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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

483RD ACRS MEETING

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WEDNESDAY

JUNE 6, 2001

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ROCKVILLE, MARYLAND

The Advisory Meeting met at the Nuclear Regulatory Commission, Two White Flint North, Room 2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. George E. Apostolakis, Chairman, presiding.

PRESENT:

DR. GEORGE E. APOSTOLAKIS, Chairman
DR. MARIO V. BONACA, Vice Chairman
DR. DANA A. POWERS, Member
DR. WILLIAM J. SHACK, Member
DR. ROBERT E. UHRIG, Member
DR. GRAHAM M. LEITCH, Member
DR. THOMAS S. KRESS, Member at Large
DR. JOHN D. SIEBER, Member
DR. F. PETER FORD, Member
DR. GRAHAM B. WALLIS, Member

ACRS STAFF:

DR. JOHN T. LARKINS, Executive Director

DR. ROBERT ELLIOTT, ACRS Staff

CAROL A. HARRIS, ACRS/ACNW

HOWARD J. LARSON, ACRS/ACNW

DR. JAMES E. LYONS, ADTS

SAM DURAISWAMY, ACRS

DR. SHER BAHADUR, ACRS

PRESENTERS:

DR. AUGUST W. CRONENBERG

DR. J.N. SORENSEN

MARK CUNNINGHAM

ALAN KURITZKY

ADRIAN HAYMER

TONY PIETRANGELO

BOB OSTERRIEDER

JOHN A. NAKOSKI

GARY M. HOLAHAN

JACK R. STROSNIDER

I-N-D-E-X

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

(8:30 a.m.)

CHAIRMAN APOSTOLAKIS: The meeting will now come to order. This is the first day of the 483rd meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting the Committee will consider the following: A status report on proposed risk-informed revisions to 10 CFR 50.46, and proposed revisions to the framework for risk-informing the technical requirements of 10 CFR Part 50.

The potential margin reductions associated with power uprates; the draft final safety evaluation report for the South Texas Project Nuclear Operating Company request to exclude certain components from the scope of special treatment requirements required by regulations; and the discussion of general design criteria and proposed ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Dr. John T. Larkins is the designated Federal official for the initial portion of this meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, and identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

I will begin with some items of current interest. The ACRS Subcommittee on Advanced Reactors held a meeting on June 4th and 5th, 2001. We would like to thank Commissioner Diaz for his outstanding keynote speech.

Also, we would like to thank all the meeting participants, especially the presenters and the panel members. This meeting was successful because of the outstanding support provided by the ACRS management, and Richard Savio, Michael Markley, and Medford L. Ztoftorie (phonetic).

Our special thanks to the administrative support provided by the Operations Support Branch personnel, especially Jenny Gallo, and Carol Harris, Beverly Joe White, Tyrone Brown, Michelle Kelton, F. M. Bernard, Tania Winfried, and Sherry Meadow.

I understand that we have a change in our management of the ACRS staff, and Dr. Larkins will tell us about that.

DR. LARKINS: Good morning. It is a bit of good news and a little bit of not so good news. When you bring employees on board for a lot of expectations and potential, your hopes are that they are going to develop and move on, and do some other things.

Unfortunately, other people recognize the expertise and potential of the staff here, and Mr. Lyons, who has been with us since I guess -- what is it, September, Jim?

MR. LYONS: Yes.

DR. LARKINS: He has been selected to be the new Director of the Future Licensing Organization, which is going to be a tremendous job and responsibility in the agency.

We just spent two days talking about future licensing for advanced reactor designs. So, Jim is going to have a major challenge, and although I hate to lose him, we still wish him good luck.

(Applause.)

MR. LYONS: Thank you. First of all, I would like to thank the committee for all the -- actually education that I have gotten since I have been here on this staff.

And I would like to thank John and Dana

for selecting me to come to this position, and it has really been very useful for me to see exactly how the committee works, and to see all the breathe of experience that you all have, and the issues that you address.

And I really want to thank you for holding the workshop the last two days to bring me up to speed on my new job. It was very nice of you to do that.

CHAIRMAN APOSTOLAKIS: It was a parting gift.

DR. LARKINS: With that, I am pleased to announce that Dr. Sher Bahadur has been appointed the Associate Director for Technical Support. Sher will be replacing Jim effective July 9th.

For those of you who are not familiar with Dr. Bahadur, he joined the NRC in 1984, and has held a number of progressively more responsible positions.

It is interesting to note that I was the technical assistant for Chairman Zech in the early '80s, and when I left to take a position in NOR, Sher was my replacement as the technical assistant to the chairman.

So he knows his way around the Commission and will be very helpful. He has worked both in the Office of MNSS and he has also worked in research, and

I think his current position there is chief, engineering research applications branch. So he will bring a balanced perspective and I should be able to dump lots of work on him.

Prior to joining the NRC, Dr. Bahadur worked in a variety of assignments in the private sector, including NUS, Acres American, Incorporated, and Lundy Engineering.

Dr. Bahadur has a Ph.D. in geotechnical engineering from the South Dakota School of Mines Technology, but even more importantly, I think he brings a wealth of experience and background in a number of areas that will impact both committees, the ACRS and the ACNW.

So I am looking forward to having Sher around for a little longer, at least a year or two, and working with the committee. So welcome aboard. thank you.

(Applause.)

DR. BAHADUR: Thank you, John. As you mentioned, I have been in research for about 12 years now, and I have looked after three different branches during this 12 years. So I think there is a wide breathe of experience that I have received in that office.

And I am looking forward to working here now and learning with the committee, and also bringing the expertise in certain areas, which we will be useful to you, as will for my own development. So thank you so much again, and I am looking forward to it.

CHAIRMAN APOSTOLAKIS: Thank you. We have three letters to complete at this meeting, and the response, and they are all top priority. There is the response to Chairman Meserve's May 7th memorandum on the differing professional opinion on steam generator tube issues.

And the response to the April 12th EDO letter on topics raised by the ACRS pertaining to issues associated with industry use of thermal-hydraulic codes, and risk-based performance indicators.

We will also discuss our letter on the South Texas project exemption request, but the letter will be completed in July, and so we have three letters. And the first session is on proposed risk informed revisions to 10 CFR 50.46.

As you see from the agenda, we had allocated almost two hours or three hours or more -- well, more than two hours to this subject. But we will only take until 10 o'clock, and after the break, we will come back and discuss Dr. Wallace's letter on thermal hydraulic codes.

So with that, we will start on the proposed risk-informed revisions to 10 CDR 50.46. Dr. Shack will lead us through this.

DR. SHACK: We will be discussing the status of the staff industry initiatives in 10 CFR 50-46, and the industry proposal is fairly straight forward.

They propose that -- and loss of cooling accidents, and some other range defined upon a plant by plant or a plant class basis through analysis and experience.

The staff has a wider range of options that they are considering for 50.46 and presumably we will hear something about that range of options that they are considering this morning, and Mark will start us off.

MR. CUNNINGHAM: Thank you, Dr. Shack. Good morning. My name is Mark Cunningham, and I am the Chief of the PRA Branch in the Office of Research. With me this morning is Alan Kuritzky, a senior reliability and risk analyst in the branch.

As Dr. Shack indicated, we are going to

try and give you some information on the options that we are considering on making modifications to 50.46 to make it more risk informed.

Right off the bat, I am going to take the slides slightly out of order, and to go to slide three and talk about the purpose of the meeting. Basically, we had hoped to have a commission paper to you a couple of weeks ago for you to review.

We weren't able to do that for a variety of reasons, and so we want to give you a status report today on our work to consider changes to 50.46, and use this as an opportunity to solicit feedback, and get questions from the committee on our proposals.

We are not requesting a letter at this point. We intend to get the commission paper -- the commission paper is due to the EDO in about three weeks. We intend to get it to you in time so that you could discuss it at the July meeting, and at that point we would ask for a letter.

Going back to slide two then, and an outline of the presentation, basically first we want to provide some background just to remind people where we are in the series of steps that are undertaken in option three.

I want to spend a little time talking

about what is in 50.46, and the different aspects of 50.46. We want to give you some options for different ways, and discuss some possible different ways to change the requirements, and discuss a little bit about what future technical work might be required to support these possible changes.

And to summarize a couple of policy issues, and then end up with some discussion of schedule. Just as a reminder to the committee and others, if we go back a couple of years to a commission paper that laid out the plan for performing option three, and it was described in Section 99.264.

It laid out a framework, and the framework basically had two phases in it. The first phase was a kind of identification and evaluation phase that we went through or had gone through everything in Part 50, and tried to identify what aspects or what requirements within Part 50 might be amenable to being changed to be risk informed.

We prioritized those and identified 2 or 3 issues as the most likely or the most important changes to tackle first. The first of those was 50.44 on combustible gas control.

As the committee knows, we provided recommendations to the commission last September on that, and there is a rule making plan now before the commission to make those rule changes.

The second priority that we identified were potential changes to the ECCS requirements contained in 50.46 and other places in the requirements. And Part C of the first phase is --

DR. POWERS: Mark, remind me why you thought that was 50.46 was particularly susceptible to risk information?

MR. CUNNINGHAM: A couple of reasons really. One was that there was a fair amount of risk information already available that would help guide you in possible changes to the ECCS requirements.

There is a lot known about the frequency of breaks and the frequency of core damage associated with different types of breaks, and that sort of thing.

It was also recognized that there is a fair amount or there are opportunities in 50.46 where you could make some -- improve the realism of the requirements.

DR. POWERS: Well, I think everybody recognized that there were things that were bound in the nature with 50.46, and I guess I am interested in why you thought that particular regulation was just right for risk information.

I think you are on the right track when you say that a lot of information -- that we knew a lot about breaks. I mean, we have looked at everything from micro breaks to macro breaks, and we know something about the reliability that the ECCS has to have to counterman those breaks. It would seem like pretty good reasons to go after that one.

MR. CUNNINGHAM: Another big factor I think was that 50.46 is one of the centerpieces of Part 50 if you will, in the sense that the --

DR. POWERS: It is a little linchpin with it.

MR. CUNNINGHAM: It is a linchpin that you start to change, and we saw an opportunity that if you start with 50.46, you could have the opportunity not only to change the ECCS requirements, but have an opportunity downstream to make other changes to the requirements, because there are many if you will spinoffs from 50.46 and other parts of the regulations.

And somebody has described it as an octopus of having tentacles that reach out into many other parts of Part 50. So there is an opportunity to start working that whole set of issues.

And perhaps to put it another way, if you don't tackle 50.46, you may have a hard time changing other parts of Part 50 as well. So it was the combination of things.

We thought that we could have some successes that would be relatively low-cost and quick to do. We had a good set of information to work from on with the risks associated with different pipe breaks, and again we saw that it was such a centerpiece of Part 50, and we thought it was worthwhile.

DR. SHACK: And I think you could also argue that there is a substantial safety benefit.

MR. CUNNINGHAM: Yes.

DR. POWERS: I mean, I think that most people would argue that what we are doing to the diesels is not helpful.

MR. CUNNINGHAM: Yes, and certainly that point has been made a number of times, and related issues on diesel generators -- start times and that sort of thing -- that have been argued to be counter to safety in some respects.

And also to be clear, when we polled the nuclear industry, and NEI provided us their ideas of what they thought would be most important to change, the ones that they identified right off the bat was -- the top two were 50.44 and 46.

DR. POWERS: You have a lot of information on breaks from the studies that have been going on for over -- gee, since '74, and we have been looking at various kinds of breaks since then.

Do you really have a lot of information on this hypothesized counter to safety or what we can do to poor, innocent diesel generators?

MR. CUNNINGHAM: Do we have the same type of level of information? No, we don't, I don't think, but I think it is the more mechanical engineering types and things like that will say that the requirement to start these diesels as they are required to do with having cold starts, and that have to be extremely fast, it is counter to good sense if you will in the design of these diesels.

They are very big machines, and it is not a good way to pursue it.

DR. POWERS: Yes, but the only thing that one would worry about is why not just go fix that?

MR. CUNNINGHAM: Because again there are other opportunities, and looking at the complete issue that I will come back to in a little while on ECCS reliability, is that there are -- that the requirements that we have that are implemented today cause us to perhaps over design some aspects of the ECCS that can lead to potential safety issues in other respects.

I have been before this committee several times to talk about pressurized thermal shock risk. One of the issues that comes up is that if you are putting greater demands to pump in cold water to deal with large LOCAs, then you may be improving the risk associated with large LOCAs.

But you may be hurting our potential to deal with pressurized thermal shock, or increasing the risk associated with pressurized thermal shock.

DR. POWERS: To raise an event in order to avoid an AB?

MR. CUNNINGHAM: Yes, that's right.

DR. POWERS: And so it is probably not a good tradeoff.

MR. CUNNINGHAM: Yes. And given that we think there are conservatisms in the current 50.46, I think we can do a better balancing job if you will between those two sets of requirements.

DR. LEITCH: Has it been decided at this point which is the next regulation beyond 50.46 to be considered?

MR. CUNNINGHAM: We have been spending some time looking at special treatment requirements, but by and large now I think for the near future our focus is going to be on getting 50.44 done and 50.46, our hands-on 50.46 if you will.

So as I said, with 50.44 in a sense, we are down in this context of the framework option three and we are down in the phase two part for 50.44. We are into rule making and that sort of thing.

And in the context of 50.46, we are back here, in terms of the latter part of the last phase or the last part of phase one, and we are looking at the feasibility of possible changes.

So in that sense what you will hear about today is us talking about what is the technical content of 50.46, and what would lead us to some alternatives, and what is the basis for some alternatives to the present 50.46.

Are there policy issues that have to be resolved, and what would be the required technical work to proceed, and in some sense the resources that would be required to proceed with different alternatives.

So the bulk of my presentation is really going to cover that sort of thing. The paper that we owe to the commission in June is a set of recommendations to proceed if we be believe that it is appropriate, to proceed to rule making.

And then if the commission approves, then we would go on into the phase two work. But in a sense this is setting you up to make it clear that there are a lot of things that we don't have answers for today.

We think there are some good opportunities for change here, but we don't have all the detailed technical work done to provide the real basis for this, or the complete basis for this.

Moving on now to what is in 50.46. And 50.46, in a sense, has four parts. The first part deals with the concept of assuring system safety function, and to assure that the requirements talk about basically ensuring that the system can operate given single failures.

That the system can operate given the assumption that there is a loss of off-site power. In effect, this first box here is a first attempt at defining a reliability requirement for the ECCS.

So we are going to come back to this later that there may be a better way to ensure reliability, rather than working with single failure and assumptional off-site power.

So a key theme of what you will hear today is changes to the reliability aspect of the ECCS requirements. The second part is dealing with what is an acceptable ECCS performance, in the context of ensuring that we don't have a core melt accident, or a severely damaged core.

Right now there are five criteria within 50.46 and other places that are used to measure that. The classic one or the most well known is 2,200 degrees F, in terms of peak clad temperature.

But there are others in terms of the maximum allowed cladding oxidation, and hydrogen generation, and a number of other things. Again, we see in this case some opportunities for making -- and some reasons to make this a little more general perhaps, and improve the quality of the requirement in general.

DR. POWERS: The requirements for maximum clad oxidation of no more than 17 percent is not really related to hydrogen generation is it? It is really an embrittlement criteria?

MR. CUNNINGHAM: It is an embrittlement criteria, exactly.

DR. POWERS: And as we are discovering

lots of things in embrittlement of the clad besides oxidation and what not are you a part of the same increased realism to change that to be an honest-to-god embrittlement requirement, rather than a --

MR. CUNNINGHAM: We will come back to that, but yes, that is a direction we are moving in. The third aspect of 50.46 and related requirements deals with the acceptable model that is used to compare with the performance criteria or the acceptance criteria.

Currently, there is an Appendix K approach to modeling ECCS, the thermal hydraulics of it, and then there is also another alternative for a realistic with uncertainty analysis approach.

And we see some opportunities there worth making some changes that could make or improve the requirements. And finally the last part is the definition of the range of break sizes that are required to be mitigated by the ECCS system.

Basically now the requirement is that it has to include up to and including the largest pipe break in the system. Again, we will talk some more about some possible changes to that as we move on today.

DR. POWERS: I was intrigued by the

requirement that a volume be able to withstand the rupture of the largest pipe in that volume. I am familiar with a reactor not located in the United States, and which had that requirement for it, and it is containment modules.

And it succeeded in blowing its containment modules up completely because it broke several of the largest pipes. But do you bear those things in mind in thinking about these pipe breaks?

MR. KURITZKY: You mean in breaking multiple -- in having multiple breaks at the same time?

DR. POWERS: Well, I mean, the requirement is not to blow up the containment volume or things like that. I mean, it is coming in and taking it back and saying, well, it is no bigger than this break that takes you one step removed from what you really want to accomplish, which is not to break the volume.

MR. KURITZKY: Right. I mean, we have certainly taken into consideration the containment integrity. I mean, changes that we will recommend involving ECCS, we will always be keeping in mind that we don't want to violate the containment, and we take containment in strong consideration if that is your question.

DR. POWERS: The containment that I was speaking of was the internal containment, and with an environment exactly like this, and that could withstand the break of the largest pipe in the volume. Unfortunately, it broke 12 of them, and that was more than it could take.

MR. CUNNINGHAM: This slide is intended to kind of provide the basic, if you will, kind of some boundary conditions to what we will talk about for the rest of the morning here.

As I mentioned earlier, I think a theme that you will see is that I think there is something to be gained and we have considered seriously ways to improve the description of the reliability requirements for the ECCS system.

And getting away from this rather prescriptive statement of single failure criteria and loss of off-site power, and there is ways to do things better and perhaps improve the reliability of the ECCS system.

Another one of our boundary conditions is that we see some opportunities and parallel and as part of being risk informed to improve the realism of what we have here in the ECCS requirements.

You will see in each case, I think, a

couple of different approaches to accomplishing our goal, and in some cases we have changes that might be still fairly prescriptive, but still improved over what we have today.

But there is still a kind of more prescriptive oriented changes, and we also have approaches that are more performance based. So I think in each case you will see alternatives that might be somewhat less prescriptive than today, but still prescriptive.

And then others that are more bigger steps if you will and to be more performance based types of approaches.

DR. WALLIS: And while we are talking about ECCS reliability, you are not suggesting that the ECCS be designed so that it cannot cope with a double ended break?

You are just saying that the way in which it copes with it doesn't have to be as reliable as we thought it had to be? Is that what you are saying?

MR. CUNNINGHAM: What I was saying is that in the present requirements the way of ensuring reliability of the system for the spectrum of breaks is a somewhat artificial way of -- well, it is done somewhat artificially, and the assumed single failure in the system, and the assumed loss of off-site power.

