository which we call HERA, and currently we're focusing on populating the repository with licensee reports, operational experience and simulator experience, and in the future we'll try to expand to open psychological literature and non-nuclear experience.

In terms of methods, I'm highlighting ATHEANA. We have a small effort in making ATHEANA implementation more user friendly, addressing serious concerns on ATHEANA being cumbersome and, therefore, not easily to be used by non-ATHEANA experts.

I mentioned the Beyesian quantification of rushes (phonetic) that go hand in hand with the data development. We do plan in the future to review other second generation methods like MERMOS and CREAM for the purposes of taking advantage of what they have in terms of modeling human performance, and if we're going to develop a third generation human reliability analysis method.

As I mentioned, we have to expand our knowledge base for human reliability, and these are some of the things. The bullets here represent some of the activities.

The less yellow color indicates that these are more future activities than current activities, but the human reliability research program is planning to address related conditions, true performers, ex control room reactions, slowly evolving events that describe the advanced reactor work, and also low bar (phonetic) shutdown operations, and severe accidents, the steam generator tube rupture PRA will force us or is forcing us to address that.

DR. ROSEN: So you left the bullet off ex control room actions then.

MS. LOIS: Yes, I did.

DR. ROSEN: Okay. That's not crew performance somehow. There are five bullets under that.

MS. LOIS: It's five bullets.

DR. ROSEN: Now, what I'm surprised and I don't see anything of is organizational issues. When you think about the future.

MS. LOIS: We went to the Commission with a request to allow us to go back to organization factors and organizational issues. We haven't had the approval yet.

In actuality we cannot address this issue yet.

DR. ROSEN: In what?

MS. LOIS: The Commission --

DR. ROSEN: Yeah, I heard the first part.

MS. LOIS: -- must tell us, must allow us to address the issue.

DR. APOSTOLAKIS: Because it has

explicitly disallowed you?

MS. LOIS: Explicitly stopped the work about ten years ago.

DR. ROSEN: So you have a current request into the Commission to allow you to begin in the context of human factors analysis or human analysis --

MS. LOIS: Human cycles, human performance.

DR. ROSEN: -- yeah, to consider the -- it's like a fisherman who knows everything about fish and knows nothing about the ocean to do human factors without knowing anything about the organization in which the fish swim.

So to me it's important to be -- you know, it's not something you're going to do overnight. It's just something you begin to consider. You understand the literature. You understand what's going on and you begin to get into that horrible issue of safety culture.

But I really think that it's just unwise to close our eyes to this

MS. LOIS: In actuality we do believe that the Commission will let this go ahead. We think in preparation, I guess, since a year ago due to Davis-Besse and other higher priority activities. Jay

Persensky has the lead, and I think NRR has the lead for it.

The EDO had some comments, came back to the staff, and we were not able to address the EDO's comments to go to the Commission. So there are two things.

One is the staff was not able to bring it back to the Commission, and the Commission was not able to -- and, therefore, we don't have the go-ahead yet.

However, I do want to remind the committee that in the early '90s or mid-'90s we were doing a lot of work in organizational factors, and we do have two NUREGS ready to go out to be published, and that represents a lot of work in the area. It isn't that we haven't done a lot, and that work is really current.

In terms of actual applications, the good practices and the HRA method review addressed primarily licensing issues, Reg. Guide 1.174 types of licensee applications.

We are developing to the extent we can -- we use HRA insights to support various activities. An example her is the fire manual actions. We tried to address in ACRS recommendations. We tried to provide human reliability insights and reliability framework in that activity, but again, as I mentioned, the HRA guidance is an activity that we're going to talk about today.

And again, to provide a broad perspective, the HRA guidance consists of three documents. Document one would be kind of a publication, a high level summary of the HRA state of the art, and we plan to have it ready to December, and document two is the one that we're going to talk about today, and we would like to go to public review in July and finalize it by December.

And then we're going to, starting in January, we'll start developing -- evaluating first and second generation methods with respect to the good practices.

Within that review we'll try to encompass HRA methods that have not been developed in the United States. However, licensees may use it, and that includes MERMOS, CREAM, et cetera. So it will be a broader review than just --

DR. APOSTOLAKIS: But why does it take so long, Erasmia? December '06. And you guys go to workshops. You listen to each other. Why should it take two years?

MS. LOIS: It will take at least one year. These are many methods. It will take at least one year to have a good draft, and then come to you, having the peer review, incorporate public comments. This is going to be at least -- I envision that this is going to be much more voluminous, much bigger document than the HRA good practices.

Now, as you remember a comment we made at the subcommittee meeting was that the good practices document should be viewed by the principles of other methods, and rather than doing things in the reverse order here, should we have this document first, evaluating what's out there before we write the good practices document?

MS. LOIS: As a matter of fact, that's how we started out. We started out looking at -- we started out evaluating the existing methods with respect to Reg. Guide 1.174 applications, and we started saying, "This is good. This is not good," et cetera, and then we figured it out, good or not good with respect to what, your opinion or my opinion?

So the good practices in a way is the standard, is the agreement among the HRA practitioners that, yes, these are the principles for the employment of good HRA. Once we agree, as you had mentioned in the subcommittee meeting, you recommended a broader review than domestic review, and we are going to do that.

So incorporating the comments from the more general HRA-PRA community then we will have an agreement that these are good practices, and then we will be able to evaluate the various methods with respect to -- I think it's --

DR. APOSTOLAKIS: Well, it could be the other way.

MS. LOIS: -- to what extent the various methods can meet or cannot handle the --

DR. APOSTOLAKIS: By the way, as you know, there was a special issue with the journal with the papers from the Munich workshop. Were you there at the Munich workshop?

MS. LOIS: I was not. I was not part of it.

DR. APOSTOLAKIS: But one of the papers by Strata (phonetic) and others, with a title on "The Way to Assess Errors of Commission," does, in fact, some of these things in different context. What is interesting is that they give a categorization of the existing methods, and there are three categories: task and activity related approaches, condition related approaches, which I think is ATHEANA, is the context issue, and cognition related approaches, which is I think somebody else's.

So there is a lot here in this paper. Again, the motivation is different. It's how do we collect data, and they say in order to collect data, you have to have some idea of it, but a lot of what they're saying here is really very relevant to this issue of what kinds of models are out there, and then the next that would be good practices and so on.

And I was very pleased to see this. There is no American quoted though for some reason.

MS. LOIS: Well, all of --

DR. APOSTOLAKIS: Unless it says ATHEANA you guys don't participate.

MR. FORESTER: John Forester, Sandia Labs.

I was at the Munich meeting, and so I'm familiar with it.

DR. APOSTOLAKIS: Yes, but you're not an author.

MR. FORESTER: No, I'm not an author on your paper, no, but we've talked a lot.

DR. APOSTOLAKIS: Well, I think you get credit at the end.

No, but what I'm saying is that people

have already started thinking about this, you know. What are the common elements. There's a figure here that has the top -- in fact, the top part of the figure is exactly what you're trying to do, and then they're saying, "Now, here is another model which is ATHEANA, how it handles these things." So it's very useful, very useful. I mean, we didn't have the resources.