And you can accomplish the same reliability perhaps in a more risk informed way without necessarily -- perhaps even improving the reliability to cope with the system.

But we are not saying that the ECCS does not have to cope with the largest break in the system.

DR. WALLIS: Are you doing something like a product of the probability of the break, and the reliability or probability of the success of the ECCS or something?

MR. CUNNINGHAM: Yes, exactly.

DR. WALLIS: And if the probability of the break is very low, then the probability of the ECCS working can be less than 99.99 percent or whatever?

MR. CUNNINGHAM: Yes, exactly.

DR. WALLIS: That is the argument?

MR. CUNNINGHAM: Yes.

DR. WALLIS: And we are certainly not backing off on the capability of the thing to respond to a large break?

MR. CUNNINGHAM: No, it is not.

DR. WALLIS: I think that should be clear to the public that you are not backing off on that sort of requirement?

MR. CUNNINGHAM: That's right.

CHAIRMAN APOSTOLAKIS: So is the same thinking then applicable to the reactor for which the core damage frequency is very, very low, so we can relax the reliability requirements of the containment?

MR. CUNNINGHAM: Relax the reliability requirements on what?

CHAIRMAN APOSTOLAKIS: On the containment? In other words, we are shifting. If you think in terms of the cornerstones, we are saying that the initiating event or the core damage frequency is so low that now the barriers that follow may not be needed.

MR. KURITZKY: I think we based everything on our framework document, which maintains or which states that we have to maintain the defense in depth layers, which containment of course is one.

So in our framework, we should not be doing anything that allows to get through a layer.

CHAIRMAN APOSTOLAKIS: In this case.

MR. CUNNINGHAM: Yes, in this case.

CHAIRMAN APOSTOLAKIS: But that is the next logical step isn't it?

MR. CUNNINGHAM: Yes, that's right. If you could take the same framework that we are working on here, and we are applying the framework to existing plants. So they have a containment, and they have a ECCS, and that sort of thing.

And the next step in a direction of advanced reactors is to think about this framework if you have nothing but a paper reactor if you will. And is today's balance the right balance for a new plant. That's a good question.

DR. WALLIS: Well, I liked your argument earlier that if you change some of these requirements that you might actually make the system safer, because you are not putting greater demands on the system in some other scenario.

If you can make that argument, I think you have a good one. If it is just backing off alone, that is not such a good argument.

MR. CUNNINGHAM: It is not just backing off it.

DR. WALLIS: It is actually improving safety if you can make that argument, and I think that is a good one.

MR. CUNNINGHAM: Yes. Again, one of the last ground rules for the flavor of what we are doing here is the issue that has been raised on the definition of whether or not you can eliminate the large break LOCAs as a design basis accident.

I think you will hear some more later that there are some possibilities that that could be done, but there is also a lot of technical work that would have to be done to justify that.

And how far we go in this particular paper in opening the door for that is subject to some discussion, and we will come back to that later.

DR. POWERS: But that would be the case then where the ECCS would no longer be capable of handling the largest break?

MR. CUNNINGHAM: Conceivably, yes. That if you could make a convincing argument that there is a set of pipe breaks, or pipe breaks of a greater than certain size are extremely low frequency, then in a sense you shift, and the pipe breaks over into the category that we would do for a vessel rupture. That it is an event of such a low frequency that you do not require ECCS mitigation.

DR. WALLIS: However, if it did happen, it would be embarrassing if you had already decided to do away with the ability to cope with it, low frequency or not.

MR. CUNNINGHAM: It would be embarrassing, and a dangerous situation. And I believe as was discussed about a month or so ago with a subcommittee, I guess, there is a lot of technical work that the staff believes would have to be done before you could make that case.

And even if you did a lot of technical work it is not clear that you could get to that end point.

DR. KRESS: Mark, do you have a list of potential changes that the licensee will make if you change the definition of the pipe size for a large break LOCA.

MR. KURITZKY: Industry has supplied us with a couple of fairly extensive lists of things that they would like to change if they could, and change the definition of a large break.

DR. KRESS: Okay.

MR. CUNNINGHAM: And we didn't come prepared to talk about that today. But I think it is clear that if you could accomplish that that there would be a lot that would change in the operations of the plant, and in the design and in probably the operations of the plant.

DR. POWERS: If all those things were implemented, and I realize that it is kind of a hypothetical list that maybe not all plants could eliminate, and could do all things.

But have you taken a representative plant and done a risk analysis on it to see if there is a change very much?

MR. CUNNINGHAM: We have not done that at this point. Again, we are in the -- and again to go back to the slide on where we are in the procession of tasks, we are at the point of do we think it is feasible to make some changes.

And then if we were going to make those changes, then we would proceed to do more work like that, but we are not at the point of having to do that.

DR. POWERS: Well, it seems to me that if you found that the risk went up significantly that you wouldn't want to bother trying to find out if it was feasible to make the changes.

MR. CUNNINGHAM: Certainly, and that comes into the feasibility part of it. And what you will see in the presentation is that we are not coming in and saying that our approach is to eliminate the large break LOCA design basis accident.

We think that today there is a lot of technical work that would have to be done to justify that. We may want to start down that path, and I think that our goal was to start down that path to talk about how that might be done.

But the changes that we are talking about in the shorter term are less radical changes to the requirements, but things where I think we can improve a much better balance to what is in the ECCS requirements.

DR. POWERS: And based on evidence from yesterday, the Chairman here, who is looking for radical --

DR. WALLIS: Well, Mark, not only do you have to do what you think is right, you have to respond to what industry is asking for.

MR. CUNNINGHAM: Yes.

DR. WALLIS: And if they come in with very good arguments that do away with a large break LOCA, you have to be on good technical grounds to respond.

MR. CUNNINGHAM: Yes.

DR. WALLIS: And you may have to do some of this technical work or maybe all of it.

MR. CUNNINGHAM: Well, when we come back later on and we talk about the future --

DR. SHACK: On page 57 of your notebook, there is a fairly detailed description of the things that they would like.

DR. KRESS: Thank you, Bill.

DR. POWERS: And that they think they can get out of this.

DR. KRESS: Thank you, Bill. Handwritten on page 57?

DR. SHACK: Yes.

MR. CUNNINGHAM: Dr. Wallis, yes, the industry or representatives of the industry have proposed certain approaches, and we and the staff have -- and again at the subcommittee meeting, we talked about some of the issues that would have to be resolved.

And I think that since then we have talked with the industry, and are prepared to continue the dialogue on how those issues could be resolved.

DR. WALLIS: And if you remember, they said they would go away and prepare a really good case. So you have to be ready for that.

MR. CUNNINGHAM: Yes, and I know that the members of the staff are trying to set up a series of meetings to talk about that. I don't think they have been scheduled yet, but I think the idea is to go forward and talk about that.

DR. WALLIS: I am just saying that talking is fine, but someone has to do a really good technical analysis which is convincing.

MR. CUNNINGHAM: Yes, we agree.

DR. KRESS: Mark, I have a bit of a strange question, I guess. We have a number of design basis accidents that the plants are required to meet, and this is one of them. And we are talking about changing or may possibly change the design basis accident.

The question I have is that isn't there a rationale that has been used by the agency to select design basis accidents, their description and what they are, and some sort of rationale that says we will choose this as a design basis accident because it has these attributes?

And it is sort of top down approach to the question of the design basis accident; and then the next question would be that if you had that rationale, what pipe size goes into meeting those criteria or whatever they are?

I suspect that we don't have such a rationale, but I guess part of the question is should such a rationale be developed in an explicit manner, rather than -- I suspect that it has grown from intuition and other things.

MR. CUNNINGHAM: The set that is in

existence today for the operating plants is this one as you know that has evolved over time, and one of the challenges in thinking about changing those is to go back in 50.46 or something else and look at the intent of the requirements when they were established.

And in some cases that is very hard to do because the decisions were made 25 or 30 years ago, or more, and it is hard to discern from the record what all the intents were at the time.

DR. KRESS: Part of my motivation for asking the question doesn't really have to do with this one, but has to do with advanced reactors.

MR. CUNNINGHAM: That's right.

DR. KRESS: If the tendency or the choice is to go with we will dream up some more design basis accidents --

DR. POWERS: Well, I think you want to be careful with that. I don't believe that you will find that the design base accident set is capricious or dreamt up.

DR. KRESS: No, I didn't mean to impugn it like that.

DR. POWERS: It is developed in a fairly disciplined fashion to test safety systems without a great deal of duplication, but with some bounding nature to it.

There are a whole bunch of accidents that one can dream up that are not labeled design basis accident accidents because they are covered by other existing design basis accidents. It has been a very disciplined process I think.

DR. KRESS: Well, it is the discipline and rationale that I wanted to see explicit, so that I can then apply that discipline to the advanced reactors and say, all right, for this reactor type and style, these are good choices for design basis accidents because they have these attributes that you mentioned.

Plus, there may be others, and I would like to have those attributes somehow based in risk considerations, too, rather than --

DR. POWERS: Well, I actually think there is an NRC document that maybe two minutes ago I could have quoted the title to you, but I can't right now, that actually outlines some of the philosophy on how design basis accidents are --

DR. KRESS: Selected.

DR. POWERS: -- defined and selected, because we have gone through this exercise before. I mean, this is not the first -- well, when the FFTF and Clinch River were in the offing, we had to go through these exercises once before. So people have actually looked at these kinds of things.

DR. KRESS: Yes, but I suspect it was before we focused so heavily on reasons.

CHAIRMAN APOSTOLAKIS: Well, if I wanted to have a design basis accident that would draw on risk information as Dr. Kress just said, wouldn't I need to know which accident sequences are affected by this regulation? Did you collect those?

MR. CUNNINGHAM: You would want that information, yes.

CHAIRMAN APOSTOLAKIS: Do you have it?

MR. CUNNINGHAM: I think we do, yes. But again I don't have it here today, but I think we have a sense --

CHAIRMAN APOSTOLAKIS: Right. I think it would be nice for us to see that, and at least it would be interesting to me to see it.

DR. KRESS: Yes, George, and it is those sequences that I want to see that not only affect CDF and our alert, but I would like to see the sequences that have to do with possibly other regulatory objectives. Frequency of releases of fusion products of higher frequency, lower magnitude, in CDF alert anyway.

CHAIRMAN APOSTOLAKIS: Well, that's perfectly fine, but what I am curious about is that if I have a bunch of sequences and ventries, then maybe we can say, look, this particular design basis accidents addresses this piece here, and that piece there, and that piece there.

And see whether we cover the whole spectrum of sequences and how, because the accident is not just the way -- the way I understand it, the design basis accident is not just a large break LOCA.

It is a stylizing, and plus single failure, and so that would be an interesting thing to see. And maybe something is left out. That would be a basis for defining the DBAs. By the way, it is not just the logic behind the position.

I think one of the great advantages of having DBAs is really that they facilitate the interaction with the licensee.

DR. KRESS: Yes, really great.

CHAIRMAN APOSTOLAKIS: I mean, it is one thing to say go do a PRA, and then we talk, and quite another to say these are the things that we expect you to do, right?

DR. KRESS: If you had a risk in some informed way to select design basis accidents, I think we have a problem, and it is because your purpose of making design basis accidents is to ensure that the design ends up with a risk status that needs acceptance criteria.

CHAIRMAN APOSTOLAKIS: Yes.

DR. KRESS: And we don't have acceptance criteria that includes uncertainties, and defense in depth, and releases the lower fusion products, and worker exposure. We don't have risk related acceptance criteria. So I think we have a problem.

CHAIRMAN APOSTOLAKIS: Well, I think looking at the sequences --

DR. KRESS: Well, that would be well worthwhile. That would give you a lot of insight.

CHAIRMAN APOSTOLAKIS: Is that out of the question to do this month?

DR. KRESS: Could we have that tomorrow?

MR. CUNNINGHAM: Well, I will tell you what we will be giving you in this part of the paper at the end of the month, and maybe this at least addresses part of what you are talking about.

DR. WALLIS: Well, I like what George is saying because once you have got that, then you could say, well, suppose we make this change in these DBAs, how will that perturb the sequences.

CHAIRMAN APOSTOLAKIS: Exactly. And are there any sequences of any consequence.

VICE CHAIRMAN BONACA: I really wonder, however, if there is that document that will have all this information. I think that this thing has evolved through 40 years. I mean, we have plants that were designed originally without ECCS systems.

So somebody evidently did not think that you could have a break of a pipe of the size of that size. And then somehow we began to think that there was a realistic possibility.

And at some point when all this information was developed and put together into a document, where a true companion to all the information and guide was developed, and I am not sure that it was.

DR. POWERS: This is an element of history. The people that did the thinking that, gee, there could be a break in this system and it won't work, was the ACRS.

VICE CHAIRMAN BONACA: I don't know where it came from, but what I am saying is that I am not sure it only came only from the NRC. I mean, the industry was very active. I mean, the NRC standards had the specific particularization of events and postulation of those.

And there was a lot of interaction, and I was just wondering if there was -- because there was a document where all of these have been brought together.

MR. CUNNINGHAM: I don't know of such a document.

CHAIRMAN APOSTOLAKIS: I don't think there is such a document.

DR. WALLIS: Well, there was a long set of public hearings. I mean, there was the ECCS hearings that went on for a long time, and as I remember it, the view of some parts of industry and the AEC was that this will never happen, and we don't have to design for it. And there was all this public hullabaloo when out of that came the ECCS criteria.

MR. CUNNINGHAM: Yes. I was speaking slightly more generally. I am not aware of something where you could look at all of the design basis accidents and have that type of information available.

Again, part of our discussion in the attachment to the June paper is here are from risk analyses the important sequences that are associated with ECCS.

And we have something like that that maps, you know, in a sense of trying to get to the issue of what does PRA tell you about the importance of ECCS as a function and that sort of thing.

So that piece of it will be there, and that is just scratching the surface of what you are trying to get at.

DR. POWERS: And an importance measure for ECCS.

VICE CHAIRMAN BONACA: Actually, that kind of reflection took place very much in the early PRAs, because that was factored in with the set of accidents from Chapter 15, and then there was a lot of discussion of are they covering the whole spectrum, and what else should be there.

And there were different issues, especially initiation of events from electrical faults that were added that were not considered in Chapter 15.

So maybe then there was a lot of -- I don't know. Maybe in some of the early PRAs there was a discussion of that.

MR. CUNNINGHAM: But you are right. The PRAs started with a set of -- on the books were already a set of design basis accidents, and then we moved beyond that.

But something like station blackout is -- I don't believe is a design basis accident, but we have requirements to mitigate that.

CHAIRMAN APOSTOLAKIS: That came later in the PRAs, right?

MR. CUNNINGHAM: I'm sorry?

CHAIRMAN APOSTOLAKIS: It is not the design basis, but the rule came because of the PRAs, right?

MR. CUNNINGHAM: Yes, but there is not a Chapter 15 accident that is --

CHAIRMAN APOSTOLAKIS: How about the small breaks? They are not a design basis?

MR. CUNNINGHAM: Yes, they are.

DR. FORD: Could I ask a question more for my clarification? When you are looking at the overview, and the thing that you showed before, when you come down to the last box, the ECCS cooling performance for number and sizes, and locations of the breaks, that isn't a very plant specific, because presumably it would be due to environmental degradation, and the size, and the geometry of the initiating defects in the pipe.

Is this something that is going to be addressed later on this program? Am I way ahead of the problem here?

MR. CUNNINGHAM: Okay. In this context, basically it is -- well, the requirement is imposed in a sense without the detailed analysis of what might be the degradation mechanisms and that sort of thing. It is that you have to have an ECCS that deals with the biggest pipe break.

DR. FORD: So the question you are asking is if I had this sort of geometry and disposition of cracks, then this is what I would do. But when it comes down to the practicality of a utility, or a plant, coming to you, then could they not say, well, we are never going to have -- the probability of my having such a system of defects is very, very low.

And that would go into your probablistic risk assessment, and you would come out with a very, very low number. Is that a possibility for the future, or is that ---

MR. CUNNINGHAM: Yes.

DR. WALLIS: And is that the way that you are going --

MR. CUNNINGHAM: That's certainly from the Westinghouse owners group and things like that, they in a sense made an argument along those lines, or started an argument along those lines.

And they said for our piping and this type of thing, we are not -- we don't see a credible way to get the large double-ended pipe break. They don't think it is credible.

DR. KRESS: Except for the large double-ended pipe break, that argument would tend to be plant specific. If you are going to hone in on a specific size, it makes the regulation very difficult it seems to me.

MR. CUNNINGHAM: And we get into this, and it might be vendor specific.

DR. KRESS: It might be vendor specific.

MR. CUNNINGHAM: Or something like that.

DR. FORD: Or operational specific.

MR. CUNNINGHAM: Yes, that's right, and that is a lot of the -- if we were to try and back away from the, if you will, somewhat artificial distinction that it will be the largest pipe break, and try to back off from that, you have to get into these issues.

DR. FORD: So right now -- and I am just trying to calibrate myself as to what we are discussing here, you are talking about really a worst case scenario?

MR. CUNNINGHAM: Yes, and the question

that we are trying to get to, or one of the questions that we are trying to deal with is how can we -- is it credible to back away from that worst case pipe break history if you will, and do we have a technical basis to back away from it.

DR. FORD: But that technical basis has been something that we will discuss not today.

MR. CUNNINGHAM: Not today.

DR. WALLIS: And if you go back to the history, you will find that the reason for this was really not technical. It was all this hullabaloo in public, and that this is what seemed to the public to be the maximum credible scenario.

There is a lot of reason for that which is not technical probably, and if you go back to the history.

MR. CUNNINGHAM: I wanted to take the next four slides or so and go back and talk a little more about each of the four boxes that were on this slide that we just showed.

In terms of the, if you will, the reliability aspect of the ECCS or functionality --

CHAIRMAN APOSTOLAKIS: Did you do number seven?

MR. CUNNINGHAM: This is number seven.

I'm sorry.

CHAIRMAN APOSTOLAKIS: Oh, okay. Sorry. So the answer was no, you didn't do it?

MR. CUNNINGHAM: No, not yet. Turning to slide seven, in terms of the elements of the ECCS requirements that deal with reliability of the system, again we are considering a risk-informed alternative to 50.46, and would basically turn it into, if you will, a true reliability requirement.

DR. KRESS: Now, Mark, are you viewing this as the LOCA frequency times the ECCS liability equates to core damage frequency?

MR. CUNNINGHAM: Yes, basically. The underlying concept for the more performance based part of this is that the frequency of the challenge and the reliability of the ECCS has to be balanced if you will, so that you have reached some acceptable value.

So that the lower of the frequency of the initiator, the lower the requirements on the reliability of the ECCS.

DR. KRESS: Now, this balance, is it going to be conditioned to 10 to the minus 4 per year level?

MR. CUNNINGHAM: I'm sorry, 10 to the minus 4?

MR. KURITZKY: We have not decided on that level.

DR. KRESS: You have not decided on what that level is?

MR. CUNNINGHAM: No. We think or we have it in mind, and that will be the subject of other discussions with the committee and things like that later on as we get into more of the details of this.

It is really -- yes, there is a value that we have in mind, 10 to the minus 4, or whatever.

MR. KURITZKY: One point is that we feel that it should be derived from the framework. The framework has quantitative guidelines and we feel that whatever value we come up with should somehow be tied to that framework.

DR. WALLIS: Well, this is a sort of a one-by-one. You say that the large break is very infrequent, and therefore the reliability or response does not have to be so big.

But then the more sophisticated way is to look at all spectrums of all breaks, and choose the ECCS system so that there is some sort of integral of a reliability frequency over all breaks is the best.

MR. CUNNINGHAM: Yes.

DR. WALLIS: And it may well be that putting all the emphasis on the big break is very bad for the optimization of the entire response.

MR. CUNNINGHAM: Yes.

DR. WALLIS: And that would be a really good idea.

MR. CUNNINGHAM: Well, ideally, we would have a well-defined frequency of a pipe break size, versus frequency.

DR. WALLIS: And then we would match the rotation as well.

CHAIRMAN APOSTOLAKIS: Can you really do it so neatly?

MR. CUNNINGHAM: No.

CHAIRMAN APOSTOLAKIS: I mean, as you look at the accident sequence, it seems to me that there isn't such a thing as ECCS.

MR. CUNNINGHAM: That's part of it. In effect, there is an ECCS function that covers many things.

CHAIRMAN APOSTOLAKIS: Exactly.

MR. CUNNINGHAM: There is low pressure injection, and high pressure injection, and things like that. So you end up splitting this continuous distribution if you will into probably ranges, and that's probably more where we will end up.

And that is for the range of pipe sizes

between this and this, then you would have to have commensurate reliability of this. And then break that into however many pieces.

DR. KRESS: The reason that I threw out this number of 10 to the minus 4 is because I was hoping that you weren't going to use that, because this is one little set of sequences among all of them, and there is some other value that is more appropriate than that.

MR. CUNNINGHAM: Yes, and it would not be 10 to the minus 4 for just the reasons that you are talking about.

CHAIRMAN APOSTOLAKIS: Even though we don't like to allocate, right? It may be a good idea though to let Mark finish what he has to say on each view graph.

MR. CUNNINGHAM: That could be.

CHAIRMAN APOSTOLAKIS: And then jump into this.

MR. CUNNINGHAM: You may be right.

CHAIRMAN APOSTOLAKIS: Except for the Chairman, of course. Shall we let him say what he has to say? Go ahead.

DR. SHACK: We can try.

CHAIRMAN APOSTOLAKIS: We can try, yes.

MR. CUNNINGHAM: So, again, we are looking now at two possible ways of getting at this reliability issue. One is what I was just saying, is that it is a fairly performance based oriented type of thing, and it was to match the reliability to the frequency of the challenge.

And then you get into traditional if you will reliability analyses if you will of the systems.

CHAIRMAN APOSTOLAKIS: So the word performance there means what?

MR. CUNNINGHAM: Performance in the sense that -- well, non-prescriptive in one sense.

CHAIRMAN APOSTOLAKIS: But it is not in the sense that we are using it in performance based regulation, right?

MR. CUNNINGHAM: But it could be. One other aspect of this possibly is that we recognize that frequency of challenges -- our state of knowledge if you will about the frequency of pipe breaks -- changes with time.

So that the performance or the requirements on the reliability may change with time also. So one aspect of a performance based type of thing might be that you say they have to meet some value, the product has to meet some value; and as one changes with time, then the other may be able to change with time also.

CHAIRMAN APOSTOLAKIS: My personal opinion is that you need a better word. Performance based is something else. I mean, you collect evidence, and --

DR. WALLIS: I like it in contrast to the second alternative.

CHAIRMAN APOSTOLAKIS: Right. But some other word would be better, such as reliability based, or reliability -- well, something like that.

MR. CUNNINGHAM: Well, it is different than what we had talked about in other contexts.

CHAIRMAN APOSTOLAKIS: Right, and we don't want to start using words. We have already a problem with nomenclature.

MR. CUNNINGHAM: Well, perhaps non-prescriptive approach or something.

CHAIRMAN APOSTOLAKIS: Non-prescriptive or risk oriented, not based.

MR. CUNNINGHAM: All right. The second alternative that we are considering is more prescriptive. It is to recognize that in one aspect of this somewhat artificial way that we look at reliability today, is that we recognize that for the very large pipe breaks that there is the probability of having this simultaneous loss of off-site power that is a requirement, and could be a very low probability.

And so the other option that we are considering is in a sense for a set of pipe breaks where we think we can argue that the simultaneous loss of off-site power isn't credible, and you remove that requirement for that set of pipe breaks.

But the rest of it still tends to look like what is in the requirements today, with that exception. It is more prescriptive, and it is a small step towards ensuring towards a risk-informed approach. But we are considering it as an option.

CHAIRMAN APOSTOLAKIS: What is functional reliability? Is it the probability that it will do its job?

MR. CUNNINGHAM: It's function, yes.

CHAIRMAN APOSTOLAKIS: Now, in the South Texas exemption request, the word functionality is used in that sense?

MR. CUNNINGHAM: I think so, yes.

CHAIRMAN APOSTOLAKIS: And so the probability that it will do its job? I am not sure it is the same meaning.

DR. WALLIS: I am not sure either.

CHAIRMAN APOSTOLAKIS: It is not the same meaning. I think it is asking to make sure that the thing will work, and is not asking about the probability that it will do the job for a period of time.

MR. CUNNINGHAM: Yes, but the term functionality -- and like in South Texas or something, that is a little bit different. Functionality is different than functional, and again perhaps functionality here is not the right word.

CHAIRMAN APOSTOLAKIS: Oh. I think in the South Texas context --

DR. SIEBER: If it will work.

CHAIRMAN APOSTOLAKIS: -- all we want to know if it will work, and if it can do the job. Actually, that is really what they mean. That it can do the job. Now, how reliability it will do it is a different story.

DR. WALLIS: It could do the job if it were reliable.

CHAIRMAN APOSTOLAKIS: I'm sorry?

DR. WALLIS: It could do the job if it were reliable. It is contingent upon it being reliable.

CHAIRMAN APOSTOLAKIS: But it can be

unreliable and still capable of doing it.

MR. CUNNINGHAM: Yes, even if it is unreliable, it could have functionality.

CHAIRMAN APOSTOLAKIS: Yes, and so I think that when it comes to the treatment requirements, and that is what they are worried about.

MR. CUNNINGHAM: Okay. We are not there yet, and we are using the word -- again, this is probably functional reliability. That is a good point. We don't want to confuse this with the context of functionality. Yes, you are right.

So this is where we are today in terms of the reliability aspect of it, and I think I heard the committee, or a couple of the members anyway weren't overly enthusiastic about this, and the more prescriptive oriented.

DR. WALLIS: Well, you wanted some input don't you and comments?

MR. CUNNINGHAM: Yes.

CHAIRMAN APOSTOLAKIS: So is anybody offering any comments?

DR. KRESS: About what?

CHAIRMAN APOSTOLAKIS: What you prefer.

DR. KRESS: Well, I have a comment, but not necessarily about that slide.

CHAIRMAN APOSTOLAKIS: Oh, okay.

DR. KRESS: But what it appears to me is that we are at the heart of it, and what we are beginning to embark on is allocating acceptable risk among a subset of sequences without real considerations of what the uncertainties are, and what this does to the uncertainties.

And how or what the rigor of the quantification of defense in depth is associated with. I have some real concerns about the process, and as you know, I have talked about this before.

CHAIRMAN APOSTOLAKIS: When I mentioned the sequences, I included the uncertainties.

DR. KRESS: Oh, okay.

CHAIRMAN APOSTOLAKIS: You might say that this requirement is here because the uncertainty of the sequence is too large.

DR. KRESS: But we don't have a good measure of what too large is, and a subset of sequences, and so there is a lot of -- I mean, I am not against this process, and I think it embarks on a method that we can learn a lot from. But I think there is --

CHAIRMAN APOSTOLAKIS: I will give you an example. In some of the sequences, I am sure that the redundancy of the system is defeated by human error. But yet that is not a single failure, part of the single failure criteria is it?

MR. CUNNINGHAM: No, it's not.

CHAIRMAN APOSTOLAKIS: Single failure criteria refers to hardware?

MR. CUNNINGHAM: Yes.

CHAIRMAN APOSTOLAKIS: And so there you have it.

MR. CUNNINGHAM: Certain aspects of hardware, too.

CHAIRMAN APOSTOLAKIS: Certain aspects of hardware, exactly.

MR. CUNNINGHAM: That's right. Again, it was an approximation to a reliability requirement, and I think we could do a better job today.

CHAIRMAN APOSTOLAKIS: And that was established 40 years ago or whatever.

MR. CUNNINGHAM: Yes.

CHAIRMAN APOSTOLAKIS: And the state of knowledge was different than.

MR. CUNNINGHAM: Yes.

CHAIRMAN APOSTOLAKIS: So retaining the single failure criteria doesn't sound like such a good idea, unless you expound the definition.

MR. CUNNINGHAM: And that is a possibility, too; is an intermediate step that is more -- a little more current.

CHAIRMAN APOSTOLAKIS: I mean, I don't know how much time you have because I know that 3 or 4 weeks is not a long time. If you could include some of these thoughts regarding the sequences in your report, that would be really very helpful.

And, you know, to speculate a little bit on this when it was placed because at that time they didn't have the benefit of sequences, but it is always --

MR. CUNNINGHAM: The background document that we will be providing was one of the attachments, and it talks about some of the history of how the requirements were established.

And it is looking at why are they as they are, and then another piece is what does risk analysis tell you about what the effect of those requirements on the reliability.

CHAIRMAN APOSTOLAKIS: Are you going to have any of those oldtimers reviewed that document, people who were present when the ECCS hearings were taking place?

DR. KRESS: Joe Murphy.

CHAIRMAN APOSTOLAKIS: Joe Murphy for sure.

DR. POWERS: But he was so young at that time that he --

CHAIRMAN APOSTOLAKIS: Yes, we are talking about who were active in it, but are now retired.

DR. WALLIS: Well, Denny Ross was here wasn't he?

MR. CUNNINGHAM: We have Dr. Wildben back there who is very much involved in helping us look at this issue, and he has been around a couple of years, and has been through a number of these things. I believe that he was involved in the ECCS requirements.

DR. POWERS: Please use the microphones.

CHAIRMAN APOSTOLAKIS: Okay. No comment.

MR. CUNNINGHAM: It is noted that Dr. Wildben, who was involved in this, was around at all of those times if you will.

CHAIRMAN APOSTOLAKIS: Okay. Good.

MR. KURITZKY: Mark, if I could make just one point, is to make it clear that when we are listing -- for instance, in this case, we have two options under there. It is not that we are viewing it necessarily as we are going either with one or the other.

But that they would both go forward possibly, and then the licensee could choose to do either one.

MR. CUNNINGHAM: Or at this point again we are at the point of feasibility, and we are going to look in the further technical work that we are doing after we have gone to the Commission, and we would be investigating both of these options as to whether or not they really make sense in terms of alternatives in the rule.

CHAIRMAN APOSTOLAKIS: All right.

MR. CUNNINGHAM: Since I am running out of time here fairly quickly, in the context of the acceptance criterium, basically the goal if you will is to revise the acceptance criteria such that the ECCS performance during the course of the accident is shown to maintain coolable core geometry.

So it is more of a fundamental thing of getting to the issue of what is the point of 17 percent, and it really is not dealing with hydrogen, and it is not dealing with that. It is a maintaining a coolable core geometry.

CHAIRMAN APOSTOLAKIS: So this is a functionality issue isn't it?

MR. CUNNINGHAM: Yes.

DR. WALLIS: We have to be careful there. Almost any geometry is coolable eventually. I mean, that is not a very good definition. Coolable without the release of something, or put some constraint on it. Eventually it is going to be cool, one way or another.

MR. CUNNINGHAM: Yes, you're right.

DR. POWERS: This fascinates me. What do you mean?

DR. WALLIS: Well, I mean to say that you may well have a core geometry which is a terrible mess, and which is still coolable. But it is not coolable in a way that you would really like to see happen.

DR. POWERS: I am still very confused. If I put a bunch of core down on the bottom of the lower plenum --

DR. WALLIS: It is coolable.

DR. POWERS: And it is coolable -- and I don't imagine that it is coolable, but for a hypothesis that it is coolable --

DR. WALLIS: Well, if it gets hot enough, it will be cooled.

DR. POWERS: No, it won't. It will penetrate the vessel.

DR. WALLIS: That's how it gets cool.

CHAIRMAN APOSTOLAKIS: We are going to run out of time at 10 o'clock, and we have to stop this at 10 o'clock.

MR. CUNNINGHAM: So again in this case, when we look at this issue of --

DR. WALLIS: Maybe we don't need to stop at 10 o'clock.

MR. CUNNINGHAM: In this issue of the acceptance criteria, we are considering a more performance oriented one, which is that you show us by test that the cladding integrity is maintained, and so that gets to this issue of is a rubble bed an acceptable end point.

So we are being a little more specific there that it is not. Again, you could be more prescriptive, more like the current requirements, and say I want to have or I am going to require through evaluation a certain temperature and cladding oxidation be maintained.

DR. KRESS: Mark, if they wanted to show that the cladding integrity was maintained, they will have to show that it is below a peak cladding temperature and that the oxidation is below a certain level.

MR. KURITZKY: Well, actually, the first point we are talking about is actually like a recompression test. It actually would do an actual physical experimental test to show that the cladding maintained some feasibility. It would be an analytical type of test.

DR. SHACK: Just before the LOCA.

DR. KRESS: Yes. I don't think that anybody is going to offer to do that are they?

MR. CUNNINGHAM: Again, today I think -- well, we will be back to you to talk to you about all of these points as we proceed into the second phase of the work.

So, again, this will give you a flavor of where we are going, but it is not trying to give you the answer of whether or not either of these makes -- well, the rationale behind either of these. We will be back with you, I'm sure, in the near future.

DR. LEITCH: The long term cooling bullet would be retained?

MR. KURITZKY: The long term cooling bullet? It would be subsumed in the fact that now in the wording that revised ECCS acceptance criteria, such as the ECCS performance for the duration of the accident, or some such words.

DR. LEITCH: So it alludes to some time constant?

MR. KURITZKY: Yes.

MR. CUNNINGHAM: We are also considering possible changes to the evaluation model, the thermal hydraulic model as well. We are looking at again a series of options in things that we are considering.

One is to replace the current requirement on the decayed heat with the 1994 ANS standard. It is a more recent standard, with some description of the uncertainty that would go with that.

And that's in lieu of something where it is an older decayed heat curve with a 20 percent margin on top of it. So we think 20 percent may be excessive, and we could put something in more realistic.

Again, the option is in -- and in the requirements, if they are acceptable today, is to use a realistic model with uncertainty propagation, and they can do that today, and in typical practice, people don't, because of the complexity of it.

Another option that we are considering is that for certain low frequency pipe breaks, we might be able to relax the modeling requirements to get away from the requirement for uncertainties, and say you can do a best estimate for very low frequency challenges.

In terms of the possible large break LOCA redefinition, again the requirement on the books today is that it has to be the largest pipe break in the system.

One thing that we are considering is changing the wording in the rule today so that you could -- to open the door a little bit to say that it is either that or some alternative that is deemed acceptable by the commission.

In rule making that would introduce the possibility of getting at the -- at perhaps the Westinghouse issue of can we show you that the large break LOCA, or that certain classes of breaks are not credible.

This in rule space would allow you to pursue that, and without having to go to another rule change, permit that type of an analysis.

DR. POWERS: When Westinghouse says that something is none, let me assure you something is not credible. I mean, I am a very credible guy, credulous guy. I mean, I can imagine lots of things. What is the proof that something is not credible?

MR. CUNNINGHAM: This comes in a sense to the next slide, which is in --

DR. WALLIS: I don't think anything is incredible. You have to define it in terms of probability.

MR. CUNNINGHAM: Well, what I just showed you before would allow from a rule standpoint some flexibility in what the staff could approve and what licensees could use.

This is a summary of what was provided at the subcommittee meeting a month or two ago on what would have to be the technical justification, or some of the technical issues that would have to be addressed in order to demonstrate credibility or incredibility if you will.

DR. POWERS: Again, Mark, could this be done without the reg guide that defines this, and leave that open, or you would really envision that this change couldn't be made until you were ready to issue a reg guide?

MR. CUNNINGHAM: Since we have today, that change could be made to the requirement as part of the rule making without a reg guide. I think that is the sense that we have.

The reg guide could at least conceptually, if we deal with these issues, then you could deal with that, and you don't have to go back and change the rule.

There are a lot of practical problems that would have to be dealt with in the course of that, but we don't think that we would necessarily have to have the reg guide when we made that wording change in the rule.

DR. POWERS: I am still struggling with what makes something incredible. You have up on your slide in service experience. Well, we have not had a whole lot of large pipe breaks, and so that certainly is not a fertile field to mine there.

I mean, we have got a few cracks in them, and maybe that is a more fertile field than I think. And analyses, I am very confident that within obscure computer codes and things like that, that you can generate frequencies that are small.

But does it mean that I have to show that never in the history of pipes in this world be a pipe of this sized break?

MR. CUNNINGHAM: No, I don't think so. We consider vessel rupture in regulatory space as an incredible event, in the sense that it is not of sufficiently low frequency that we do not have to require ECCS to mitigate that type of failure.

That is not to suggest that there has never been vessels of that type that have failed or not failed in world history if you will. But it is a combination of -- that in a sense, and perhaps implicitly, it becomes a sense that the probability of such a failure is low or very low, and that the confidence or the uncertainty in that probability is small enough that you can have confidence that it is not going to happen.

DR. POWERS: I am going to keep asking because I am still struggling with this. Okay. When these guys do these calculations, they usually hypothesize about lipsoidal cracks and certain aspect ratio, and what not.

Of course, there are no cracks that look at all like that are hypothesized in the computer codes. So there is a lot of uncertainty here and what not.

What kind of percentile of a conceivable distribution do they have to get to, to say okay, it is incredible here?

MR. CUNNINGHAM: I don't know that I have a good answer for that, because I think that at some point it becomes that quantitative information leads to a qualitative judgment that it is close enough.