MS. LOIS: One clarification is that the good practices address current state of the art. I mean, we've talked a little bit about that in the subcommittee. To the extent that, yes, we look at the errors of commission as beyond the state of the art, but probably what you recommend here, it would be like probably the next step, third generation methods where we would sit back and we'd go and we'd review everybody else's method in a collegial way we'd develop the method that encompasses the good aspects of --

DR. APOSTOLAKIS: Yeah, but that's for the future.

MS. LOIS: Yes.

DR. APOSTOLAKIS: I mean, for this particular document, I recommend that you have a peer review right away.

MS. LOIS: Yes.

DR. APOSTOLAKIS: Yeah.

MS. LOIS: But I doubt that those ideas will get into this document.

DR. APOSTOLAKIS: Well, I mean, there is a group of methods that is related to cognition. Now, those guys may tell you, well, it's a good practice to worry about ABC, and then you decide whether it, in fact, would be a good practice.

Because this document now is really very much influenced by ATHEANA, which is not surprising, you know, but --

MS. LOIS: You mean the current version.

DR. APOSTOLAKIS: Yeah, the current version. So getting some input from those people. Are you going to talk at all about the plan? You said you are planning to have this peer review, or this is it?

MS. LOIS: This is it. I think John is going to --

DR. APOSTOLAKIS: So this PRA review will take place --

MS. LOIS: In July.

DR. APOSTOLAKIS: -- in parallel with the public comment period.

MS. LOIS: That's right. As part of the public comment period we will request non-domestic entities that are recognized in the HRA area --

DR. APOSTOLAKIS: Why not also domestic?

MS. LOIS: Domestic is given.

DR. APOSTOLAKIS: Oh, I see. Okay. So it would be a formal peer group or you will them individually?

MS. LOIS: We have to think about individually. You just recommended and we haven't thought about it, but we plan to do that.

DR. APOSTOLAKIS: Okay.

MS. LOIS: Okay. With that I will ask John Forester to do the presentation.

DR. APOSTOLAKIS: Although, just a last comment. When we talk about cognitive models, it's worthwhile to repeat what Dr. Kress said at the end of the subcommittee meeting. Throw everything that is related to the operator's mind out of the report.

DR. KRESS: I did.

DR. APOSTOLAKIS: That's going to be the advice. He doesn't want to get into anybody's mind.

MR. FORESTER: I'd like to first address the issue that's been underlying the work we're doing. As you know, PRA/HRA is being used. It's being used to assess risk associated with current operating conditions, for example, pressurized thermal shock, as Erasmia mentioned, possibly steam generator tube rupture, severe accident induced steam generator tube rupture, fire scenarios, and so forth.

So since a human is an important -- can be an important contributor to risk, it's also important to insure that the HRA quality is good. So HRA needs to sufficiently represent the anticipated operator performance, and the support of that NUREG standard review plan 19 is noted that modeling of the human performance needs to be appropriate.

In addition, the reg. guide for PRA, Reg. Guide 1.200 cites and reflects the ASME standard and industry documents related to what kind of things should be done. So they address what to do, but there's less in those documents on how to do it.

So that's what we're trying to address, is to provide better guidance for how to do these things.

So our solution then is to develop the HRA good practices as we've talked about, and the goal is to have something that's useful obviously for practitioners, people that are doing HRAs, but also non-experts such as possibly reviewers and NRR that's going to be reviewing submittals for plant changes and so forth.

And incidentally, that's another way HRA is currently being used is for plant changes and the risks associated with plant changes.

Okay. So we developed the nature --

DR. APOSTOLAKIS: During the subcommittee meeting that I think one member -- I don't remember who -- said that maybe this is too ambitious to have a single document both for reviewers and practitioners, do you remember that? And that perhaps you will need additional guidance for reviewers?

MR. FORESTER: That may be the case. You know, I guess that's part of what Reg. Guide 1.200 is trying to do, is a specific guidance for the adequacy of the analysis, and this type of document, you know, assuming you could read this, it would give them some insight about what to look for in reviewing those documents.

You may be right. They may need more specific guidance, but this should be a useful guide at some level, I would think.

DR. APOSTOLAKIS: Right.

MR. FORESTER: So as Erasmia mentioned, we're developing the good practices, and that's what we'll discuss today.

DR. POWERS: John, a couple of months ago, Jay Persensky came down to us and talked about a document they had prepared to describe some screening methodologies for human factors examination of licensee applications. Does that document provide a hint that you need a similar sort of thing for the human reliability analysis of licensee applications, a screening kind of technology, or is that part of it or --

MR. FORESTER: I think this would be considered part of that. I mean, I'm not familiar with exactly the work you're describing, but certainly guidance for how to assess human factors issues.

DR. POWERS: What was identified then is licensees submit an application that involves some sort of human activity. They would consider the human factors in kind of a rote fashion, whereas what you really wanted was to spend a lot of time on the things where human factors were important and blow off the things where human factors was there, but just not very important in the operation, and so they needed some sort of screening methodology to know how to devote their time.

And they came up with this approach that seems like it's reasonably successful in focusing their attention on the things that are important.

Similarly, I would just presume that there are lots of licensee applications that have something to do with human reliability in which human reliability could be quite low and still be quite acceptable; others where the human is very critical in the success of the operation, and so one would obviously want to screen those things, to look at those things, looking at the best practices and whatnot in great detail if human reliability were very important and maybe not so much if it did not matter.

I'm just wondering if there isn't another thing on your to do list here or another aspect of the to do list that Jay has pioneered something that we could look at.

MS. LOIS: This document is kind of going hand in hand with the one that Jay created. That document helps more to what extent, how much effort the staff should devote to reviewing all of this activity or request.

DR. POWERS: Okay. So it really covers what you're doing here.

MS. LOIS: But assuming now that some of the requests have been considered important to be reviewed, then if it's a risk informed request, these documents will help the reviewers.

DR. POWERS: Okay. So these things are not independent of each other.

MS. LOIS: Absolutely, and we're working on inter --

DR. POWERS: I just have to say I thought that that was a singularly good concept that Jay had come up with then, and I would think that the agency would be just cheering like crazy over it because he's finding a way to optimize the resources devoted to these reviews, and that seems like a good idea to me.

MR. FORESTER: Okay. This is just a little bit now the bases and the approach for the HRA good practices, of course relying on the SME standard and industry documents that address, again, what are the high level things that need to be done. That, of course, provides some general guidance, and we want to provide more detail for that.

What we're doing is based on existing HRA methods and tools that are out there to describe these issues that talk about HRA processes, insights from the literature, reviews of PRA and HRA applications. Both myself and Alan Kolaczkowski were an author on this and participated in these applications.

So we have experiences from reviewing it, from reviewing the applications and in conducting the applications also, and of course, we're relying on the reviewers of the document for additional support for the basis of the good practices.

So our approach then has been to get consensus from the experts at the NRC in terms of what we're doing. It will be in your internal NRC reviews, ACRS feedback about what's contained in the good practices, and as Erasmia has said, we're going for public comment and input from the international HRA community.

In terms of the scope of the good practices, the good practices themselves address reactors at full power, internal events analysis, but in reality these good practices should be useful for anyone doing a PRA whether it's for eternal events or other kinds of modes of operation.

The idea is that, you know, these are good practices in any case. What you might need for additional applications, for example, external events or low power and shutdown would be additional information that might need to be done, but I wouldn't expect to find any inconsistencies between what we say. This should generalize I guess is the point I'm trying to make.