DR. POWERS: Well, presumably it has to be on the order of what you accept for a pressure vessel?

MR. CUNNINGHAM: Oh, yes, from that sense, we accept certain things, and --

CHAIRMAN APOSTOLAKIS: What is that, 10 to the minus 6?

DR. POWERS: Well, we are still debating that, but on that order.

MR. CUNNINGHAM: Yes, on that order, and in the PTS space, you say if the risk associated with a PTS induced vessel rupture is 5 times to the minus 6 or less, it is acceptable.

DR. KRESS: But that doesn't seem like a good choice to me, and I will tell you why. The consequences of a pressure vessel rupture are surely much greater than the consequences of this pipe breaking.

DR. POWERS: That's right, but they will never say that. I mean, I know this PMF guys. They come along and they will say okay, the nominal probability for a single crack is 3 times 10 to the minus 45th, or something like that. I mean, they come up with very low numbers for this sort of thing.

And they will say, yeah, but there is the possibility that cracks will interlink and things like that, and I don't know how to deal with that. So it could be a higher probability, and they will pick a number like 10 to the minus 5th, and it could be up that high.

And what Mark is saying is that there has to be some confidence limit with that, and I am trying to find out what the confidence limit has to be. Does it have to be 99 percent confident that the probability is 10 to the minus 6th or lower? Or does it have to be 95 percent, or 80 percent, or --

DR. KRESS: Yes, I have wrestled with that question on other issues.

DR. POWERS: I know you have.

DR. KRESS: And there is no clear technical way to arrive at the confidence level unless one goes to the utility function, which is not exactly technically arrivable at.

DR. POWERS: Well, right now I am on a very specific thing. What if Westinghouse said that it takes to show something this is incredible? I am very credulous. I mean, I can believe lots of things. I even believe in 10 to the minus 45th for cracking in BWR welds.

DR. LEITCH: Aren't we really saying then that anything above this alternate size, if there was some alternate size approved, that anything above that is going to lead to core damage?

MR. CUNNINGHAM: It could be that or it could be that anything above that size does not have an ECCS system that has to meet the requirements of 50.46, although there may still be some mitigative capability in the plant, but not safety related if you will. There are several alternatives for that.

DR. KRESS: Anything above that alternate size contributes a contribution to the CDF at a probability or confidence level that is unacceptable, or that is acceptable.

So you have a confidence level that the contribution to CDF of any pipe above that is acceptable, and none of those things have been rigorously defined to my knowledge what the confidence level is, or what is an unacceptable contribution to CDF for a subset of sequences.

But that is their problem, and they have to wrestle with something like that. I think that is the basic concept.

MR. CUNNINGHAM: Again, there will be other opportunities, and we will be back before the subcommittee or the full committee to talk about all of these issues that we are wrestling with here as time progresses and as the rule making proceeds.

DR. LEITCH: Before although there you say that the ECCS systems exist and no one is going to tear out ECCS systems, yet some of the testing criteria -- I mean, what will go along if this is approved, and then people will start to ask for a relaxation on testing criteria out of service time, and diesel, and all those kinds of things.

MR. CUNNINGHAM: Yes.

DR. LEITCH: And they would no longer be able to demonstrate to the same degree that we can now.

MR. CUNNINGHAM: And clearly we see that as one outcome, is that there could be relaxation in the text specs and that sort of thing as an outcome, and again using risk information that would suggest that that could be justified without having a substantial increase in risk or anything like that, at least for the large breaks and things like that.

And to some degree there is an element from risk analysis that would tell you that there is some degree of over design of the ECCS for the very largest breaks. Mr. Chairman, it is 10 minutes till. Did you --

CHAIRMAN APOSTOLAKIS: Keep going.

MR. CUNNINGHAM: Okay. Just to give you an idea of what things we think will be coming back to the committee to talk about over or during this second phase of our work, assuming that the Commission tells us to proceed, we have hit on a number of these.

Such as developing the method and dealing with, for example, on how you deal with uncertainties on ensuring the reliability requirements match the frequency of the challenge.

And the LOCA frequency versus size information; and the resolution to what degree we can either eliminate or modify the current large break LOCA basis accident given the industry's interest in that.

Again, the technical basis for some of the changes to the evaluation methods, and what would a new decay heat curve look like and that sort of thing.

And then this issue that we talked about earlier of the technical basis, and saying what is an acceptable post-quench ductility, and what does that really mean. I think we would anticipate coming back to the committee on all of those issues.

DR. FORD: I have a question on the first bullet in engineering. There is going to be a time dependence to that statement?

MR. CUNNINGHAM: Yes.

DR. FORD: What is your timing on all of this, and who is going to do all this work? You have got two problems with that particular bullet. One is the information necessary, the factual information on the time dependence of the development of the flaws.

MR. CUNNINGHAM: Yes.

DR. FORD: This is a very large engineering topic. Another one is how you apply time dependence to PRA, which I understand is not done here; is that correct? There are two major problems there; time and effort. Is there a limit to that, or should we even be discussing this?

MR. CUNNINGHAM: Well, again, in the concept of how you build time dependence and aging effects and things into PRAs, we have done some first steps, some good first steps along the way in that regard.

In terms of the frequency versus size information, I think we need to be able to -- in this context is it sufficient to be able to deal with the reliability requirements on the current ECCS systems.

So I think in this case be able to have a fairly crude approximation of this, and still get something that is satisfactory for being able to set the reliability requirements.

So I think at least in my mind that it is achievable, because we can be fairly crude in what we are doing. The people that we have talked developing a fairly good curve of this if you will, and that is years worth of work.

And I think we can do less than that and get an acceptable answer for what we are trying to accomplish on the reliability requirements. On the second part of it, the resolution of whether or not the large break LOCA definition could be -- the DBA could be eliminated, there is a lot of work.

And again at this point, we are going to be interacting with the industry to see if we can get some agreement on what the extent of that work would be.

DR. POWERS: Mark, why is it that you want to remake the reliability requirements commensurate with the challenge frequencies, and not the product of challenge frequencies and the consequences of failure to meet that challenge?

MR. CUNNINGHAM: The interest in -- to me, I would say that those would be the same thing. That you would end up with a product that is fairly -- of the two that is fairly consistent across the spectrum of break sizes.

DR. POWERS: So what you are saying is that the consequences are all the same?

MR. CUNNINGHAM: In this case, we are kind of defining it so that the reliability of ensuring that a certain consequence isn't achieved, or that the reliability for ensuring that adequate coolable geometry or that type of thing.

CHAIRMAN APOSTOLAKIS: You could look at the spectrum of planned damage space that the PRAs define and see which ones would be effective by these.

MR. CUNNINGHAM: Yes.

CHAIRMAN APOSTOLAKIS: And work with the frequency of those, rather than the total --

MR. CUNNINGHAM: Yes, and we talked -- when we talked about this today, we talked about it in terms of CDM, but containment performance is still -- we are going to deal with both.

The policy issues that we expect to see in the paper, one is that we are attacking, if you will the issue of the single failure criteria, and here in the context of the ECCS requirements.

A single failure criterion applies to other parts of the requirements as well. One is that we are considering putting in a recommendation in the paper that would ask the commission's approval to proceed to identify where else in the requirements of Part 50 that we would take on this reliability concept if you will, or attack the single failure criterion.

DR. POWERS: The ECCS really has a two failure requirement criterion; is that right?

MR. CUNNINGHAM: I'm sorry, but I didn't hear the question.

DR. POWERS: The ECCS really has a two failure requirement?

MR. CUNNINGHAM: Yes.

DR. POWERS: There is a power requirement and the failure of any other system?

MR. CUNNINGHAM: Yes, that's right, and so we would be revisiting the combination of those things. Another policy issue is in the context of selective implementation.

We have talked about this in the context of 50.44, and the same issue applies here, of whether or not if somebody wants to use this risk-informed alternative, whether or not they can pick and choose within the risk-informed alternative, like 50.44 would be.

And in 50.44, we recommended it, and the commission approved it, that there not be selective implementation within a rule.

CHAIRMAN APOSTOLAKIS: Right.

MR. CUNNINGHAM: And just quickly here again, we owe you a copy of the commission paper here towards the end of this month, and we would like to come back to you in July, and --

VICE CHAIRMAN BONACA: How big is that?

MR. CUNNINGHAM: The paper itself is going to be less than 10 pages. There will be 4 or 5 attachments. One of them will be --

MR. KURITZKY: It will probably be comparable with the 50.44 report.

CHAIRMAN APOSTOLAKIS: So how can we review it?

DR. POWERS: Read very quickly. Actually, we have got lots of time, George, because July 4th is a holiday. Dr. Shack, do you think we can review that in time to write a letter?

DR. SHACK: We have to see it when it arrives.

CHAIRMAN APOSTOLAKIS: And assuming it arrives on the 29th of June.

DR. WALLIS: You can take it to Waterford with you and read it.

CHAIRMAN APOSTOLAKIS: And if we don't do it in July, it has to go to September. Do you expect the commission to take action from these -- I mean, sometime soon, or --

MR. CUNNINGHAM: It is hard to tell. It is hard to tell.

CHAIRMAN APOSTOLAKIS: It is going to be very hard for us to write a letter I think.

MR. CUNNINGHAM: Well, we owe the paper to the EDO like on the 23rd of something like that. So, maybe we can get it to you in that same time frame.

Obviously, we would be interested in getting a letter in July, and if it can't be done, it can't be done. That is the committee's call obviously.

CHAIRMAN APOSTOLAKIS: No, I mean, the point is if we write it in September and the Commission has already decided on whatever you ask them to decide, then it doesn't make sense. Are there any more questions or comments from the members?

DR. LEITCH: Mark, just a question as to the total scheme of things here, and one of the things that you said was that special treatment requirements may be a follow along situation.

So we are looking at later on in our agenda today, we are looking at South Texas with respect to option two, which is really an exemption from special treatment requirements. But further down the road there may be a redefinition.

MR. CUNNINGHAM: Yes.

DR. LEITCH: I mean, we are putting a lot of if's, and's, and maybe's in there, but what is in our embryonic thinking here is that maybe rather than seeking exemption from special treatment that special treatment requirements could be changed.

MR. CUNNINGHAM: The option two work is looking at the scope of special treatment requirements, and that is obviously what you are going to be hearing about today with Southern Texas and others.

The longer term effort is getting at what should be the environmental over qualification requirements for the equipment that is subject to special treatment requirements, and that sort of thing.

But for the near future, our resources are going to be principally focused on 50.44 and 50.46.

DR. LEITCH: I understand.

MR. CUNNINGHAM: So I wouldn't expect that we are going to -- at least with the present situation, in terms of funding and things like that, I wouldn't expect that we would have an ability to deal with the special treatment requirements in the near future.

But the goal, long term, is to go back and revisit what should the requirements be.

DR. LEITCH: Okay. Thank you.

MR. CUNNINGHAM: But it is a long term goal.

DR. LEITCH: I understand.

DR. SHACK: We are running over schedule. So, Adrian, and we will have the industry perspective.

MR. HAYMER: Good morning. My name is Adrian Haymer, and I am with NEI, and I am a program manager working for the Risk Informed Regulatory Group.

Tony Pietrangelo is the director, is our director of the Risk Informed Regulatory Group, and Bob Osterrieder is the project leader at Westinghouse, dealing with option three and redefining large break LOCO.

And what we would like to do today is just to give you some feedback on where we think we are on 50.46, and risk informed regulation, or the technical requirements in general.

Because we have had some discussion with the staff, and we have been meeting with the staff now for -- certainly for 18 months or so, and discussing option three.

In January of 2000, we sent a letter saying where we need to focus our efforts in regard to option three to the Commission, and I think we have been consistent in our message, and we would like to go forward and take a look at redefining the large break LOCA activity.

And when we met I think a few months ago, we had some discussions with you on that, and our thought process has evolved a little bit, and perhaps we need to make some clarifications in that regard.

But I guess our approach on 50.46 and redefining the large break LOCA is what we might term a graded approach, and I think some of the statements that the staff made about their proposed language rule is along the lines that we were thinking.

In other words, you would go forward as a first step with taking a look at the co-incident loss of off-site power, and defining a break size that goes along with that.

So where they said there were two options, we would blend those into one, and you would then get a break size. But you would still have a commitment or the ability to mitigate the large break.

But it wouldn't be the full design basis, Appendix B, type requirements, but you would still have to show the ability to mitigate the large break or the largest break in the plant.

And the language that we think in the rule would be very similar to what the staff mentioned a few minutes ago. Tony.

MR. PIETRANGELO: Yes, I think that summarizes it pretty well. We think you can treat the double ended guillotine break more like you treat things in severe accident management space than as a design basis requirement that it currently is.

That double ended guillotine break assumption drives many of the other regulatory requirements in Part 50. That is a very, very conservative assumption. And we see this first rule making with 50.46 as really an enabling condition to be able to go forward, and then take a more realistic break size first for eliminating the coincident with loop and single failure that is currently in the regulations.

That would be the focus of the first rule making. But once you have a redefined large break LOCA, that assumption is used in many other applications within the scheme of regulations, and we can't possibly know all the impacts in the first ruling making of taking a reduced large break LOCA size.

But the point is that you can't make changes to those other regulations based on the new assumption without NRC approval in each of those applications like we do via Reg Guide 1174 on risk informed applications.

So this first one is really an enabling rule. There will be a lot of effort to look at the analysis and come up with a new break size will probably be different for each NSSS reactor design.

But once that is done that really sets up a very methodical comprehensive phased-in approach for taking that assumption, and promulgating it through the rest of the regulations, with tremendous benefits in terms of the focus on safety and operational benefits to the licensees, in terms of operating margin and burden reduction and cost effectiveness.

And so we think that this is probably the biggest fish in Part 50 to go after. I think we have been consistent as an industry stating that since the letter went in in January of last year.

We are anxious to get on with that, and

the Westinghouse owner's group, and Bob will speak to you about that in a moment, and they have already done an extensive amount of work looking at the analysis to get down to that reduced break size. But we think that this is a very important effort.

MR. HAYMER: And I think with had a question about what comes next, and I think when you take a look at 50.46 and some of the activities that we think would flow from what we have discussed, and what the staff has discussed in regards to defining a large break LOCA coincident with loss of off-site power and single failure, when you see what flows from that -- and we have given a list of those areas that we think would be amenable to further review once we have done this first step, that is a very large amount of work.

And I think once we have gone through that, we might then think about going back, but I think we are talking about a fair way down the road as regards those activities.

So that is where we see it at the moment. The only other point that I would make is that we have given consideration that if this is beginning to take some time that we should think about breaking off the decay heat requirement into perhaps a separate rule.

And that is something that we will look at and then decide what needs to be done with regard to that. Bob, did you want to say something?

MR. OSTERRIEDER: Yes, just a couple of comments. The question was brought up, you know, what does Westinghouse or the industry feel is a good limit on CDF or LRF, or defining what is incredible, and we certainly don't want to define what is incredible.

But I do want to comment that first of all the issue of the probability of these breaks occurring is a key issue, and there is two areas here that we need to get on with in interacting with the NRC.

That is, the estimates of the LOCA frequency, and how they are obtained in this curve of frequency versus break size, and about what there has been a bunch of discussion here. That is the first piece.

And the second piece is related, and that is the technical justification related to the frequency and what is enough rigor in the calculations.

We feel -- there has been a lot of comments here that this is a big wide open area that is going to take a lot of work, and what we feel is that we need to get some of these pinned down pretty quickly so that we can decide if this work is worth doing.

We think that we can get together and I think somebody already mentioned that we are working on setting up a meeting with the staff to talk about some of these issues, and that is the next technical meeting that we have to schedule.

And we need to get that scheduled, but those key issues, we need to in our opinion work on those quickly in the near term, and decide what do we have to consider in these curves, and what are the issues that have to be resolved.

And that's because right now it continues to be an open-ended high level, and there is more rigor required here, but we need to pin down what this rigor is on these probabilities and on the -- if we are going to use leak before break or something to justify the specific size which relates to that curve, we need to get those issues down on paper as to what they are so we can decide how to deal with them, and whether or not they are too extensive to deal with.

And I guess that is a key point, and for us it is a key item for moving forward. We need to get into some of that in the near term and get that pinned down further.

DR. WALLIS: I am intrigued by your statement that you might need more rigor on the probabilities. Maybe you need more rigor on the effect of modal uncertainties.

MR. OSTERRIEDER: Well, that --

DR. WALLIS: And maybe eventually after a decade, somebody is going to look at some aspect of the codes that affect the probabilities.

MR. OSTERRIEDER: Well, the rigor again, and when we presented our basis, and what high level technical basis, we were told that we would need more rigor in that area, and that is why I was focusing on that area.

DR. WALLIS: Well, I am saying it is not just probabilities, but it is the things that affect the probabilities.

MR. OSTERRIEDER: That's correct.

DR. WALLIS: And it will always have an effect on success and all that kind of stuff, and it is all tied together.

MR. OSTERRIEDER: Right. But we are not focusing on changing the acceptance criteria of the codes, or the methods in the codes. And again when we started the program, we were looking at the rigor that was applied in GDC-4 and the ISI programs as being sufficient.

It has been brought up that the staff feels that that is not sufficient, and we need to talk in more detail. There were some details brought forward at the March 16th subcommittee meetings, and we need to meet, and we hope to cover some of that in our next technical meeting.

Also, as to more specifics about why that is so different, and what is the basis of some of that.

MR. HAYMER: While we are pulling on from that topic as we go on schedule, I think the industry is very interested in getting down and looking at some of the detailed work that the staff plans to do and see what we can do or have done to address those issues.

And working together, we can move it forward, but we have got to get a better understanding of what we are looking at from a technical perspective so that we can move forward on this regulation.

And that brings into mind the overall schedule of option three, and when we started this activity, we said 50.44 and 50.46, and the reason that we selected 50.44 is that we thought it was going to be fairly straightforward.

And in truth the staff moved very quickly. There were recommendations made last September and the Commission directed the staff to move forward with an expedited rule making in January.

And things have seemed to have gone silent, and now we hear that the only thing that has been sent up is a plan, and we don't know what that is, and we have been working on this now, for Option 3, for 18 months.

We probably are not going to have anything to show the industry for at least another two years, and that is beginning to concern some people.

MR. PIETRANGELO: Adrian is right and it is frustrating from our standpoint, because 50.44, the reason that it was selected was that it has benefited the licensees and there are things that we do with the plant with the recombiners and monitoring it that make no sense from a safety standpoint.

And really that has been a belief since about the late 1980s when this regulation was looked at under the Marginal Safety Program. It was one of the three final regulations that were looked at as part of that program, and the only regulation that did get changed was Appendix J for integrated leak rate testing.

And then San Onofre went through an exemption request on recombiners and on combustible gas control, and after a 2 to 3 year review by NRR, they finally got their exemption request in 1999.

We thought that was going to be the principal basis for the 50.44 rule making. Yet, there has been a lot of other things that have been brought into play on 50.44 on certain containment types, and I won't go into great detail here.

But we had something that already had a technical basis, and was applicable to about 95 percent of the industry. But I think the kind of business as usual approach to this says that we have to make this rule perfect, and apply to everybody equally, and make sure that is all dealt with in this one rule making.

And as a result, I think you are seeing the schedule dragged out on this for additional technical basis for these other containment types, and new gas source terms, and all the rest.

While the principal benefit of this for the vast majority of the industry is kind of sitting there, you have three exemption requests sitting in NRR waiting to be reviewed, and others that probably would be submitted if they knew that this rule making was going to take so long.

So I think there has got to be a new mindset when we look at these improvements via Option 3, especially when we get to something as complex as 50.46. When you see something that has benefit, and is fairly straightforward, you need to take it.

There may be additional work done later on to look at other aspects, but it should not preclude or at a minimum slow down to this extent the progress in making the regulations more risk informed.

That is our real message on this, because on 50.46, if you wait until you know everything that might ever happen when you go to a redefinition of hard break LOCA, we will never finish this. We will never finish.

DR. WALLIS: I am trying to disentangle this. You are complaining about the way 50.44 was handled?

MR. PIETRANGELO: Right.

DR. WALLIS: And you are extrapolating this to 50.46, but what I think I detect is that you realize that you have to do a lot of work on 50.46, and that is sort of reducing the enthusiasm a little here?

MR. PIETRANGELO: No, I think that's why Adrian said there is a piece of decay heat --

DR. WALLIS: Decay heat may be handable, but all these other things that we heard about this morning are not trivial. You have to produce a really good piece.

MR. HAYMER: Yes, and we agree that we are willing to sit down and produce that, but --

DR. WALLIS: Well, that is what you said last time.

MR. HAYMER: Yes, and we are willing to work with the staff, and we are setting up meetings. But our concern is that if you see the way that 50.44 has gone, and then if you say that is how we are going to go in 50.46, with the amount of work that is involved, that is going to be -- are we really going to get there.

And picking up on Bob's point a few moments ago, that's why we think it is important to sit down with the staff and get a better understanding, because we think we have the basis to move forward with the case, and they had a plan laid out of when certain work product would be produced, and given to the staff so they could sit down.

Now, the staff has come back and said that we need more rigor, and now we are trying to find out, well, we have got a program that Westinghouse and others are working on, and it is meant to produce these products in this period of time.

And now we are saying there is more rigor and now what does that mean, and it is important that we sit down soon and discuss what those are so that we can work on that.

MR. OSTERRIEDER: Right, and we are not afraid of the new work, or the work that needs to be done. What we need to do is to get it defined so that we understand it.

If it is such a massive effort, then like any other business decision, you have to decide if it is worthwhile. But my main point is that we need to sit down and define the issues that we are talking about, and what is additional rigor, and what is an acceptable curve of frequency versus break size to support the PRA aspects.

We need to sit down and move on with that so that we can decide what the work is that we have to do, because we have been talking too long and we need more rigor.

And we keep saying there are a lot of issues and there are, but we haven't --

DR. WALLIS: Well, it seems to me first of all that you need to have a case which is persuasive to you.

MR. OSTERRIEDER: Yes.

DR. WALLIS: And then it might be persuasive to somebody else, and waiting for the staff to tell you what that case has to be isn't really going to achieve very much.

MR. OSTERRIEDER: Well, we believe that we have a case, and what we are being told is that it is not sufficient, and what we are trying to get from the staff is please help us understand what is not sufficient about it other than --

DR. WALLIS: But you remind me of the student that keeps telling his professor to tell me what should be in my thesis, and the professor says, well, you know, it is up to you to figure that out.

MR. HAYMER: Well, they have a series of work products, and a plant to develop those work products. Now we are told that we have to be even more rigor than that, and we are saying okay, what more do we have to do beyond this.

CHAIRMAN APOSTOLAKIS: Is the report that you guys are preparing for the end of June going to answer some of these questions?

MR. KURITZKY: The report at the end of June is going to discuss the technical issues that we believe need to be resolved in order to proceed with the large break LOCA redefinition, and I believe as I said earlier that the staff has agreed to meet with the industry to talk in technical terms about the issues that have been raised.

CHAIRMAN APOSTOLAKIS: Okay.

MR. OSTERRIEDER: The only other comment on the amount of work is we are concerned a little bit that we are looking at such a wide variety of options here -- the acceptance criteria, and the different pieces here that we have looked at, because each of these in themselves could be a lot of work and to do the acceptance criteria.

And our feeling was that we should focus on these issues related to redefinition to define them, and get on with that first, versus having little resources to have the meetings with us and to define this, and do some work because there are so many initiatives going on.

And these initiatives and to do all of this would take many, many years we believe.

MR. PIETRANGELO: And the other factor that was not on the table maybe in some of the earlier meetings on this was -- I think there was some miscommunication, or we weren't on the same page with regard to the remaining mitigation capability for the double ended guillotine break.

I think the perception was that there wasn't going to be mitigation capability left for that, and so that the approach has changed. We do want to maintain mitigation capability, even for the double ended guillotine break.

But the point is that that can't be the design basis assumption that drives the rest of the other regulations where that assumption is invoked. And there needs to be more talk about, well, what does that mitigation capability have to be, and what is the acceptance criteria for that.

Is it the same as the ones for 50.46, or do you keep core damage frequency below some number? So there is a lot of details to be worked out, but you can only have one design basis on a system. You can't have that this is the more likely one, and this is the less likely design basis.

That won't work in the current regulatory framework. So there are issues that have to be worked out, but I think you have another factor there that can play on rigor.

If you have remaining mitigation capability for the double ended guillotine break, how much more rigor do you need to demonstrate to produce break size that is going to be the design basis.

So there is kind of a scale there that you can use to make yourself comfortable that there is assurance that you can handle those situations.

DR. WALLIS: I still get the impression that there is technical work needed on both sides, and that is what has to be done, and just arguing about it is not going to resolve the positions.

MR. PIETRANGELO: I think part of the reason this was selected was that you are building on things that have already been done -- leak before break, and risk informed ISI work. That is all work that can be brought to bear on this subject.

So we are not starting from scratch. We have gotten things that have been accepted in the regulatory process already, and that is a good foundation to go after this additional work. So we are not starting from scratch.

DR. SHACK: Any more questions?

(No audible response.)

CHAIRMAN APOSTOLAKIS: All right. Thank you. I would like to also thank the staff for their presentations. We will recess until 10:40.

(Whereupon, the meeting was recessed at 10:20 a.m., and resumed at 11:22 a.m.)

CHAIRMAN APOSTOLAKIS: The next item on the agenda is the potential for margin reductions associated with power uprates, and this is Dr. Wallis and Dr. Bonaca.

DR. WALLIS: I would simply say that you all know that we are interested in this issue, and you all know Gus, and we are looking forward to what he has to tell us.

CHAIRMAN APOSTOLAKIS: Dr. Bonaca. Okay, Gus.

DR. CRONENBERG: This is basically a status report on some work that I have been doing that came out of the retreat. So I started this in March, and I titled it, "Signature Estimates of Margin Reductions," because I think we have bits and pieces of information, and sort of sign posts, but it is not the full story.

In the outline of my talk, I am going to give you a little bit of how margins is used in the regulatory process, and then I am going to give you some estimates of what I was able to find for a case study that I did for the Hatch plant.

Hatch had two prior power uprates and is under present review for license renewal. So I will do the power uprates, and then some estimates from basically time limited aging analysis for the Hatch plant, and then some preliminary findings.

DR. KRESS: Are those bullets little land mines or what are they?

DR. CRONENBERG: They are something or other.

DR. LEITCH: Gus, the status report that we got, is that what you are referring to, or is that -- I guess what I am saying is some of the chapters here seem to be not aligned with --

DR. CRONENBERG: Yes. That is just a draft of --

DR. LEITCH: It is just a draft?

DR. CRONENBERG: Yes, the end product is in September, and I want to give you a final report on this study, and that is just where I am on what I have to date. It is a little disjointed, but I just wanted to show you where I am going.

And so that report will be in a final form in September when I intend to wrap this project up.

DR. LEITCH: Okay. Off-line then, I will give you a couple of comments here after just reading through this.

DR. CRONENBERG: That's fine.

DR. LEITCH: Editorial type of things.

DR. CRONENBERG: Yes, okay. And then you also have in your notebook like a four page summary of what we did and where we are at. Okay. Margins, from Webster, are as spare amount allowed for contingencies or another definition of bare minimum below which something is no longer desirable.

DR. WALLIS: It's marginally, you mean? You mean marginal performance on a test or something like that?

DR. CRONENBERG: Yes. Well, you understand.

DR. WALLIS: Well, you go to Webster, and in fact the agency doesn't define what it means by margin.

DR. CRONENBERG: Margin is used in a rather general sense, and what I did was go to the general design criteria and just try to give you examples of how margin is used in the general design criteria.

And then actually you have to go to regulatory guidance, and you have to go to ASME pressure and pressure vessel, or code, or American

Institute of Standards type of thing to really look at margin.

For example, Criterion 10. It says that the reactor core and the associated cooling control and protection systems shall be designed with sufficient margin to assure acceptable design limits shall not be exceeded.

Well, Graham, you might say, well, that doesn't tell me anything, and it might be the kind of thing that we would expect from Graham. This exactly how -- and it goes on and on. They are all like that.

Criterion 31, the reactor coolant pressure boundary shall be designed with sufficient margin, blah, blah, blah, so that it behaves in a non-brittle manner. Again, it doesn't tell you. You have to go a step further, and that is coming in the next few slides.

Criterion 50, the containment. Now, not only the primary system, but the containment, including openings, penetration, shall be designed without exceeding a design leakage rate, and with sufficient margin to reflect metal, water, and chemical reactions.

DR. WALLIS: Doesn't sufficient margin relate to uncertainty in all of these things?

CHAIRMAN APOSTOLAKIS: Yes. Sure.

DR. WALLIS: It is tied in with uncertainty, but that connection isn't explicitly made.

DR. CRONENBERG: These are general design criteria.

DR. POWERS: I think you would end up with confusion if it made that tie, because the margins are there for the things that are not included in the analyses that are typically done.

CHAIRMAN APOSTOLAKIS: Not necessarily. If you are uncertain about something, you don't know what the value would be.

DR. POWERS: These are Chapter 15 analyses, George.

CHAIRMAN APOSTOLAKIS: Oh, oh, okay. Thank you.

DR. POWERS: And there are things that you may not know.

CHAIRMAN APOSTOLAKIS: That is what it should be, yes.

DR. POWERS: And that nobody thought of, and so those margins are things that are not taken into account.

CHAIRMAN APOSTOLAKIS: But how can you do that?

DR. WALLIS: Then this is just a gut feeling then, and if you don't know what they are, then you can't assess them. You have to make some sort of a guess as to what they are.

DR. POWERS: You've got it.

DR. WALLIS: And so margins are just guesses about how unsure you might be.

DR. CRONENBERG: Well, for example, it will say that you can't exceed -- that a pipe can't exceed a design pressure of a thousand psi. The licensee will come and say my LOCA now shows that this steamline for design basis accident gets to 950 psi. I have a 50 psi margin.

The licensee will say that to me is sufficient margin to meet --

DR. WALLIS: But your uncertainty in your prediction is plus or minus a hundred, and therefore I am not going to --

VICE CHAIRMAN BONACA: They would come back and say that we have built in considerations for uncertainties for the conservatism. Now, to negotiate whether those conservatism would in part account for uncertainty or not.

DR. WALLIS: Well, you can't be so wishywashy about it.

DR. POWERS: Graham, in no case would you come in and say the uncertainty in your calculations here is plus or minus anything. You would always be that your uncertainty in this is plus X, minus nothing, because they are conservative calculations.

DR. CRONENBERG: Okay. That's -- we are going top down. It starts with the general design criteria, where margin is first, and that is the rule of law. It says that you have to have sufficient margin, and it doesn't define in psi what that margin is, or percent, to some limit.

You have to go to a regulatory guidance, and even there the regulatory guidance usually refers to, let's say, the ASME pressure and pressure vessel code.

But it will give you acceptance criteria for design pressures, pressure temperature limits, stress limits, allowable materials, ductility limits. Those are the kinds of requirements that will be placed on certain system structures and components -- a piece of pipe or whatever.

And basically it will then say go to the ASME pressure vessel code, and then the ASME pressure vessel code will tell you more detail. It will tell you how you have to test, and how you have to remedial this material if you are going to us the thickness of this material with that alloy and composition.

And that this is the pressure that you cannot exceed, and that is how it is all established, and that is how we establish design criteria. We build upon code upon code.

DR. WALLIS: I am puzzled about what Dana said about having no error in the other direction, and if it is a conservative analysis, why do you need a margin if there is no error output?

DR. POWERS: It is put in there because you may not have thought of everything. These are complicated systems, and at the time they were built they didn't know what --

DR. WALLIS: So it is an illusory to say there is no error in your conservative analysis?

DR. POWERS: Well, there are presumably things that get discovered all the time. One of the reasons to put margin in there for is that the coding analyses tells you how the thing is built, and as soon as it is built, it starts degrading.

And it degrades in ways that may not be reflected in things like corrosion allowances and stuff like that.

DR. CRONENBERG: And in the ASME code, there is margin for design limits that will take into account aging and rusting of field components and those sort of things.

Those already have margins, and the way that I am going to estimate margin is that I am going to say that this is the ASME design limit for this particular pipe, and how close are we to that design limit.

There is margin above that, too, that is supposedly built in, and if you test it right, and if you subjected this material to the kinds of environment that it was tested for. Sometimes, of course, we have stress corrosion cracking, and those sort of things that aren't in there, or irradiation.

We had a lot of things added to the pressure vessel code and to the irradiation embrittlement, and that sort of thing over time.

VICE CHAIRMAN BONACA: But even when you talk about degradation -- for example, from corrosion in vessels, even there, there are limits to how much you accounted for. It's not that it is a indefinite process of corrosion that lasts forever.

I mean, it is not a time limit as others, but there were certain assumptions made which was essentially limits of the acceptability to inspections.

DR. CRONENBERG: I am going to show you examples of this. Probably the best education is via an example here. Let me go on. The first thing that I wanted to look at is the impact of power uprates, and changes in operating conditions, a change in design basis accident conditions for increased coolant, and that you have already associated with the power uprate.

And you will have changes in primary system conditions, and you will have changes in secondary size steam generator flow rates, and feed water flow rates, and you will have changes in coolant and temperature, and flow rates and that sort of thing.

Those are the kinds of things that are changed with power uprates. Here is some current power uprate applications. We have the Duane Arnold, 15 percent; and the Dresden plan, and the Quad Cities, Brunswick, Clinton, and we have Arkansas 1, and a PWR, and significant power uprates.

We are not talking now these days about 5 percent, or 3 percent uprates. We are talking major uprates, and I guess in the conference yesterday they were talking about 10,000 megawatts of electrical generation, like building 10 new plants from power uprates.

So we are talking about a major activity here and a major responsibility of the ACRS. We are also talking about plants that are pushing 30 years old; mid-'70s, and vintage 25 or 30 years old.

So we are not talking about uprates, but we are talking about uprates to an age depletive plants.

DR. WALLIS: And some of these plants had a power uprate before, because perhaps they were operating conservatively initially or something. I think some of them actually had a power uprate before of a much smaller amount.

DR. CRONENBERG: The way I read this is that these keep coming in. I don't know if they will ever be an advanced light water reactor. I don't know if they will ever be what you were talking about yesterday.

But this train is already leaving the station, you know, on the uprates. So your concern about margins, I think, is a very timely, timely subject at this point.

DR. WALLIS: The references that you made in your earlier report about --

DR. CRONENBERG: I am not talking about -- well, on Tuesday, there is a thermal hydraulics meeting, and I intend to go back over that if Graham wants.

We will look at operational experience from prior uprated plants and what I found there besides this talk today. So I plan to give both talks, but not today.

DR. WALLIS: You will be there on Tuesday?

DR. CRONENBERG: Yes.

CHAIRMAN APOSTOLAKIS: Just one note. I mean, many of the PWRs are not listed here, and they went through the five percent, but they were really designed originally, and even the accident analysis in the FSAR was done at the construction stage of the higher power level, and they were really operating at 95 percent power like this or whatever.

So that is not really a power uprates. It is something that was designed to be that way. These are substantial power uprates.

DR. CRONENBERG: Those are what are called power stretches, I guess, in the G.E. vernacular. Okay. I did a case study for the Hatch case, because that is on the plant renewal, and it had two prior uprates. It is a G.E. BWR/4 direct cycle plant. It is an early '70s vintage plant.

It had a power -- it is a two unit plant, and sister units, and the same power generation from each unit. It is originally a 2,400 megawatts and then to 2,500, and then to 2,700. And it is now on to license renewal.

And Monticello had or was sort of case studies for the G.E. guidance on power uprates.

DR. LEITCH: Gus, one of the things that concerned me about the Hatch situation, but I don't think it appears on your slide though and on your paper, but it talks about the stress increase in the access hole cover plate.

And it is really quite appreciable. I mean, most of the rest of them are kind of what you would --

DR. CRONENBERG: I am going to get to that, to the cover plate story.

DR. LEITCH: You are going to talk about that?

DR. CRONENBERG: Yes.

DR. LEITCH: Okay. Great.

DR. CRONENBERG: This is just a sketch or a schematic of the direct cycle G.E. plant, and we are going to look at, for example, what the design pressure for the main steam line is, and the design pressure for the feed water system, and the design pressures for the piping and the research evasion pump.

We are going to march around this plant and look at some design limits, and then some calculated pressures and temperatures, and we are going to look at some time aging analysis for piping and that sort of thing.

So wherever I could glean some information that is how I estimated margin. Okay. Here is a summary of the uprate conditions for the Hatch, Units 1 and 2, and the years; 5 percent uprate, and then 8 percent, both of which change in operating system conditions. So these are operating conditions.

As you can see, steam flows get higher with uprate, and design pressure got higher on the first, and the steam dome pressure got higher on the first uprate, but remained the same for the second uprate.

The dome temperature, the steam dome temperatures got higher on the first uprate, but not for the second. Feed water supply always is increased and feed water temperature is a little bit for each of these uprates.

So these are some operating conditions and then we will look at what the design limits are for the temperature and pressure for those kinds of operating conditions on various piping.