We do not endorse a specific method or tool. The good practices should fit with any HRA method that's being used. I will say that in terms of some of the issues, the quantification level, for example, some of the existing methods might have to be adapted somewhat to some special cases, but again, this is meant to be method free.

And we have linked it to the ASME standard. In fact, in the document we summarize the high level ASME requirements so that you can see where the good practices fit with respect to the requirements in the standard.

And as part of the guidance we also provide some impacts of not performing the good practices correctly. Now, in most cases that addresses things like, well, you'll be in complete or your model will be inaccurate and, therefore, your assessment of risk might not be exactly right.

But we talk about that, and we provide additional remarks on how to make sure that the good practices are achieved, and again, we focus on the HRA process as opposed to things like data.

When you see the actual HRA good practices document if you haven't, it's organized by logical analysis activities. We begin by talking about the overall or general good practices and then move to the pre-initiator human events. Pre-initiators are operator actions or maintenance personnel actions associated with calibrating instruments or restoring systems. So these are actions that if done incorrectly could make systems unavailable in case an initiating event occurred. So we want to provide guidance for how to model those pre-initiating or how to identify the pre-initiating events, how to screen them, how to model them, and how to quantify them.

Similarly, we address the post initiator. Once an initiating event has occurred, the operators want to strive to restore the plant to a safe condition. We talk about how to identify those events and provide guidance for that, how to model them, how to quantify them, and then address how to add recovery actions to the model.

There's also a section in the report that addresses errors of commission and how to document your HRA results.

DR. SHACK: But it does this not in the context of particular models; just general discussion.

MR. FORESTER: General discussion because we're really focusing on the HRA process here. so there's a lot of activities associated with doing the

PRA and HRA as opposed to just focusing on quantification, for example, which is what most HRA methods focus on doing the quantification process.

DR. APOSTOLAKIS: They do develop structure and don't put them down.

MR. FORESTER: I'm sorry?

DR. APOSTOLAKIS: HRA methods do not necessarily focus on quantification.

MR. FORESTER: Not only on quantification, no, but many of them will not provide a lot of guidance for how to identify human failure events or how to put them in the models, and so forth. There are exceptions. You know, there's SHARP-1, the SHARP work that was done by EPRI which provides some of that kind of guidance, but again, that was more of a framework for doing HRA as opposed to a specific quantification process, to just slam more -- the THERP kind of quantifications.

DR. APOSTOLAKIS: Does the whole community agree with the terminology "human failure events"?

MR. FORESTER: Well, you know, it seems to be being used by most everyone at this point when you see it discussed in the literature and so forth. That seems to be a fairly common terminology.

MS. LOIS: ASME has endorsed the human

failure event image.

DR. ROSEN: But doesn't this structure lend itself nicely to the discussion of issues raised by organizational environments?

DR. APOSTOLAKIS: Sure.

DR. SIEBER: It certainly does.

DR. APOSTOLAKIS: In fact, I wanted to say the Commission has vetoed research programs whose sole purpose is to study organizational, cultural issues. I don't think the Commission has ever told the staff, "Do not consider organizational factors in the context of human reliability."

In other words, if it's an element of a bigger picture, I don't think there is a -- no, but what Erasmia was referring to, there were projects back in the '80s and '90s that had the title, you know, organizational such-and-such-and-such, and the Commission said no.

DR. POWERS: I can't imagine me splitting a hair like that with my boss.

DR. APOSTOLAKIS: No. You know --

DR. POWERS: I think I would ask him if I was splitting the right hair before I went ahead and did it.

DR. ROSEN: Well, a pre-initiator --

DR. APOSTOLAKIS: No, there's a difference there.

DR. ROSEN: -- on identification. Let's take that one for an example. Organizational issues can dramatically affect the ability of an organization to identify, you know, conditions that are pre-initiated. I mean, it's classic, right?

DR. APOSTOLAKIS: Sure, sure.

MS. LOIS: So in a way the HRA and PRA include some aspects of organization performance, but not explicitly, and not probably to the extent that it should.

Even equipment performance, if you do a true plant specific analysis and in the case of a high unavailability of important systems, one could infer from that that because of corrective action problems, maintenance problems, et cetera. So you have that aspect, the organizational aspect in your PRA without explicitly addressing it.

However, you have the capability to do a better job, and that's what we are working on. Now, the title probably was misleading and probably the commission overreacted by saying organizational practice and PRA or HRA.

But it isn't that it's totally absent, but it's not as much as we could have if we had contained the work. That's all.

MR. FORESTER: Yeah, there's one area in particular I'll discuss where we do try and get at some of the organizational influences. There's another areas that we actually do not have in the good practices, but based on the subcommittee meeting I think we should include where with respect to pre-initiators and the identification process.

There's not a discussion in there about the fact that we do look at how the organization schedules the work, you know. Do one train one day, another train a different day? How do they use their crews? And so there are aspects that we do look at that's not in the document, and I think those should be --

DR. ROSEN: With the idea that they're trying to avoid common mode or common cause failure.

MR. FORESTER: Exactly. So we do look at it in that sense, but with respect to attitudes and things like that.

DR. SIEBER: Standards.

MR. FORESTER: We don't really do that.

DR. ROSEN: You certainly need to address this. I mean, we're going to write a letter on this then.

DR. APOSTOLAKIS: When the reactor safety study was published, it was all Beyesian, but you won't find the word "Beyes" anywhere because it was controversial.

There was a footnote in one of the 11 volume, "Sometimes this approach is called Beyesian, but we're not going to use that term." So we use some organizational factors, but call them something else.

MR. FORESTER: We just addressed the specifics of it, I think, and that's what we're doing now to some extent, but definitely more needs to be done.

Okay. So now from this point on I'll be discussing examples of --

DR. APOSTOLAKIS: Is it correct to say it's not a disciplined or multi-disciplinary?

MR. FORESTER: I would say multi-disciplinary would be better.

DR. ROSEN: Disciplined is what they have.

DR. APOSTOLAKIS: Yeah, the HRAs discipline.

MR. FORESTER: You're right. It should be multi-disciplinary.

DR. APOSTOLAKIS: Okay.

MR. FORESTER: So from this point on I'll be discussing the good practices at a general level and we can get into detail as much as you'd like. We can begin by talking about general good practices. We emphasize the importance of having a multi-disciplinary team participate in conducting the HRA. It should be an integrated effort with the PRA.

So the idea is to have operators, trainers, procedure writers, PRA people, systems analysts, and so forth participating very early on in the PRA. You know, it's a bit of an exaggeration, but in the older days I think a lot of what was done was the system analysis guys, engineers would identify what went into the models and then they'd ask the HRA folks to quantify the events.

Well, obviously I think the role of the operator should be considered much earlier, and the right people should be involved in doing that, be involved with the guys doing the TH work because what the human can do can affect the timing events. So again, the main point is we want an integrated effort.

DR. APOSTOLAKIS: I think this is a good point to discuss in the context of this report that Dana raised earlier that Jay has developed. I'm not sure you guys have thought about it, but if I were to do -- when I should do this, in the baseline PRA that Jay takes and finds the importance measures and tells me here are the important human actions on which I have to spend more time? But I have already spent the time, or should I first do it crude analysis and then after I have identified the important human failure events, I go and do all of this?