Basically what I said is what -- okay. We just saw from the general criteria that there was no definition of what margin is. It just is that there shall be sufficient margin.

And so I said I will make -- this is my definition of margin, and it will be the design limit that is in a code, the ASME pressure vessel code, and the value over the design limits, and how close we get to the design limit.

So here we look at the main steam line pressure and the design limit for that piping is 1,250 psi. And the original was 1,015. So we had an 18 percent margin to the design limit.

Then we went on the first uprate and the pressure increased to 1,050. So we dropped down to 16 percent between the value of the operating condition and the ASME allowable pressure for that type of piping.

And the same thing with steam line temperatures. There is a design limit for that pipe of 575 degrees F. We increased -- and sometimes I could not get the information, and I want to talk about that a little later, too.

The difficulty of getting information, especially design basis calculational information, and trying to retrieve historical data and historical calculations to get the changes in margins over time.

DR. WALLIS: We are supposed to have adequate margin, and I just can't quite grasp how we decide what is adequate. Is 16 percent adequate, and would 12 percent have been accurate? Would 5 percent have been adequate? How do we know?

DR. CRONENBERG: Let me say that I am not answering that question. That is a question before the committee, the commission, the staff.

DR. WALLIS: Do you have any guidance about how we can decide whether it is a reasonable margin or not?

DR. CRONENBERG: Let me go on and then I will come back.

DR. SIEBER: It is really not that easy, because part of the margin is to accommodate transient, and so you have to know what the transient response for the plan is.

DR. CRONENBERG: The real degradation in

margin is in your calculations for your design basis event. An 8 percent could make a 20 percent difference in a load to a pipe, okay?

VICE CHAIRMAN BONACA: And I think that Gus has a good example on that, that we can use to discuss this very issue, because the question will then come on that issue that -- and when we get to that issue, we can talk about it.

DR. SHACK: Well, from the code point of view, it would be 1,250 gives you adequate margin.

VICE CHAIRMAN BONACA: That is correct.

DR. WALLIS: But there is already the margin in that.

DR. SHACK: Right. There is the code design limit provides what they believe is adequate margin.

DR. SHACK: That's right.

VICE CHAIRMAN BONACA: And the degree to which you can show that, for example, that as the plant ages, that you still have a value of 1,250.

CHAIRMAN APOSTOLAKIS: So this is additional margin.

DR. SHACK: It is a code margin, that's correct.

DR. WALLIS: And this is one of the

debates; who does it belong to and all of that. I think it would be very good if we could be clear do we need any margin beyond what is already in the design limit margin.

CHAIRMAN APOSTOLAKIS: Well, that is not what he is addressing now.

DR. SHACK: Assuming there is no defects, and that is a good point.

DR. WALLIS: There are always defects.

DR. SHACK: The code is part of the reason that it is in fact lower --

DR. CRONENBERG: The value point or the yield --

VICE CHAIRMAN BONACA: You may remember, for example, on the primary side that the whole debate in 50.59 for what the value documented in the FSAR versus a set limit.

And the industry position was that from the set limit up it is my margin, or below is our margin, and above is your margin. And the position of the NRC is that we want to control also the margin between the maximum value that you have in your FSAR and the set limit because it is a margin. So that is still debated.

DR. CRONENBERG: Okay. The last

presentation was not surprising with the change in LOCA. If you want to go into significant power uprates, that is maybe where you had better or you could see, because as I will show you in the next couple of slides, when you look at margins for design basis events, they are decreased rather dramatically.

DR. WALLIS: What I am trying to grasp is what is the criterion for deciding when you stop? Is it when you cross the design limit or something, or what is the criterion for limiting uprates?

DR. CRONENBERG: You will have to ask the staff on Tuesday. We have no standard review plan. If we had a standard review plan, we might have specified acceptance criteria for uprates.

And I have been talking about that point for a few years now, and I will talk about it again on Tuesday. Here is some more feed water piping where actually the feed water pressure went down on the second uprate.

So the residual margin was increased, but the real story here I think is what happened with -- that each time you come for a power uprate, you have to recalculate your design basis accident conditions, and that is a good part of the safety analysis report that accompanies a license amendment request for an uprate.

And these are design basis LOCA loads for -- well, this is the pressure vessel, and in the original the load was estimated at 8.9 kilopounds per square inch, and the design limit is 15.

DR. WALLIS: Just remind me that these are forces due to momentum effects during a LOCA?

DR. CRONENBERG: Yes. These are forces on piping during a LOCA.

DR. WALLIS: So you have to have a good momentum equation to predict them?

DR. CRONENBERG: Yes.

DR. SIEBER: Or a water margin.

DR. CRONENBERG: Okay. And the first uprate, the prediction is nine. So you have a little -- you decrease your margin a little bit. The vessel shroud, and this is stress calculations.

One thing that was hard to do when you chartered me to look at what this reduction in margin is, you can only get results for little bits and pieces of components in the system.

You don't have an ISO stress figures for that margin of time for the LOCA. You will have a summary table saying here is the stress on a bulk, and here is the stress on a weld, and here is the maximum stress during the LOCA, and that's all.

And that will be an appendix usually to the SAR, and it is usually for a G.E. applicant, and it will be G.G. proprietary information, and all it will be is these five numbers of various stresses.

So it is hard to get a real good comprehensive feel for what is going on, and it will change with time. One operator will give you the stress on a bolt, and the other one will give you the stress on a weld.

The other one will be stress on a plate or the pipe itself. So you can't get a good feel for what is happening with time for just even one component. You can see there is blanks in here.

You would rather see a better picture. So if you guys are serious about requesting the staff to estimate margin reductions for power uprates, where are they going to get the information when they get summary reports? And how are they going to retrieve this information that is 10 years old?

CHAIRMAN APOSTOLAKIS: We are trying to get a feeling right now for what the issues are. So I think you are going in the right direction.

DR. CRONENBERG: Well, I just wanted to bring that out to you. It was not easy to find the information, and some of the information on the license renewal, I had to request from the applicant itself. It wasn't even in the agency.

And I will go on, but anyway, you see a general trend of margin reduction for increased power uprate, and here is this access cover plate.

DR. LEITCH: And that is exactly the point that I wanted to address. That seems to be kind of counterintuitive there, that large reduction in margin.

And I wonder if we are really comparing apples and apples, because it seems to me that in about 1990 or so -- I don't remember the exact time period -- that access cover plate had some problems and was redesigned.

DR. CRONENBERG: Yes.

DR. LEITCH: And I was just wondering if those stresses --

DR. CRONENBERG: These are the two stresses. These are numbers that I took from the G.E. appendix to the license amendment request for the uprate, and it was on the same bolting. Now, that access cover plate was replaced.

These are again to the design as to 107.7, and this is an 8 percent power increase that you had over a 20 percent reduction in margin for the 8 percent. The lows were significant, a significant jump in loads from 60 to 90.

Now, that access cover plate is what they found in Peach Bottom, a sister type of plant, was that they had stress corrosion cracking in Peach Bottom, and NRC required that that access cover plate be replaced.

Hatch did -- all sister plants had to do ultrasonic testing on theirs following shutdown, and do ultrasonic testing. They found evidence of cracking on their cover plate, but they could neither confirm or deny how deep that cracking was.

NRC dictated that they put in a monitoring program to monitor those welds, and they decided to just preempt the problem and replace those cover plates on Hatch because of what was confirmed at Peach Bottom, but never really confirmed at Hatch.

They just replaced the cover plate, but what is happening here is that Peach Bottom did have confirmation of significant stress corrosion cracking, and probably that design limit was not retained. And I am always comparing it to design.

VICE CHAIRMAN BONACA: And I think this is a good example because -- and we brought it up with the staff already. The staff was asking what kind of questions do you want us to ask, and the questions, if you have aging, that may challenge in fact the design limit of 107 KSI because of the degradation that is resulting as a part of aging.

The question is do you still have the margin between 90 KSI and 107, and you probably don't. As a minimum, the uncertainty is very much in question, because you have only 16.4 percent of margin. So that was simply an observation that as a minimum, in reviewing the power uprates, the reviewer should not just simply compare a apple with an apple.

They should ask some questions regarding the operating history, and the inspections done, and what is happening to the plant, because the plant is aging, and it is a fact. So that is just one point that I wanted to make that we brought up with this stuff.

DR. CRONENBERG: But most of the time in the license application, they will just quote we have this limit to our design, and this much margin to our design limit.

I have not seen the kind of discussions that Mario was talking about in a license application.

CHAIRMAN APOSTOLAKIS: You have not really addressed the strength here. You are just saying that as a design limit and calculations show that the predicted strength is this, but you are not saying anything about how or what is happening to the design limit today.

DR. CRONENBERG: Well, that does come in the aging, but these are all numbers that I got from a licensed application. I am comparing that this is the licensee's numbers, and this is the degradation in margins based upon the licensee's own numbers.

And I was hoping that I could get more information, and I found it rather confusing because we never say you shall give me -- if we had a more structured approach to operate, you shall give me these stresses for these bolts, for these pumps, for this pipe weld, for that access weld, so I can compare in time what is happening as I uprate the power.

The story to me is confusing because we don't have a rigorous approach to how we review power uprates, and so --

CHAIRMAN APOSTOLAKIS: But this is really the residual additional margin, right? Wouldn't that be more accurate, because there is already a design limit.

DR. CRONENBERG: I gave you my definition of what I am using as margin.

CHAIRMAN APOSTOLAKIS: But I think if you put the word additional there --

DR. POWERS: Residual he calls it.

CHAIRMAN APOSTOLAKIS: The concern here was, and as we expressed before, was that when you go with power uprate, the project engineer goes through a checklist, but especially uprating plants that have been running for 20 years or 30 years, there is a history behind which involves aging, irrespective of license renewal.

VICE CHAIRMAN BONACA: Is it adequate to simply go back --

DR. SHACK: But again if he had any known cracking, he would be operating under a different set of rules. That is, that he would have to account for the crack, the crack size, and he would have limits on that.

VICE CHAIRMAN BONACA: I don't deny that there are considerations like that, but I am only saying that until now it seems to me -- and what Gus has pointed out -- that without a specific more thorough checklist almost of how you are going to do it, it would be purely checking a number against a number.

And if you have a residual margin of one, it is enough to say yes, and the point that Graham was raising before. And I think there has to be a more thoughtful review given that you have an operating history behind it.

CHAIRMAN APOSTOLAKIS: But you can't just look at the incidents of aging, because there are also inspection programs, corrective actions, and so all of those have to come in, and so the assumption here is I guess, but unless there is evidence of something going on, the design limit is preserved.

VICE CHAIRMAN BONACA: Absolutely, and I am not denying that, but I am only saying that we are checking to see what kind of margins there are, and how they are reduced, and the significance of those, and the fact that as you get very close -- I mean, originally they started with a blowdown pressure of stress with a component of 64.5 KSI. That was the original design. And the design was actually 107.7, and a 40 percent margin, and so --

DR. CRONENBERG: That was on the first uprate, and I don't even know what -- I couldn't find it in the FSAR what it was on that bolt.

DR. LEITCH: But, Gus, that is the one -- in all of this data, that is the one thing to me that is surprising, and almost counterintuitive, that it would change that much.

And I guess what I am saying is that there has been some redesign work done down there on that access cover, and I am just wondering whether these numbers are presenting the correct story, or whether the numbers somehow got skewed by reanalysis, redesigning.

DR. CRONENBERG: Which number are you talking about, the design limit or the calculated load?

DR. LEITCH: No, the design limit. I am saying that maybe they went back and after finding this problem at Peach Bottom, they might have gone back and said, oops, maybe we had better recalculate that 64.3, and maybe they found out it was 88 or something like that.

And what we are saying is a significant reduction in margin due to power uprate may be due to something totally different than that. I am just surprised that that order of magnitude of change.

The rest of the changes almost seem intuitive to me, and I just want to be sure that that one piece of data isn't taken as --

DR. CRONENBERG: That was just a number.

We get summary reports, and we don't get detailed on what boundary conditions are on codes, and what stresses are predicted, a time line. We just get a summary table. I am going to show you the kind of information that we get in an application.

DR. LEITCH: Yes, but all I am saying is that I don't understand the phenomena that would increase the stresses on those bolts by that much by just --

DR. KRESS: It is strictly the pressure doing that, and the pressure didn't change that much. I think you are right. There is something wrong there.

DR. LEITCH: Yes. I just don't want to focus on that question and --

DR. CRONENBERG: Well, it is coolant and higher flow rates, and --

DR. KRESS: But that is a lot of change.

DR. CRONENBERG: Well, this is in the application, and these are reported numbers, and none of these are anything else but reported numbers.

CHAIRMAN APOSTOLAKIS: I think you made a good point, and we should be cautious about that.

DR. CRONENBERG: Okay. Here is some of the containment again, and this is an inverted light bulb type of BWR, and we can see that the pressures there are going up and the drywell or the margin is going down.

And the peak drywell gas temperatures are exceeded for a small time. However, it is only for a short time. So that was allowed. And then the design limit, and the suppression pool temperatures, and the design limit is 281, and we go from 198 to 202, to 208. We keep creeping up as we might expect the margin to design limit goes down.

DR. KRESS: Should we be concerned about all these decreasing margins?

DR. CRONENBERG: Well, let me get to the end, and let me talk about a more holistic or conclusion. We also have signatures of margins for license renewal, and most of that was gleaned from looking at the time limited aging analysis.

And basically that comes out of appendix material for the Hatch, and this was surprising to me that we had discussions of the accumulative usage factors, and estimates of those cumulative usage factors for various components for the Taurus, for the piping.

But that was information that I couldn't get from the staff here. I had to go back to the licensee and the licensee had to request from G.E., and G.E. has a structural associate contractor that G.E. uses to do this cumulative -- essentially fatigue calculations.

So you really had to go back and reference it, and it wasn't in the agency where I got these numbers. I had to get it from the licensee, and Mario saw all the E-mails back and forth to retrieve this information.

So it is not just something that -- well, you have got to work at getting it if you want to look at margins. Okay. This is a cumulative usage factor, and it is basically a fatigue estimate for various components.

And they estimated for 40 years for the end of the first renewal, and they gave estimates for the license renewal period of 60 years. Basically, they keep track of the number of SCRAMs, and the number of bolt up and bolt down operations, and anything that can fatigue a particular component, any minor seismic events.

And if you exceed one, then you exceeded the allowable fatigue limit for that particular component. So you estimate these things, but a lot of this is based on historical data. You have got to keep track of SCRAMing, SCRAMs, and bolt ups, and bolt downs, and that sort of thing.

So the cumulative usage factor, essentially you are going to one. The design limit here is one. If you exceed the design limit, then you have to negotiate something with NRC, whether the surveillance has to be higher surveillance, or that component has to be replaced, or whatever.

The suction piping, the cumulative usage estimate for that is 57 at 40 years, and it goes up to 77 at 60 years.

CHAIRMAN APOSTOLAKIS: Again, let me understand this. Does this include the impact of inspections and corrective actions?

DR. CRONENBERG: No, this is just an estimate of how close to a fatigue limit you might have been if you had 35 SCRAMs, a combination of 35 SCRAMs, 60 head removals, a seismic event.

DR. SHACK: And we don't even know if these are calculated based on actual cycles or some projected design cycle?

DR. CRONENBERG: It is a combination. When you look at them, they do have tables of historic data for the SCRAMs, and then they estimated what it is going to be in the future, and that is how they get it to 40, and that's how they get to 60.

It is a combination of historical data and estimates. I think it is a pretty nice analysis. I thought this was -- I thought this was somebody trying to estimate margins, you know.

And it is for various things that you have said, because you have a standard review plan for license renewal, and you say you will do these kinds of estimates on these kinds of components. And then you can begin to see, well, at least there is an estimate of margin here.

DR. FORD: On a procedural aspect, for instance, the piping. This is based on a code analysis, which takes into account normal fatigue and corrosion, but it does not take into account, however, corrupting, and corrosion would be an additional effect. How is that taken into account?

DR. CRONENBERG: That is a good point. As far as I can tell from looking at these contractor reports, it is assumed that same power for the next 20 year cycle, and I did not see something in here that related to if you had added on top of it a power uprate.

Just that you had so many bolting operations, and so many SCRAMs at power. So I can't be sure, but I would have to go back into this.

DR. FORD: Well, maybe I am asking a question where there is no way of knowing the answer, but how would the staff address the degradation mode on this --

DR. CRONENBERG: This kind of thing never comes up in an uprate. You don't have -- usage factor estimates in the power uprate. Those are time limited aging analysis, and that is what the whole -- Mario and some of your concerns are.

We don't look at licensing of a plant in a holistic sense. We look at one licensing action and make a judgment. We will get another licensing action and make a judgment, and we will look at fuel replacement and we make a judgment.

But we don't make or you don't have to have legacy tables in here, where I did this to my system, and I did that, and this was an uprate, and this was a license renewal, and this was a fuel change, and these are the changes in design basis loads for all these changes.

Maybe somebody has, but I can't glean that kind of information from any of these reports on the legacy of this plant and all the changes that have been made, and how it impacts margin. We review separate licensing actions.

DR. SHACK: Peter's direct question, and I think they would argue do the code analysis, with a very small thinning requirement allowance in the code, which is done independently --

DR. FORD: So the worst --

DR. SHACK: That is the only way the flow assisted corrosion affects the CUF, and there is no other thing, but then you would address the flow assisted corrosion separately.

DR. FORD: Separate and take the worst one?

DR. SHACK: Yes. You would have to demonstrate that you weren't violating any of your code limits on thinning.

DR. SIEBER: Well, there is actually margin built into the manufactured product, because the code says here is the minimum wall, and when you go and buy a new one, it is thicker.

DR. WALLIS: George, we are due back here at 1:15 after lunch, and that is a fixed time isn't it? So we have to move along.

CHAIRMAN APOSTOLAKIS: Yes, and there is also a separate meeting in 10 minutes.

DR. CRONENBERG: Okay. Do you want me to

wrap this up? okay.

CHAIRMAN APOSTOLAKIS: Okay. Why don't you go to the conclusions, and summary and observations.

DR. CRONENBERG: Okay. Margin estimates. Again, I talked about not getting or having to go through lots of steps to get numbers. This information is not readily available as far as I can see.

And I tried to tell you that we get summary reports in the license applications. We don't -- if you want margin estimates for a plant, you are going to have more than just I got it for this bolt and this piece of pipe, and that's all I am going to give you. There is not a lot of information.

And summary and observations. Safety margins is used in a broad sense in the regulatory process, and we have already talked about this. There is a lot of difficulty in getting self-consistent data for an assessment of margin impact.