It's the issue again that, as you know ATHEANA was criticized for a few years ago, voids. It's the Rolls Royce of human reliability analysis. It costs an arm and a leg. You don't expect anybody to do it. So do we need a phased approach and tighter coupling with that document?

I don't know myself, but I mean, if I have to do all of this from the beginning, then you are defeating the intent of the Persensky report.

MS. LOIS: I will let Alan Kolaczkowski, who is obviously awake --

DR. APOSTOLAKIS: Is he here?

MS. LOIS: He's on the phone.

DR. APOSTOLAKIS: Oh.

MS. LOIS: Alan?

MR. KOLACZKOWSKI: Yes, hello. Alan Kolaczkowski.

MS. LOIS: Do you want to answer the

question?

DR. APOSTOLAKIS: Did you hear the question?

MR. KOLACZKOWSKI: No, I did hear the question and I understood it.

I do recognize that as you say, Dr. Apostolakis --

DR. APOSTOLAKIS: Wait, Alan, wait.

Can you hear him?

THE REPORTER: Not real well.

DR. APOSTOLAKIS: No. Can you take the microphone and put it there?

You will be recorded. You know, when you're on the phone and being recorded, don't you have to alter the guy?

Go ahead. Alan.

MR. KOLACZKOWSKI: I heard the question and I understood.

(Pause in proceedings.)

MR. KOLACZKOWSKI: Should I try again?

DR. APOSTOLAKIS: Yes.

MR. KOLACZKOWSKI: Is this working better now?

DR. APOSTOLAKIS: Yes.

MR. KOLACZKOWSKI: Okay. I think the

intent of this first one is not so much to tell people when they have to do it. In fact, that's true of all of the HRA good practices. It's not that every good practice is always applicable. One has to look at what is the scope of work that they're doing and when it makes sense to apply these good practices or not, and that's is stated, testified earlier on in the document.

However, I think the intent of this good practice is that not the extent required if you are going to model human failure events in the model, whether it's in the base PRA or whether you're doing some application five years later and you're going to use the PRA for that application and you're going to revisit certain human failure events on the model and adjust them, perhaps modify them, perhaps add others to the model, whatever; what you're saying is it's good practice to not have just the -- again, I'll maybe stress the point a little bit -- not do it the way we did it in the olden days when we just had the system engineer decide what the event ought to be, the time it put in the model and then have the HRA person go and quantify it, but it really should be a collective effort with input from trainers, from operators, et cetera, deciding what the event ought to be, how it ought to be defined, when it's applicable in the model and when it's not.

We think that's a better practice, if you will and is something that ought to be done whenever you're adding or modifying events.

DR. APOSTOLAKIS: Okay. I understand that. Let me ask all three of you: would you be amenable to or agreement; would you find it agreeable to add the paragraph in the introduction making the connection of this document, between this document and the other document and maybe say a few words after you think about it a little bit?

I'm not asking for a major revision, but I think we cannot issue one report that says, you know, use importance measures to find the important ones and then have another one that says here are the good practices because a reviewer might say, you know, "I don't care what Persensky says. The good practices document tells me to do this. So I'm going to do it everywhere."

MS. LOIS: Gareth wants to --

DR. APOSTOLAKIS: Gareth wants to confuse the issue. Okay.

MR. PARRY: Hopefully to clarify it. This is Gareth Parry.

I think there's a slight misunderstanding here. What Jay Persensky's document is is basically related more to what level of human factors review should I give to, say, a new human action that might be taken to replace an automatic action or something like that. It's really a very specific event.

To that extent, the way he uses the PRA results is that the PRA is used to assess the importance of that particular human action, which may, in fact, no even be in the base model because it may be something that's replacing a piece of hardware.

I think all of these good practices are really related to how you do the base PRA which helps Jay decide how much resource he has to spend on reviewing that particular action, depending on how risk significant it is.

At that point it may be some of that might feed back into a revision of the model.

DR. APOSTOLAKIS: Well, I think that a paragraph or two would be helpful making the connection.

MR. PARRY: It may be helpful, but --

DR. APOSTOLAKIS: You may say that if you want, but as you know very well, people who actually do -- well, people who do PRAs, at least in the old days, wouldn't go to the full blown Level 2 uncertainty analysis immediately. They would start with a point estimate, identify what's important, and then focus on those.

So it seems to me that Jay is trying to do something similar, you know.

MR. PARRY: He is trying though to --

DR. APOSTOLAKIS: He disappointed your reviewer, yeah, yeah, but why should I have to do everything that's in the good practices document even for human actions that will turn out to be insignificant?

MR. PARRY: And I don't think you do. I think the way the document is structured is it allows you to screen out certain things.

DR. APOSTOLAKIS: There is a screening phase. That's for sure.

MR. PARRY: And allows you to go into as much detail as you want.

DR. APOSTOLAKIS: Yeah. Anyway, I think a paragraph, summary, introduction would be helpful. Okay. Alan?

MR. KOLACZKOWSKI: Yeah.

DR. APOSTOLAKIS: Good.

MR. FORESTER: Okay. Next we emphasize

the importance of actually going to the plant and participating in the analysis and getting a real sense of what goes on there by doing talk-throughs, walk-downs of, for example, ex-control room actions, if the operators have to leave the control room to carry out certain things. You would definitely want to observe those and look at the timing associated with them.

And there's a heavy emphasis on doing simulator exercises. Again, you can't simulate, watch simulator exercises for all of the sequences you're analyzing, but you can learn an awful lot of important information about the way the crews interact, about how they use their procedures, how they implement the procedures, what their attitudes are about various actions they may have to take, whether they feel they're supported, I guess, by management in terms of their ability to decide what to do.

So again, you can use simulator exercise to get a lot of information and be relevant to what you include in the model and how you quantify it. So we emphasize the importance of that.

And then the final general good practice. They just not that HRA should consider both core damage and larger releases.

DR. KRESS: Would you be amenable, using

George's word, to just striking out the third one? Because all it does is place limits on it, and it doesn't add much.

MR. FORESTER: It wouldn't bother me. I guess the concern is not everybody always looks at larger or considers human actions related to larger --

DR. KRESS: I know, but if you know it's for a PRA and a PRA does that, you're putting limits on it here, which I don't think you want to do because there are other things besides CDF and large early release.

MR. FORESTER: That's true. That's a good point.

Okay. So now we're moving into some of the good practices associated with the post initiator human events. We begin by, you know, we have this basic book, basic processes, and the first is associated with identifying the pre-initiators. The good practices provide guidance about what to address, what to review. For example, they want to review the test and maintenance procedures, calibration procedures, any kinds of activities that's associated with equipment that's going to be credited in the PRA. So procedures and actions associated with those, with that equipment should be modeled.

So the notion is what to review. Anything that is going to render equipment unavailable, then you're going to want to review the procedures and how those things are addressed at the plant.

Another point that we emphasize is what to include. We try and talk about what kind of things should be included in the model. Particularly important are single or common mode actions that could affect redundant or multiple diverse equipment. So if an action could affect both trains of the system, for example or, again, they're diverse equipment. You want to make sure those kinds of actions are included in the model.

You still might include single actions that affect the single component, but we do provide some guidance, and we'll talk about that later for how to screen some of these types of things out so that you don't have to model and quantify everything that's involved, but there are a few things you do need to make sure you include.

And of course, the impact -- we'll address the different impacts of these things -- is that if you don't do the right reviews and you don't include the right things, then you may have incomplete or inaccurate models.