Not only do you get it for different components, but calculational codes change, and calculational procedures change for LOCA. You are already talking about major calculational changes for LOCA.

So it is hard to get an apples and apples comparison. Nevertheless, I think that we had some success for this case study for Hatch. We were able to estimate from the licensee's own number some signatures of margin reductions, and it looks like there is always some margin reductions for various pipe.

DR. WALLIS: And it is not particularly as severe, except for these bolts and that may be --

DR. CRONENBERG: Yes, but we have not looked at it integrated. I have given you bits and pieces of information, too. I never put it all together.

To me, the SARs and the SERs do not appear to have information of sufficient detail or consistency for any in-depth quantitative assessment of margin info for multiple licensing actions.

I don't think we have the kind of information from the SARs and SERs, and the type of information requirements that we have to date.

Uprate review. Again, I want to endorse the prior recommendations for a standard review plan. I have been talking about this, and you have other studies in this agency. The Maine Yankee lessons learned says why don't you have a standard review plan for uprates, and it would probably be better if there was a scientific study of power uprates from the early '70s.

And it came to the same conclusion. It is an ad hoc sort of process that is not in place, and I think the agency would be better served if we had a standard review plan, especially when we are talking about the power uprates that we are talking about; 20 percent for an aged fleet of plants.

And it also came from my own review of operational events for operated plants. I had some suggestions on what could be included in a standard review plan, and it goes on from there. I think I can wrap it up.

CHAIRMAN APOSTOLAKIS: Okay. Thank you.

DR. LEITCH: Just one question. I thought that one of the effects that we were going to look at is increased fuel burn up, and I don't see anything about that here.

In other words, in addition to power uprates and license renewal, I thought that one of the other major things was increased fuel burn up. And I just wondered if you planned to take a look at that yet.

In other words, is that coming along in

the future? Are you saying what we have here is just a preliminary draft?

DR. CRONENBERG: I don't think I am going to be able to get to it. I think I have about 6 weeks left in my time, and I want to wrap up what I have done in a coherent paper report. So this project ends in September, and I work half-time.

So I don't plan to do anything on fuels or another plant, or anything else. I just wanted to give you a report and I wanted to give you a 10 page summary paper if somebody wants to publish it.

And I also want to do the same on a prior study that I did for operational events. I want to write a 10 page summary and leave it with some of you guys to publish it.

DR. LARKINS: Gus, is there any -- do you have reason to believe that there may be information out there that if someone were to follow on to this activity, this project, to do something in this area additionally, like high burn up fuels?

DR. CRONENBERG: Yes, I think you could. You have got to delve into it, and yes, there is corrosion limits, and irradiation, and brittlement on control rods that march on with time.

DR. LARKINS: One of the things that I am getting at, and one of the things that you might want to do in finalizing your report is to make some recommendations for any follow-on activities.

DR. CRONENBERG: Sure. Sure.

VICE CHAIRMAN BONACA: Are you going to look at some of the PRA aspects that we discussed before?

DR. CRONENBERG: I am going to try to, but basically you know what is in PRA. You don't reach your design limits, and you march on. You don't fail components.

DR. WALLIS: I am trying to grasp what the ACRS should do on this, and we have a meeting on Tuesday about uprates, and are we expected to write a letter for July on power uprates or are we just sort of learning as we go along, and eventually we will have to do that.

VICE CHAIRMAN BONACA: I think we are learning.

CHAIRMAN APOSTOLAKIS: At this point, we are learning.

MR. ELLIOTT: I think that would be up to you guys, depending on what you hear at the subcommittee meeting. One thing to note is that back in December when you discussed this issue last time, the research people came in and said that they were proposing to look at the issue of synergism that Gus has raised here.

But they said that they had no funding, and what you are going to hear Tuesday is now that they do have funding, starting in FY '02. So you may want to think about commenting on that, depending on what he has to tell you on Tuesday.

DR. POWERS: It seems to me that it would be surprising if we didn't come back and say how come you guys haven't developed the standard review plan for power uprates.

DR. ELLIOTT: Well, you may recall back again in December that they told you that they didn't plan to do it, and the committee took no action at that time. They basically accepted that, and they claim that they have a template that they used based on the last two reviews, the Hatch and the Monticello, and that is what they are following.

VICE CHAIRMAN BONACA: I am still left with some curiosity in my mind regarding how would LRF be affected with a power uprate and containment that is not any more capable of being assumed strength, and assuming the PRAs. I would just like to understand that.

And maybe the sensitivity on the PRA would give us some answer on what the sensitivities are. I really don't know.

DR. KRESS: I think the answer is that the containments fail at the discontinuity that Dana tells us about, and those probably don't change much by this process.

DR. POWERS: We can probably get rid of the containments, and it is not doing any good for us, and --

DR. KRESS: Yes, we might as well get rid of them, as they don't help.

CHAIRMAN APOSTOLAKIS: Okay. We are recessed until 1:15.

(Whereupon, at 12:15 p.m., the meeting was recessed.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:18 p.m.)

DR. POWERS: I will bring this session into order, and we can just go right ahead with the presentation on the South Texas project.

DR. SIEBER: Okay. The lead speaker today will be John Nakoski, as the senior project manager for this project; and since I have read most of the things that you have written, you must have a sore arm by now.

I would also mention that we are getting down towards the end one way or another of this project, and I have received lots of mail from anyone.

DR. POWERS: There are sore arms and a lot of us with sore fingers, right?

DR. SIEBER: I would expect today to have us have concerns to ask questions to see if they can be resolved, and I intend to do the same. And from those questions, you probably will get some of the gist of how we are thinking.

But right now, and until we are through hashing this over, we don't have a consensus yet, and hopefully we will arrive at one. So with that kind of introduction, John, I would like you to begin.

MR. NAKOSKI: Okay. Thank you. To my

right is Jack Strosnider, and he is the Director of the Division of Engineering; and to my left is Gary Holahan, and he is the Director of the Division of Systems Safety and Analysis.

I would like to go quickly just to refresh everyone's memory where we are and where we have been. This is an effort that started in July of 1999. We have met with South Texas a number of times, and those meetings are on here, but we talked about them before.

In January of 2000, we issued a request for additional information. South Texas came in with a revised submittal in August of last year, and as you can see, we briefed ACRS on this issue a number of times.

In December of last year on the draft safety evaluation that we issued on November 15th, and in February of this year, we discussed categorization with the NCRS subcommittee. In April of this year, we had a meeting with the full committee on treatment.

Recent activity is that the staff, the risk informed licensing panel, met with South Texas on the content of the FSAR. In the middle of last month, we finally brought to closure all the open items identified in the draft safety evaluation.

And yesterday, the SE was forwarded to the

EDO for his review in support of a July 20th commission meeting. And we are here today meeting with the ACRS to cover our findings that are described in a preliminary safety evaluation that we made publicly available yesterday in a letter to South Texas.

Going forward, we expect to brief the Commission on July 20th, and following that, we expect to issue the notices of exemption and the final safety evaluation in August.

DR. SIEBER: You will get a letter from us and it will probably come out in July, but we won't have enough time from this meeting to resolve everything and get it printed, and I don't think we will anyway.

MR. NAKOSKI: And on our expectation, we would expect that after the July meeting, after you have had sufficient time to review the final safety evaluation, to provide us with your comments.

The conclusions that the staff reached in categorization is that we found or that we concluded that it is acceptable to categorize the risk significance of both the functions and the structure systems and components for use in reducing the scope of structure systems and components subject to special treatment.

It is also acceptable to define those structure systems and components for which exemptions from the special treatment requirements can be granted.

DR. SIEBER: Let me ask a fundamental question, and the answer is not in the FSAR, but when you use PRA, you calculate CDF and LRF, but if you look at the regulations, there are restrictions on plants, and there are components that are basic components according to 1.3 that are that way not because they impact CDF or LRF so much, but that there are other kinds of accidents or things that can release radiation either inside the plant or outside to the public, like a spent fuel pool, and accidents, and so forth.

How do you assure yourself that you effectively blanket everything that is necessary by using just CDF and LRF as the metrics for categorization, or the deterministic process to the extent that it addresses that?

MR. HOLAHAN: This is Gary Holahan. In part, I think the answer is buried in your question, and that is that CDF and LRF don't measure --

DR. SIEBER: Everything.

MR. HOLAHAN: -- everything, and that is part of the reason that the categorization process, and the testing of what belongs in each of those categories can't be done just by the risk importance measures.

In effect, there are many components that are not modeled in the PRAs.

DR. SIEBER: That's right.

MR. HOLAHAN: And that's because either the subject matter doesn't relate to core damage frequency, or even if it does, because they are screened out, or because their judgment is that they are not such important contributors, or they are subsumed in other super components if you will.

For all these reasons, we have pressed in this activity, as well as all our decision makings, back to regulatory guide 1.174, and that you need to have an integrated decision process that covers issues like defense in depth, and respects barriers, and safety margins, and good engineering processes.

So we don't have numerical metrics for all of those other things. South Texas has a process that they use, and other people have used other processes. But we recognize that the issues are more than core damage and large LOCA release.

And the measures are more than CDF and LRF. So you have to look at the whole process, and we think that we have done that in this case. So we hope to learn more about that.

DR. SIEBER: So you are relying on the expert panel?

MR. HOLAHAN: We are relying on the expert panel and that whole process involving the expert panel to capture the rest of the features.

DR. KRESS: And that is what we mean by the categorization process and the whole thing.

MR. HOLAHAN: By the categorization process, we mean the whole process and not just the importance measures.

VICE CHAIRMAN BONACA: You know, on this issue, I was looking at the five questions that they have used as some question that would lead you to, for example, FSAR Part 100, and I thought that they related more to CDF and LRF conclusions, but you are telling me that they don't.

Or they may lead you, insofar as answering to those questions, to Part 100 releases, or for example, a limited amount of fuel damage?

MR. HOLAHAN: I think that the questions are intended to do more than that.

VICE CHAIRMAN BONACA: Okay.

MR. HOLAHAN: I mean, we could ask South Texas for some practical examples, but for example, if I look at one of their questions, does the loss of function in and of itself directly cause an initiating event.

Now, that could cover events, whether they are dominant sequences in the PRA that might cover other initiating events as well, and that there is a value of protecting against.

VICE CHAIRMAN BONACA: And if we could ask that question to South Texas?

MR. GRANTUM: There are several questions that are used in the determination process, and this is Rick Grantum, South Texas. The one that Mr. Holahan mentioned is one covering initiating events to cover a spectrum of initiating events.

We also have other questions that are associated with is the component mentioned or taken for in our emergency operating procedures. So that carries another set of components, and a lot of those components are used, and the basis for those components being in the EOPs is Part 100 requirements and others of those aspects.

So we have a catchall in the EOPs that we take credit for, and we also ask questions relative to could it fail another risk significant component, and is it used to mitigate accidents or transients.

Those are the deterministic types of questions that the working groups and the expert panels deliberate on to encompass the concerns that have been mentioned.

DR. KRESS: When you talk about the categorization process here, does that also include the sensitivities analysis?

MR. HOLAHAN: Yes.

DR. KRESS: You are considering that part of the process?

MR. HOLAHAN: Yes. In fact, if the sensitivity studies, which in fact I think are more as a Delta CDF, Delta LRF test, and if they showed that the cumulative effect of these proposed changes was too large, then in fact I think you would have to cut back on how extensive a list of low safety significance items you would put in that category.

DR. SIEBER: That is the 1.174 test.

MR. HOLAHAN: Yes, that's right actually.

DR. SIEBER: I guess in my opinion that you can categorize any reasonable engineering happening, provided that you have the sensitivity studies and apply the result to a comparison of 1.174.

MR. HOLAHAN: Well, we talked about this subject before, and I think in terms of the things that can be measured by a PRA, the delta CDT test is more important than the importance measures.

DR. SIEBER: That's what I think.

MR. HOLAHAN: And the fundamental nature of it shows, because it is in reg guide 1.174, and importance measures are not.

Importance measures are discussed in some of the other issues, specific regulatory guides, but in all of those cases there really are subordinate to the overall goal of -- that the net effect of the change should be -- on risk should be small.

DR. SIEBER: Right.

MR. HOLAHAN: But neither of those processes captures the engineering safety margins or defense in depth issues.

DR. SIEBER: That's right.

MR. HOLAHAN: So you couldn't go directly to the Delta CDF and say that is the only issue.

DR. SIEBER: If I performed the so-called thud test, and how much does it weigh, and how much space do you put in the FSAR for these various aspects, I see on page 16 that there is a paragraph that looks at the Delta CDF and Delta LRF as compared to the standard in Reg Guide 1.174.

MR. HOLAHAN: Yes.

DR. SIEBER: But as you described the screening process in the PRA, that is multi-pages, and indeed that is plant specific, because I think that the screening values, they don't seek to make a whole lot of difference on exactly what they are.

But you could choose another set of importance measures and as long as you could perform this test that is on the bottom of your page 16, you are okay.

So if you go and read it, it looks like this comparison was an after-thought, and all the categorization was done, and then they said, oh, gee, we have some metrics here that we can apply to the reg guide to show that we are okay, and that is sort of the impression that I get.

MR. HOLAHAN: That is an impression or a perception that we would not like to have widely seen. The real fundamental measure is that the change that you are doing has a small effect on risk.

DR. SIEBER: That's right.

MR. HOLAHAN: And I think the reason importance measures took a large place is that certainly in other applications we didn't know how to calculate Delta-CDF, and as a substitute, we said -- for example, on graded QA and other issues, we said that one way of showing that the change in risk was small was by only allowing changes to components that we knew were very unimportant.

And having done that, we had a qualitative feeling that the Delta-CDF's risk effect was small. In cases where we think we can calculate Delta-CDF, even though it is only through a sensitivity study, or give a range, I think that is important.

We have given some thought to the subject, and I would say one other thing. I think you could meet the small effect on risk goal by almost arbitrarily picking the components and then doing this test.

But I don't think you could meet one of our other goals, and one of the goals of this whole process is that we should be focusing the staff and the licensee on those components that are most important to safety.

So I think it is advantageous to give the best shot we can at identifying important and less important components. For example, you could approach this issue from a purely economic point of view, and go to the most expensive components and apply it, and keep subtracting until you get Delta-CDF is equal to whatever it is, and say that is where I am going to go.

I think that is not the overall safety approach that has been laid out. What we have said is that that would not be focusing your attention on safety. It is focusing your attention on the costs.

And though we recognize that we would like to reduce unnecessary burden, we would like to do it in a way that produces a better safety focus. So the categorization process in my mind is not arbitrary. You ought to take your best shot at it, and then you ought to also test it with respect to its effect on the overall result.

DR. KRESS: That leads me to believe sort of in an indirect fashion you are giving a blessing to the use of RAL and FSER vesely as a way to provide this focus on risk significant items. Is that a correct interpretation of what you said?

MR. HOLAHAN: In this case, yes. I think what we have said in our general documents is that we have given these as examples, and not to say that this is the only way to do it.

But that you always ought to have more

than one -- I think what reg guide 1.174 says is that you ought to have at least two risk matrix, and there ought to be two complimentary ones. And it suggests that these are two of the four that are mentioned.

DR. KRESS: The problem that I may have with that is that I am not sure that developing the RAL and FSER vesely for each individual component of an entirely group, of which there may be many of, correctly addresses the group importance, and in giving a blessing to the process under those circumstances.

And that's all right for one component, and that's fine, or one or two components even. but for a relatively large group of components, I am not sure it is wise to give that blessing at this moment to the use of RAL and FSER vesely of each individual component as a threshold to decide safety significance of the items. Could you respond maybe to that?

MR. HOLAHAN: I think there are a couple of unresolved issues with the importance measures. So at the moment, in this application, we are satisfied with what was done. In part, because we watched them do it, okay, and we saw how it was coming out.

And we know quite a lot about the PRA, and we know what the dominant risk sequences are, and what the total CDF and LRFs are for this plant. I don't think you can pick risk matrix -- FSER vesely, RAL, or any of these things -- and use them abstractly.

I think it makes a difference whether the baseline risk is 10 to the minus 4 or 10 to the minus 6. I think that affects how you pick the components.

I think we all recognize that if you slice the pieces down to the sub, sub, sub, subcomponent, you could eventually show that everything isn't very important, every little piece isn't very important.

So what we found is that as it was done here is okay. I think you have to be a little bit careful about extrapolating that to say any plant can pick up these risk matrix and these thresholds and use them in the future.

DR. KRESS: Will that be made clear in the FSAR?

MR. HOLAHAN: Well, I think it is not so important in the FSAR.

DR. SIEBER: It is in the FSAR.

MR. NAKOSKI: This is John Nakoski. I believe we do mention or state in the FSAR that these screening criteria, or FSER vesely and RAL, are pretty much SDP specific.

DR. SIEBER: You say that, and you go a little bit further to say that it is not necessarily a template, and that is where I think we ought to be with this.

DR. KRESS: And how is it that you know that the screening criteria is appropriate even for SDP? Is it because of the sensitivity analysis verifies it?

MR. HOLAHAN: The sensitivity analysis shows that the total of change can't be all that large.

DR. KRESS: And if I do not have the sensitivity analysis?

MR. HOLAHAN: It would be very hard to judge that.

DR. KRESS: It would be hard to make a judgment on that?

MR. HOLAHAN: Yes. And I think also when you do a sensitivity analysis that you would find out that 99.99 percent of that change can change just a couple of components.

I think you would think that maybe you didn't do it right either. In this case, I would have been surprised to find that.

DR. SIEBER: Could you describe or give us a list of the sensitivity studies that were done?

MR. HOLAHAN: I couldn't, but I think a member of our staff could. Sam, Sam Lee.

MR. LEE: Hi. This is Sam Lee. I am not sure if I understood the question. The question was to give you a list of the sensitivity studies that was done for this particular --

DR. SIEBER: What the perimeters were. There was more than one study, right?

MR. LEE: Yes. First of all --

DR. SIEBER: There was 21 studies or something like that.

MR. LEE: The particular study that we focused our review on was the study where it took all the components and took the mean failure rate and multiplied by a factor of 10, and that gave us some sense that there were to be a change in reliability in these components.

And if we were to assume that it might have changed by a factor of 10, what impact would that have on the overall plant frequency. That was the sensitivity study which we focused our view on, but I believe that maybe South Texas can help me with this.

Is that there were many more sensitivity studies done that were done to support that finding.

The other one that we also focused on was as you pointed out, that CDF and LRF were not the only matrix that we looked at.

We did ask the question in our REI as to how they accounted for the importance of those equipment that are there to protect the containment, and so one of the studies that the licensee performed for us was the failure containment probability. That is another one that we looked at.

MR. GRANTUM: This is Rick Grantum, and I can give you some other examples if you want to hear some more.