Next.

Good practices address how to focus the analysis on the most important contributors. This relates to what Dr. Apostolakis was talking about. We provide criteria that would allow them to say we don't really need to model this action. We don't need to address it.

For example, if you have a system that gets a signal to realign when something goes wrong so that if the crews -- the only thing that could happen here is they could just leave it misaligned. If there's an automatic signal that realigns it, then you don't really need to model that. You can be confident that, you know, for most cases you still have the system.

Similarly, if there's a compelling signal in the control room that a valve was left in an inappropriate position or a system wasn't restored correctly or something, then again you probably don't need to model that because the probability of it being unavailable is so low that it's not necessary. So there's other criteria that we provide, again, to help them screen out these different kinds of initiators.

Again, we emphasize not screening out things that will affect multiple equipment, and then we also make a note about that if this is a -- for example, a licensee may have submitted a change, a plant change, and the PRA is going to examine that. Well, if in that analysis certain pre-initiators were excluded, then with the plant change though you probably need to revisit those to make sure that they are not relevant now or that the change didn't affect some assumptions you made earlier on.

The good practice, that it address how and where to include the pre-initiated events in the model. So you know, within PRA you're building event trees and fault trees. It's fairly easy. You can be logical in terms of -- the logic can be correct in terms of where you place things, but in terms of traceability, potentially understanding dependencies between those actions and so forth, there's guidance about trying to tie the different actions to the component or the system or the function or whatever that's being addressed to make sure they're in the right place and you'll have good traceability.

Another related good practice is when it's okay to combine multiple individual acts in a single event. So restoring the system, for example, might involve multiple actions. In some cases, you might be able to treat that as a single human failure event.

In other cases it might be a better idea to break it apart to some extent and provide guidance for when it might be appropriate to have the subtasks or sub-events essentially.

You know, if the acts and the effects are going to be the same, if all of the performance shaping factors are going to be the same, and there's no potential dependencies between some aspects of the overall task, then you can probably treat them as a single human failure event. So there's guidance there, again, to help in the modeling process.

There's essentially eight good practices that address quantifying the pre-initiators. These are some of the main points. Folks are learning how to do detailed analysis of the events that were not eliminated during the screening process. We focus on, again, emphasizing the importance of revisiting that screening analysis when you're looking at plant changes and so forth or new submittals that change the base PRA.

It talks about what performance shaping factors could be important for pre-initiators to make sure they address the right things. You know, the primary method that is used for pre-initiators is a set third (phonetic) technology, and there's guidance in there, and this just reemphasizes, you know, the important ones such as having written check-offs and how often the plant changes and whether there are signals in the control room and so forth.

And then there's some guidance given for deciding whether the probabilities are reasonable. You know, when you look at this particular probability for an action and another reaction, does it make sense? Is one of them fairly complex? Does it have a probability that -- the other one may be very simple -- you know, does one have a higher probability of failure than the other?

So this is guidance for how to check and make sure that the probabilities are reasonable.

And now we're moving into the post initiator human failure event and good practices. Again, we start out by giving guidance about how to identify post initiators, what to review. You know, you've got to look at the emergency operating procedures because now we're looking at actions associated with responding to initiating event.

Abnormal operating procedures, enunciator and alarm procedures. So if it's possible that you might get an alarm and there's a particular procedure or action indicated by that alarm; if the alarm is wrong, could that lead to possibly taking an inappropriate action?

So, again, it emphasizes what kinds of procedures should be reviewed and how to consider them.

Examining training material to understand how the operators are trained to respond to particular events, and of course, doing simulator runs so that you review the procedures. You review what the control room does. You look at simulator exercises and try and get some idea about plant philosophy with respect to how operators should respond in that particular scenario.

And then we provide it again trying to give them some general types of actions that they should expect to be included. Obviously if there's an automatic start of the system expected, then there are going to be modeling failure of that other start, and then the model and the human action to manually initiate the system.

It addresses non including heroic actions and emphasizes that all of the actions should be procedure based. So no non-procedure based actions. So, again, the idea is to give them guidance about what to include or not include.

I think in the handouts you may have we noticed right at the last minute that a couple of pages were out of order. We're now going to page number 18. I think 20 got in the wrong place.

Okay. So we're on Slide 18, which is modeling post initiators.

Again, we're talking about how to include these actions in the model and what level. Is it a functional level? Should it be modeled relative to the system, the training of the component?

The basic event needs to be linked to the equipment that's going to be affected, and is the poor performance related to the train and what's going to be effective.

It also points out that the modeling should be based on plant and accident sequence specific characteristics. So where you include an action in an event tree, for example, it depends on the sequence timing. When is the action going to be relevant? What are the cues going to be for the actions? How are the procedures and the training represented in terms of when that action might take place?

Where the action has to take place could be relevant where it's model, and of course, insights from the simulation and walk-throughs and so forth. So again, it helps them understand the things they need to consider in order to be able to include these things in the models.

And the next slide here addresses how we quantify post initiators, the guidance we'd give them. The good practices address the importance of modeling both cognitive and execution failures. So if the control room has to diagnose the need to take the action, obviously that should be included. It could be a particular failure probability associated with that.

But you also have to look at the execution failures. This is a very simple task where you're simply turning a switch in the control room. I mean, that execution failure may be fairly low probability, but in other situations it could be fairly significant. If there's ex control room actions involved, possibly throttling various kinds of injection systems might be a little trickier than others. So, again, it's just emphasizing the importance of the need to consider both cognitive and execution.

DR. ROSEN: Failure to diagnose in the control room is a crew activity, right?

MR. FORESTER: Yes.

DR. ROSEN: So you'd have to have the probability of the whole crew, not just --

MR. FORESTER: That's correct.

DR. ROSEN: -- not just one individual.

MR. FORESTER: That's absolutely correct. We talked about I shouldn't say the crew, in fact, rather than the individual because --

DR. APOSTOLAKIS: In fact, I wanted to make that comment. It seems to me that when it comes to evaluating crew performance, we are not really up to date, are we?

We tend to treat the group as one entity, and in many instances this is not quite right. So --

MR. FORESTER: That's true, and we actually do try and address it. That's one of the things we get from looking at simulator exercises. You see how the shift supervisor, for example, interacts with his crew. Are some of the crew members allowed to do things independently? Are there some actions that they have the privilege essentially to take on their own and then report to the shift supervisor later?

Or is it everything has to go through the shift supervisor? How do they handle --

DR. ROSEN: We're just talking about diagnosis at the moment. At least I was just trying to say what's happening here. That's the question, and that's a crew activity, and the crews are different, depending upon the structure of the control room staffing.

MR. FORESTER: That's correct.

DR. ROSEN: I mean, I can think of one plant where there are two units controlled from one control room. So there are two unit supervisors, two crews, two unit supervisors and one shift manager who kind of sits in the middle, and that's a complex crew.

And when you're thinking about trying to find an error or diagnosis, you know, you have to think about a complex crew environment, but that's the most complex one I've seen. But there are simple ones that you'd have to think about, too, and the probability of failing to diagnose might be different for different crew compositions and structures.

I'm just saying that this is not just one number.

MR. FORESTER: Well, I think you can get to one number if you've considered those internationals.

DR. ROSEN: No, I understand, but --

MR. FORESTER: No, I agree with you that, you know, ultimately it's the plant supervisor responsibility, but if there's a particular scenario or context that's involved that has confused one crew member, well, that influence could then carry over to the shift supervisor.

So you have to sort of evaluate how as a team they might respond to that situation.

DR. ROSEN: Right, and I'm thinking more broadly in terms of a capability that you're suggesting in this good practice to build into HRA. That capability needs to be applicable to very complex situations like we're considering for what has been proposed for certain advanced plants, many modules, one control room, many modules, very few operators.

MR. FORESTER: And I agree with that, and that's an area that we haven't done enough work in.

MS. LOIS: The current state of the art cannot handle it well, with the exception of ATHEANA that tries to take into consideration all different aspects, and that's why we have the Holden simulator experiments.

And Dr. Apostolakis has recommended to review what other second generation HRA methods do, but you have recommended that crew activity to look at for the HRA purposes.

DR. ROSEN: Well, I'm just trying to explore the dimensions of some difficulties, the real world difficulties in dealing with crews or crew structures and crew challenges. Those, plus the ones I've mentioned before about not having the crew that you trained with in the simulator really on shift with you when the event occurs because somebody is off relieving something else.

So you know, there are some real issues to be dealt with in how one goes about HRA under the complex circumstances.

DR. APOSTOLAKIS: John when you talked about the slide, you said it's important for the analyst to consider both cognitive and execution failures.

MR. FORESTER: Yes.

DR. APOSTOLAKIS: You didn't use the word "model" that you have on the slide. I think that is a dangerous word to use there. "Consider" I think is much more appropriate.

Surely you're not asking them to start modeling cognitive processes and make Dr. Kress upset, and it's an impossible task to begin with. So what you mean is consider the possibility of misdiagnosis and maybe whatever else may affect performance, but you don't mean modeling.

MR. FORESTER: No, I think the model referred to is you want to have a cognitive element and an execution element that you consider. You're right.

I mean, some how we're trying to model the group cognition, but obviously we don't have --

DR. APOSTOLAKIS: Is the IDEA model from Maryland focusing a lot on --

MS. LOIS: We are just looking into that.

DR. APOSTOLAKIS: -- on the cognitive processes and so on?

MR. FORESTER: Yes.

DR. APOSTOLAKIS: You don't meant that.

MR. FORESTER: No.

MS. LOIS: But even that is very simple minded.

DR. APOSTOLAKIS: Yeah.

MS. LOIS: It seems three people, and it's -- yeah.

DR. APOSTOLAKIS: Still, I mean, you're getting into the realm of psychology. I'm sorry, John.

MR. FORESTER: No. It's hard to use right now.

DR. APOSTOLAKIS: You're an applied psychologist, are you not?

MR. FORESTER: I'm aware of the limitations there. So that's good work; it's important work, but when it will be useful to HRA is another question.

DR. APOSTOLAKIS: Okay.

DR. ROSEN: You know, the problem you face is a little bit like the one we used to face and we still face like, say, in thermal hydraulics where we know this is a three dimensional world, and in three dimensions things behave differently than they do in one dimension, but we can't really do much more than one dimensional analysis or two dimensional analysis.

So you know, you're always attempting to approximate the real world. So the real world is crews operating under stress and short time frames with some of the other features that I mentioned before, you know, complex command and control arrangements, et cetera.

And you're really trying to model that to get the right answer because you may get a different answer if you take a one dimensional model of human performance. It may look very easy with a one dimensional model. Sure, he gets the signal and he follows his procedure and shuts it off.

Well, yeah, but that's not exactly how it turns out in the real world.

MR. FORESTER: That's correct. That's why I think ATHEANA has emphasize the air forcing context. And we talk about the importance of context more generally in the good practices. Just the things you're saying needs to be considered. These are the most likely things that influence performance. You need to sort of look at it in the real world sense rather than some special processes inside the brain. I mean, it would be good if we could do that if we had the data.

DR. ROSEN: But what I'm saying is we're just calibrating each other here, but that's not how it really works, and that if we're really trying to model how it really works three dimensionally, you know, how the fluid really flows, it's more --

DR. APOSTOLAKIS: One way of handling those approximations, Steve, would be to actually see, collect the evidence, what happens in that real world and ask yourself, "Am I missing in my model something important that appears to be driving operating experience?"

Now, have we ever done that? I know that there have been collections of events and so on and analysis, but this last step might, in fact, be a good, convincing argument that certain performance factors that we don't consider now should be considered.

I remember there was a NUREG or two way back, you know, human error events, failure events during shutdown. It was a very nice listing of things, analysis and so on. But the next step, which is to look at the whole report with however many events it has analyzed and then synthesize and say, "Hey, we see here like prioritizing maintenance, for example, appears in every other event. Is that in anybody's model?"

And say, well, this is strong, because then you will have to go to the two dimensional world that Steve mentions, but that is you have a basis. Okay?

MS. LOIS: That's correct. We hope we'll obtain through HERA. That's why we're developing the database.

DR. APOSTOLAKIS: Okay, okay.

MS. LOIS: And HERA has a structure that is amenable to HRA analysis, and the analysts will be able to do the searches for various types of --

DR. APOSTOLAKIS: You know every well though that HERA was betrayed many times.

And the other thing, Steve, after 40 years of extensive research, thermal hydraulics, I don't know whether they're modeling the three dimensional world well or --

DR. ROSEN: At least they know there's a three dimensional world there.

DR. APOSTOLAKIS: Unfortunately Professor Wallis is not here.

DR. ROSEN: But they know there's a three dimensional world, and what's more, they're allowed to discuss it.

DR. APOSTOLAKIS: Well, they do miraculous things there. They even take vectors and convert them to scale-ups.

DR. POWERS: George, one of the issues that has come before this committee that continues to arise in my mind, arose in the BWR power up-rates for a particular event, was analyzed both before the power up-rate and after the power up-rate, and the human error probability was assigned to it, and of course it was a little bit higher after the power up-rate because the time available had shortened somewhat.

Well, in some cases it was a substantial shortening because there was a relatively short period of time available.

But the thing that harps in my mind is that even for those people where there was a short time available, the licensee assured us they tested this thing routinely. They had tested it 50 times with every crew that they had ever had, and no one had ever failed to perform the function in 30 seconds when I think he had seven or four minutes to do it, some substantial time. It had always been done very reliably.

And the question that comes into my mind on assigning the human probability gets back to the "do they make sense" question. You know, when faced with that, how do I answer that question? Does it make sense?

The human error probability was like all of them at .01 or something like that. I mean, they're all kind of the same, and yet the database here is not inconsistent with .01. I mean, you could look at 50 times and no errors. It's still consistent with .01.

Does that make sense? Do we know whether that makes sense or not?

MR. FORESTER: Does the value make sense?

DR. POWERS: Yeah.

MR. FORESTER: Well, you know, to determine whether it makes sense, again, I think you have to evaluate what's involved in the decision process and what the event would be, and once you do that and you have other events that are examined that have different characteristics, you can compare the probabilities amongst those to see if at least relatively speaking it makes sense, I guess.

DR. POWERS: Well, here's what I'm really asking you. Here these guys train on this thing. They do their thing, and I'm sure they use THERP for the analysis on this. You clearly gave credit for the training in assessing the probabilities. I don't know the details of what they did, but you would ordinarily do that. You'd take something.

They come up with a number, and of course, to them they were being enormously conservative when they evaluated because 50 out of 50 times the guy had done the job, and he had done it in a time that was minimal compared to the time that was available. So clearly the licensee was coming in and saying, "Well, this number I put in here is very conservative. So you guys can take confidence."

And the question that keeps running into my mind is: is it really that conservative?

DR. ROSEN: Well, I think, Dana, you had your finger on it. The question they were answering was the case in point, was the throwing of a key lock switch in the control room, and when an operator knows he has to throw the key lock switch, 50 out of 50 of them were able to do it. The question wasn't whether he could get from his seat to that key lock switch in throw it. Everybody agreed that was possible.

It was a question whether he would know he had to do it, was the part that no one could assess.

DR. APOSTOLAKIS: Which brings up the issue of again how credible are these simulation exercises. In a real time environment --

DR. POWERS: I mean those are the questions we ask around it, and I was just asking John to contribute to our debate just because it just won't go away in my thinking.

DR. APOSTOLAKIS: It will never go away.

DR. POWERS: Oh.

DR. APOSTOLAKIS: I don't think so.

DR. ROSEN: It's because they didn't address the big --

DR. POWERS: You mean 100 years from now

when I'm on my death bed I'll be saying, "Hell, I wonder if that guy could really do that."

DR. APOSTOLAKIS: My words, 100 years from now.

DR. ROSEN: Dana, you have to ask the right question for them to get closer to the right answer, and the right question is not whether he could turn the switch. It's whether he would know that he needed to turn the switch.

DR. APOSTOLAKIS: Yeah, that's the difficulty with the simulations.

DR. ROSEN: Right. They never asked that question or they never addressed the question of whether he would know that he needed to turn --

DR. POWERS: Well, I think they were implicitly -- I admit with you in our discussion of it they didn't understand what we were asking, but I think implicitly they did. I mean, they're just on the hot seat here and they're trying to get a license extension.

DR. APOSTOLAKIS: Yeah.

DR. POWERS: And things like that.

DR. APOSTOLAKIS: But I think we were supposed to finish this by 4;45.

DR. POWERS: This is interesting stuff,

George.

MR. FORESTER: It certainly is.

DR. POWERS: This is what the staff should be doing here even if it doesn't have immediate applications.

MR. FORESTER: Okay. This just continues then with the good practices we're going to address.

DR. APOSTOLAKIS: So you're going now to Slide 23 or what?

MS. LOIS: Twenty.

DR. APOSTOLAKIS: See the big difference if you put the "the" there? "Errors of the Commission."

(Laughter.)

DR. APOSTOLAKIS: You'll be in real trouble.

DR. POWERS: Yeah, but there's not enough room on the slide, George.

(Laughter.)

DR. APOSTOLAKIS: I swear you would be in trouble. So what if their errors were to incur a EOC surface, right?

Okay, John. You only have four minutes.

MR. FORESTER: Okay. Quickly, we do include some guidance about treatment of errors and commission. I imagine as everyone knows, traditionally PRA and HRA has not included errors of commission in the model. The thought was that they would tend to be low probability, and there are so many possibilities it would be a very difficult search.

We think some of the newer techniques has provided ways to reduce the search to make it more useful at least to go ahead with the search. We encourage that EOC searches be done, particularly in submittals if there are plant changes for applications; encourage to investigate if those changes could create situations that now might confuse the operators so that if now the way the systems are behaving it would be different than the way they were before. If some of the operators change and so forth, they might get set up, for example, to take an appropriate action.

So the main idea here is, again, to not require errors of commission, but encourage that they look for them and some guidance for when they might be important, when there's a chance you might find them and they would turn out to be important.

There's a section on HRA documentation, the various aspects involved with doing that. I can go through those if you'd like.

DR. SIEBER: We can read it. No.

MR. FORESTER: No, okay.

DR. APOSTOLAKIS: This is a very prescriptive document though, isn't it? I mean disciplines involved. I don't remember exactly how you put it, but don't make it sound like you have to have -- I mean, the discipline is okay, but it's conceivable that one person, let's say, an engineer who has been doing this for 20 years, that he could represent another discipline as well, right?

You don't necessarily mean you have to have an engineer. You have to have an operator. You have to have a psychologist.

MR. FORESTER: No.

DR. APOSTOLAKIS: That would be awfully prescriptive.

MR. FORESTER: No, I don't think that's the case.

DR. POWERS: But you do indicate that you have to have a chemist.

MR. FORESTER: I don't think we really name. We might have some names in there, but we all have chemists.

DR. POWERS: He doesn't want one of those.

MR. FORESTER: And another point I think is that we acknowledge that depending on what your application is, not all of these things may be necessary.

DR. APOSTOLAKIS: So I really think you ought to separate or to say very clearly somewhere that a renewer of an HRA shouldn't really follow these things. A reviewer should be more performance based. I mean, you don't want the reviewer to say, "Ah, did you actually walk into this place, or did you actually make a right turn?"

I mean, come on. The analysts should do things like that. So the more I think about it the more I think you really ought to make a distinction between a review document and the guidance for analysis document because a lot of the things you said make perfect sense for the analyst, but I'm not sure about the reviewer.

MR. FORESTER: But you just want to examine -- I don't disagree with you entire, but I guess one example is if the renewer is looking at the document and he notices that there's no mention that they actually walked down the action, that they might say we estimated how long it was going to take.

Well, if time is very important and

they're relying on someone's judgment of how long something might take, then that might be a reason for concern, not necessarily depending on how the rest of the analysis reads, but --

DR. APOSTOLAKIS: I agree. I agree, and I may even argue that this is a performance based comment. You're giving me an estimate. I have the right to ask you how you got it, right? So that's performance based.

MR. FORESTER: That's true.

DR. APOSTOLAKIS: But to say that, boy, you have to have walked down, well, gee, you know.

MR. FORESTER: Yeah, that's true. It does get kind of tricky because, again, depending on what the application is and the nature of what was being done, not all of these things would be absolutely necessary.

DR. APOSTOLAKIS: I think you should make the distinction clear either in this document or maybe say that somewhere else you're going to.

MS. LOIS: But the walk-down, et cetera, is part of the ASME standard, is a part of the PRA standard.

DR. APOSTOLAKIS: Well, this particular thing maybe you're right, but in general, I think your focus has been the analyst. Maybe all you have to do is go back and think again and say now for the reviewer, do I want to say this. You know, I'm not saying that you should start another project, but just look at it again.

MS. LOIS: Another step that probably will be next step is to develop a review guidance. This is not a review guidance.

DR. APOSTOLAKIS: And maybe you can say that up front.

MS. LOIS: Yeah.

DR. APOSTOLAKIS: A lot of these things can be resolved easily by writing, expanding the introduction, and explaining to people what your intent was.

MS. LOIS: Okay.

DR. APOSTOLAKIS: Okay.

MR. FORESTER: I guess this is just a slide on the usefulness. We still think it could be useful for reviewers, again, just general knowledge about what's appropriate.

DR. APOSTOLAKIS: Very good. Any comments from the members?

DR. LEITCH: I had a question about the last bullet on 15 and 19. Basically after we go through all of this, we say does it make sense. I mean, if we knew it made sense at the beginning, why would we go through all of this?

I mean, are we just developing a technical rationale for an intuitive feeling anyway? And then if it doesn't turn out right, well, there's enough flexibility in this thing we can go back and say, "Well, we should have given more weight to this or more weight to that"?

And the bottom line is we come out with what we intuitively believe from the get-go?

MS. LOIS: Can I answer that?

These criteria came more from our experience with IPU use. We had seen a lot of IPUs provide the very detailed documentation of how they came up with an estimate.

However, if you look at the estimates from the perspective of do they make sense, then did not. For example, we show one particular IP where the operator failure to scram, which we suggest at the bottom it was ten to the minus three, and then failure to feed or bleed was ten to the minus five, and that is the aspects that it makes sense that we're looking for here.

You know, failure to feed or bleed is a

very complicated activity. The operators are dreaming how to scramble the reactor. I don't think they are dreaming how to feed or bleed, et cetera.

So it's more the logical relationship or this.

On the issue that the good practices are addressing is the fact that a lot of HRA experts, we sort of didn't agree, did not have a good understanding of how to do HRA, and they may apply a particular method, quantification method, for example, THERP, to an extreme degree so that they could come up with estimates that are not logical.

So it's a bad aspect of it. You're supposed to rationalize your numbers afterwards.

MR. PARRY: Could I add a comment here? This is Gareth Parry again.

I think part of the intent of this is to, in fact, make sure that the analyst revisits all his estimates in one table and make sure that they're in relative agreement.

I mean, these analyses may be done over a protracted period of time. There's an element of subjectivity that goes into all of them, and I think all this is doing is saying that it may be necessary to recalibrate yourself and one day you might have not felt very good. So you were being particularly pessimistic about something.

It's a sanity check and making sure that the event that has a more challenging set of conditions associated with it, in fact, is a lower error probability than one that has a more straightforward set of characteristics.

So I think really it's a sanity check in making sure that on a relative basis things make sense.

DR. LEITCH: Yeah, I hear what you're saying. I guess you're talking to a skeptic admittedly, and you know, I don't have a whole lot of confidence in this particular scientific discipline because I think the uncertainties are so great that they swamp what you're trying to do here.

MR. PARRY: I would agree that the uncertainties are large, but I think you can take those into account by the way that you use the results, and by the way that you use them in the decision making process.

I think part of the discipline is to recognize that your uncertainties are, indeed, large and to still be able to make useful conclusions.

DR. APOSTOLAKIS: Anything else?

DR. LEITCH: You know, this is largely an empirical science, and yet there's very little mention of data or validation of these methods, and I'm just wondering how do you.

DR. APOSTOLAKIS: Well, you're raising a much bigger issue now, but they have problems to collect data and so on. Here they're just saying, "Look. If you want to do a decent HRA, there are many models out there, but certain good practices have been emerging over the years, and here they are."

We are not trying to quantify anything here, but that question is more relevant to the other stuff they're doing, which we will discuss some other time.

DR. LEITCH: Yeah, I feel it's a very good document on what those good practices -- what things, one, ought to consider. My question is concerning our ability to quantify those things.

DR. APOSTOLAKIS: A lot of people have those doubts.

DR. LEITCH: I certainly have no objection, and I think it's a good piece of work, and if the question is should we issue this for public comment, I think that's great.

DR. APOSTOLAKIS: Yeah, this does not

address quantification anyway.

DR. POWERS: I guess the way I have looked at it is I'm not sure that I would stake my life on the .01, which is the number that always comes out on these things versus .05 or ten to the minus fifth. But I'm pretty sure that when they come in and say, "We judge this action to be more complex and as a result the likelihood for human error to be higher than this other action," then I think they're on pretty good ground there.

DR. APOSTOLAKIS: Right.

MR. FORESTER: I think so.

DR. POWERS: And so it's like free energy. You don't know exactly where the zero is, but you sure know what the deltas are to a great precision.

And I particularly like Gareth's comment that, recognizing you have broad uncertainties is, of course an essential element to the interpretation of these, and I point out that in severe accidents we make enormous strides even though we work with decades and decades of uncertainty all the time.

DR. APOSTOLAKIS: The only thing is that, again, we are off the subject now, but the effort to quantify has led to all of this qualitative work. Erasmia referred to the second generation models.

Well, there was a first generation model which basically said they were really numbers oriented, and the most sophisticated one would say if the operator has so many minutes, he has the probability he will make a mistake.

And then people realized that this was not good enough, and they started bringing into the process models that were developed elsewhere by well known people and so on.

So the numbers drove the qualitative models, and I think we have gained a lot of good insights. Now, the numbers are still up in the air.

CHAIRMAN BONACA: But I think this effort to quantify, you're absolutely right. For example --

DR. APOSTOLAKIS: It's a discipline.

CHAIRMAN BONACA: -- help tremendously in the control room designs. I mean, there were a lot of upgrades that took place on a plat specific basis in the '80s, early '90s, that were really tied to an attempt to understand further action, particularly for older plants, some of the critical sequences. You know, you do go through recirculation. You have to do certain things. Some of the more modern plants were set up to have high confidence that the operator would do that. Some of the older plants did not even have the same level of confidence.

In fact, you could look at a simulator and see the response of that and understand that you had critical issues there. If you had to quantify still today, you would have significant uncertainties. But there is much higher confidence that they will do it correctly because you can see it on the simulator how the respondents are.

So I believe this effort to quantify has been very helpful.

DR. APOSTOLAKIS: And not only that, but look at the efforts of the design of the new generation plants. One of the requirements is, you know, don't ask the operators to do anything for the first 24 hours or the first 70 hours. All of that came from this kind of analysis and worry that time is critical, along with other things.

The designers cannot make sure that the operators feel good, but they can do something about the available time. So the EPRI -- what was it called? -- utility requirements document explicitly said that, that the next generation, I think, for 24 hours they have to do nothing, and then for another period of time something else.

So there are some practical results that have come out of this, but the numbers, you're right.

CHAIRMAN BONACA: But if you take PWRs, 20 years ago the likelihood that operators would go into bleed or feed, although the direction was there, it was very low. In fact, they would into the procedure and see what they were planning to do. I mean, there were informal points of self-training almost that are given there about doing things.

And today because of the focus on this actions required to do that and the training, there is much higher confidence there because you can see the crews now when they're supposed to go to bleed and feed, they do so. They do that, and they do it within the allotted time, and you can see it on the simulator how they respond to that.

So this has all come from this focus on operator action.

DR. APOSTOLAKIS: Okay. Any other comments? Questions from the members? Would the staff like to make a comment?

(No response.)

DR. APOSTOLAKIS: No? Well, Erasmia and John, thank you very much.

MR. FORESTER: Thank you.

MS. LOIS: Thank you.

DR. APOSTOLAKIS: We appreciate your coming again, and I guess you will hear from us some time in the next two weeks.

MR. FORESTER: Okay. Thank you.

MS. LOIS: Thank you very much.

MR. FORESTER: Thank you very much.

DR. APOSTOLAKIS: Back to you, Mr. Chairman.

CHAIRMAN BONACA: Okay. With that we will go off the record now, and we'll take a break until 5:15 and get back here and talk about letters. I actually want to have John coming in because he has some messages to give us about the discussion on Saturday morning I would like him to hear.

(Whereupon, at 4:57 p.m., the Advisory Committee meeting was concluded.)