DR. SIEBER: No, I would prefer in the interest of time, and we aren't even through the first sentence yet.

MR. HOLAHAN: But there are only two topics.

DR. SIEBER: On the other hand, it is important for me to understand what the staff relied on to come to the conclusions in this FSAR, as opposed to how many thousands --

VICE CHAIRMAN BONACA: I would like to ask just one more question before we move on, because I asked the question before with regard to the other measures of performance, and the answer was satisfactory to me.

But you also spoke about that you don't want to communicate, and when I read the FSAR, I really did not appreciate from it that that integrated process that really is the heart of 1.174 is truly addressed here through those measures.

I mean, maybe I didn't read it right, but it didn't come through, and so I am glad to hear that it was used. But I think it could have been more explicitly addressed in the terms.

Because one is left with the impression that other subsumed goals, such as Part 100, are not being addressed, and that is really what I concluded.

DR. KRESS: Before Sam Lee sits down, for the sensitivity studies, could you maybe tell me why it is that you feel comfortable with the factor of 10? Do you have some database that says that?

MR. LEE: When we first were reviewing their initial submittal, and we wanted to see -- again, we are postulating that there could be changes in the reliability. We are not sure of the reliability, but --

DR. KRESS: You may not change it at all.

MR. LEE: But what may be a good number, and the factor of 10 was actually submitted by the licensee. But what gave us a sense of comfort for that was that if you look at most of the failure rates, and the distributions for the components in South Texas, you have a range of the 50th percentile to the 95th percentile.

And typically for those components, the error factor of three sort of lined up with the 95th percentile. So in our view, if you had a factor of 10, that well exceeded the 95th percentile.

DR. KRESS: Somehow that doesn't give me much comfort, because that is a distribution of failure rates for things that have been given special treatment.

MR. LEE: That's correct.

DR. KRESS: And what I am really interested in is how would that change if the special treatment were not given to them, which means that you may shift the whole distribution one way or the other and by some amount.

And so I am more interested in whether there has been a comparison of things that have been given the special treatment with things that have not been given, and if you had any feeling as to that.

MR. LEE: Well, that is really a good point, because a factor of three would be within the boundary of the 95th percentile. That's why if you assume a factor of 10, it wouldn't actually exceed the distribution, and that gave us some sense that even if you were to shift the distribution to the right a little bit, that that might be bound by that.

But you are right. It is hard for us to tell how much of that shift will be, and a factor of 10 at this point gave us some sense that it would be okay.

And again I would emphasize again that when you do the sensitivity analysis and you look at the results of the Delta changes, they are fairly small.

DR. KRESS: They are really small with a factor of 10, yes.

MR. LEE: Yes. So maybe perhaps we can assume that if we were to extend the factor out even further, and we haven't -- and I don't think that South Texas has done that.

But even if we were to do that, my guess would be that it might still be within the window. But I am not suggesting that we ought to do that.

DR. SIEBER: One of the disappointing things to me is that not only does it seem a little arbitrary and we don't know the answer now, but we never will know it with the exemption on 50.65.

MR. STROSNIDER: This is Jack Strosnider, and I would like to make a few comments on this because it starts getting directly to the treatment issue, and I guess just a few thoughts.

One is with regard to trying to quantify how this distribution shifts. And I think we have to recognize that we can't quantify right now what the special treatment rules actually add in terms of CDF, or LRF, or any of these.

We don't have that quantified to begin with. There was a lot of judgment and the intent was to maintain a high confidence and a high reliability functionality.

DR. KRESS: Is there a database out there for failure rates of things like these that have been given the commercial treatment?

MR. STROSNIDER: There is some, and South Texas did some work, and it is referred to in our SER.

MR. GRANTUM: On page 53.

MR. STROSNIDER: On page 53. They looked at NPRDS, the nuclear plant reliability data system, for information, and it indicates here between the years of 1977 and 1996, and to try and answer the question of reliability of commercial versus safety related components.

And in fact I think the staff has tried this a few times in the past, and I think the conclusion was that there was no appreciable difference in the reliability. In fact, it is not like you can actually tell if you were given a component and you tested it a while, it is kind of hard to tell if it is safety related or commercial.

MR. STROSNIDER: I would just add that I think that is true based on the sort of data that was looked at, where you are looking at unavailability times and that sort of thing.

But I want to come back again to that I don't think you should really expect that there is a quantitative correlation here, or that it is easily quantified in terms of the change in treatment, and what the quantitative effect is.

And to recognize a comparison with commercial equipment and that the data does not include would this equipment function under seismic or harsh environments, or some of those things.

So you can get some insights certainly, but also some of the specific things that we are trying to look at are not directly addressed by that database.

But that tells you that you shouldn't expect necessarily a quantitative relationship, which is a valid question, and in the ideal world you would like to have that. But then if you go another --

DR. KRESS: Well, I just want a good feeling that in fact --

MR. STROSNIDER: And to go another step, too, talking about the sensitivity analysis, and what does a factor of 10 tell you. We discussed this at the last meeting on treatment, in terms of potential for common cause failures, and you could argue that changes in treatment could potentially influence that, and that was one of the subjects that we did discuss.

And I would just point out in the safety evaluation, which as John Nakoski indicated, is sent to the licensee, we stated our understanding of that sensitivity study and how it addresses the potential for common cause failures.

In fact, the licensees indicated that for certain groups of components, like MOVs, that it was not explicitly addressed in their sensitivity studies.

But we put down our understanding of it so that we could get confirmation from them when they look at this to see if it is accurate. So those are all issues that come up in terms of the sensitivity studies, et cetera.

But the thing that I want to point out is that the finding that we were trying to look at, and I am getting a little bit ahead here, but what the PRA staff told the engineering staff is that you want to maintain functionality of this equipment.

And it might be with lower confidence, but you need to maintain functionality because I don't think that anybody concluded that these sensitivity studies indicated that if you had common cause failures of some significance that it might not impact the CDF and LRF values.

So when we start to talk about treatment, I would just point out and recognize that the intent is to maintain functionality throughout the life of the component under the design basis conditions.

DR. SIEBER: Well, the point that I was trying to make though is that the maintenance rule is a way to gather information, and with the NEI Maint 9.301, there is a lot of flexibility in how you group components.

You can group them by TRAM, by system, or by individual component, and it seemed to me that just keeping what goes on in the maintenance rule, since they already do it now, is not such a great burden.

And that you maybe get a better sense after a process like this was in process for a couple of years as to what those failure rates really were and how they would change, provided there was enough data to do it. You know, you don't have 50 failures a day and so it takes a lot time to accumulate data.

MR. STROSNIDER: But I do think that if you are going to try to address some of these issues through the maintenance rules, you would have to make sure that that program is really looking at some of these issues that are addressed by special treatment.

Again, harsh environment and seismic conditions, and those are tough things to get at, and that's why I said that in the end that you end up having to apply considerable judgment, in terms of what is the appropriate level of treatment.

DR. SIEBER: Yes, but the problem is without the maintenance rule, you have no documentation, and so there is no chance of doing an analysis, even though you may not know what the answer is. Well, that is my feeling on that subject.

DR. KRESS: Could you give me a better idea of what you exactly mean by maintain functionality?

MR. STROSNIDER: Well, let me go back and say let's start by thinking about what it is that we are looking at exempting. If you look at the special treatment rules, at least to some extent, or I think to a large extent, the purpose of those was to make sure that that structure systems and components, when called upon to mitigate an accident, would perform their safety related functions.

And so this is mitigating an accident, and so you are into a situation where perhaps there is steam, radiation, humidity, whatever the environment is, and the component has to be able to function, and that is to deliver its safety related function under that environment.

Similarly, if you postulate the seismic event, that it will perform its safety related function under that seismic event. So those are two easy examples of what the special treatment rules were intended to address.

Now, the question is if you go look at what is required by those rules and everything, can you for low safety significant components, can you relax some of the treatment, and the amount of rigor that is in those special treatment rules and to come up with a program that would still maintain functionality, but might not require as much in terms of whether it be documentation or testing, or whatever it is.

DR. POWERS: I guess I am still struggling with the difference in your mind between functionality and availability is.

MR. STROSNIDER: Well, there is in my mind, because if you look at availability, if a component fails to function under normal operating conditions, then you have probably got a pretty good indication that it is not going to perform under these more challenging conditions that I referred to.

But if a component does function under normal operating conditions, or if it is not called upon to function under normal operating conditions, but is called upon during the accident and the more severe conditions, you have to ask yourself are you getting information that says, yes, will it operate under those conditions.

Those are very difficult things to get and they always have been, and that should not be a surprise. When you talk about collecting information on-line, how often do you really do a test under those sort of environments or seismic conditions? You don't.

That's why the special treatment rules try to address that in terms of the other elements that we will get to in the treatment program. You know, procurement, and maintenance, and those sorts of activities.

CHAIRMAN APOSTOLAKIS: So functionality here means the ability to function as expected? It has nothing to do with the probability that it will do it?

MR. HOLAHAN: It has to do with capability.

CHAIRMAN APOSTOLAKIS: Capability.

DR. SIEBER: I think a better comparison is to equate availability with operability, and operability according to the rules is a pretty high standard.

You have to meet a number of rigid parameters for a component, and you can fail to do that, and it won't be operable or available, but it will still function, because maybe the service demand is not as severe as the envelope in which the component is supposed to be maintained to be operable. I don't know if that makes sense or not.

MR. HOLAHAN: I know of some utilities who use the terminology of big "O" operability and little "o" operability, because there is some legal implications.

CHAIRMAN APOSTOLAKIS: There is no Greek "O" there. Remember Greek "O"? Well, let's go back to the categorization, because we are mixing too many things.

And the thing that concerns me is that -- well, first of all, I agree with what Gary said earlier and what is in the FSAR, that the overall approach makes a convincing case, at least in my mind, that the risk 3 and risk 4 components belong there, and we can discuss their treatment and so on. But what worries me is that if we approve this and list everything they have done, and put it in the FSAR and so on -- and I will use a word that was used a lot in our meetings with the Commission, that we will ossify the methodology, okay?

And that is not only -- I mean, that concern doesn't only have to do with the importance measures, but it is also the questions that the expert panel used with some issues here regarding the degree to which they overlap and so on, and evidently nobody really thought about them.

It was a purely -- and that reminds me a little bit of the old days when we were dealing with expert judgment. If an academic was doing the exercise, they would tend to invite academics, and so they would talk about pumps in the abstract.

If engineers were to do it, they would invite pump experts, and they would have no idea as to the normal part of dealing with expert opinion. It dawned on us with 1.150 and later studies, that actually you need both kinds of expertise.

And you need the normative expert and the substantive expert, and here I think the expertise that was missing was the normative kind. You know, the structuring, and maybe it was missing in the actual work that you did.

But if I look at the paper that I have in front of me, and questioning the overlapping, and at the same time if I read the whole thing, I say, my goodness, the overall conclusion makes sense. It does make sense.

I may pick one page and say why did you do it this way, and you could do it better, but does that really change the conclusion? But what worries me is that what if you have 20 licensees tomorrow who come and repeat everything that South Texas did and a factor of 10?

Why not a factor of five? It seems to me that to shift the mean value by a factor of five is a heroic effort. You are shifting the mean.

DR. KRESS: That would be a hard thing to do.

CHAIRMAN APOSTOLAKIS: And you are taking the whole distribution and putting it up there, you know. And judging from the weak evidence we have, Gary, you said that they couldn't tell the difference between the failure rates.

So all this stuff, it would be nice to have some incentive to think about it without necessarily -- you know how it is. If these guys approve something, that's it.

MR. HOLAHAN: If they can get away with a factor of five that would be an incentive.

DR. SIEBER: One wonders whether that would make any difference.

CHAIRMAN APOSTOLAKIS: But you know how it is. The moment it is approved though, everybody else says we are going to get it, too, and that's it.

MR. HOLAHAN: I am not so concerned about the ossification problem. It is not as though this is the lead plant in an exercise where we expect other plants to follow this model.

Remember that the overall context of this is we are working risk informed regulation, Option 2, rule making. And this is sort of a proof of principle that shows that we are capable of defining a program and a licensee is capable of implementing such a program.

I think the issue of how to do this more generically so that it applies to everyone still faces us, and it is an integral part of Option 2 and the rule making activity.

So I don't see this as the model that will last and be used by many people. I see that as being framed by how we deal with these issues in Option 2 and in a rule making context.

CHAIRMAN APOSTOLAKIS: And when is that going to take place by the way?

MR. HOLAHAN: Well, we have already started.

DR. SIEBER: Is there any more questions on this first sentence?

DR. LEITCH: I am in the first paragraph, and I guess that's all one sentence. So, yes. I am concerned about the reliability of the instruments, particularly control room instruments that the operator uses to make significant decisions.

And there is a subset of those instruments described in what I think is Reg Guide 1.97 if my memory serves me correctly.

CHAIRMAN APOSTOLAKIS: That's it.

DR. LEITCH: And the operators are trained in accident situations to specifically rely on those instruments. And I guess my question is whether is it fair to assume -- and I think it is, but I just would like to hear confirmation, but is it fair to assume that none of those instruments would have been categorized as Risk 3?

MR. HOLAHAN: Well, let me answer the question a little differently. The staff is approving a process, and so we can't give you a list of how these components fall out in the process.

As a matter of fact, probably most of that categorization hasn't been done. We approve a process and over a period of time a licensee will implement this system by system. So many of those components may not have been categorized yet.

DR. LEITCH: But what you understand of the process, would you expect that the process --

MR. HOLAHAN: From what I understand of the process, I would think that particularly the part of the process that addresses the expert panel and the look at the emergency operating procedures would go directly to those instruments that are referred to in the emergency operating procedures. And that would push them into the high category.

DR. SIEBER: Well, this is question two in the deterministic section on page 18, which tells me that if it is in the EOP or an ERG, it is category one or two.

CHAIRMAN APOSTOLAKIS: Now, one other thing about ossification. The extensive use of conservative assumptions in a risk-informed framework, I think we ought to be very careful before we start doing that.

And a factor of 10 is one, and I think it is conservative from everything that I know about it.

MR. STROSNIDER: I guess I would just suggest that we probably need to think about that. If I could give some examples. There was a discussion on just one of the open items that we had, which was how you treat metering test equipment and whether you found that that metering test equipment was out of calibration if you needed to go back to some of these slow safety significant equipment and recalibrate it.

The original proposal was not to do that, and the only reason that I bring that up is because there is the potential if you look at something like that for treatment.

If you had something that was really way out of calibration, and to go off and mis-calibrate a set of equipment, such that it wouldn't function -- and the shift there is much greater than -- could be much greater than a factor of 10. We dealt with that open item, and --

CHAIRMAN APOSTOLAKIS: A shift of what?

MR. STROSNIDER: In the probability of functioning. If you take equipment -- and let's say it starts at 10 to the minus 3rd probability of functioning, and you go out and you mis-calibrate it, it may go to a point where it is not going to function.

And if you do that across a number of different components, you could have an issue. Now, like I said, that is an open item that we dealt with, but when you start talking about treatment, there is the potential to have impact on functionality.

And if you are starting at 10 to the minus 3rd, and you say I am going to go from one in a thousand chance that it doesn't work to one in a hundred --

CHAIRMAN APOSTOLAKIS: Yes, but mis-calibration is not part of the failure rate as far as I know. Mis-calibration is a human error that is found separately, and they didn't increase that by a factor of 10.

If a failure rate is due to random causes, and it is very hard to say that going up by a factor of 10, the mean value.

MR. STROSNIDER: I would suggest that there is random causes, but one of the other issues that you really want to think about when you are talking about changing treatment is the potential for common cause failures; common cause maintenance, common cause calibration and the sort of things that I was mentioning, which could affect more than a factor of 10.

CHAIRMAN APOSTOLAKIS: Were these analyzed?

MR. STROSNIDER: Well, again, I would like to put that into the context of that is one of the reasons when we get to the treatment discussion, where we will say that the objective of the treatment program is to make sure that these structure system components will function, and that functionality is being maintained.

And that is one of the reasons it is important to put that as a goal of the treatment program because of those kinds of considerations.

MR. HOLAHAN: I would like to go back and say something about conservatism, because there is some forms of conservatism that I think are detrimental to a risk informed process and others that are not necessarily.

If you make some conservative assumptions in the PRA in some areas, you will distort the perception of what is important and what is not, and those are I think destructive. That sort of conservatism will in fact change the importance measures, and it will change what goes into the categories.

The kind of conservatism associated with picking a factor of 10, as opposed to something else, I don't think distorts the results. It may put a little more margin in some way in your decision.

It may restrict you in how many components go in this category versus that one, but I don't think it is as serious a concern as sort of distorting your views so that you are not really focusing on the most important things.

You are simply focusing on the things that you assumed were problems, and drove those to be the answers.

CHAIRMAN APOSTOLAKIS: On the other hand, if a factor of 10 is used 2, 3, or 4 times, then it becomes part of the tradition, and then the first guy who cannot show that a CDF has been small with a factor of 10 is stuck.

Now what do you do? If he dares go down to a factor of five, all hell is going to break loose again. So that is the danger of that, and also the treatment of common mode failures, and taking the whole importance of the therm, and putting it under one component, that is also a conservative thing to do.

And again we don't want to bless those and have them there forever. For a particular regulatory decision, I think conservatism is fine, but again this works now and it doesn't work tomorrow.

And the whole idea of risk informing the regulations is to be as realistic as possible.

DR. SIEBER: But it seems to me that that kind of literary discussion would go on with the writing of the rule and its companion reg guide, which would be the suggested implementation; as opposed to trying to somehow or other weave it into this particular set of requests for exemption, provided that those documents appear within my lifetime.

CHAIRMAN APOSTOLAKIS: So let me

understand you. You are asking STP to put all this stuff in the FSAR, right?

MR. HOLAHAN: All this stuff?

CHAIRMAN APOSTOLAKIS: The thresholds that they use for all --

MR. HOLAHAN: Yes. Yes, we are.

CHAIRMAN APOSTOLAKIS: So I guess you have categorized all the components, right? Are there any more?

MR. CHINSEL: Yes. We have done about 45,000 systems.

CHAIRMAN APOSTOLAKIS: How many all together?

MR. CHINSEL: There is a few over a hundred-thousand per plant.

CHAIRMAN APOSTOLAKIS: But these remaining 55,000 are not in the PRA and so the importance measures are irrelevant, right? It would be part basically of the expert --

MR. CHINSEL: Some of the components are still in the PRA that we have not yet categorized.

MR. HOLAHAN: I think we are going system by system.

MR. CHINSEL: That's correct, going system by system.

CHAIRMAN APOSTOLAKIS: So you are blessing this particular process with the 50,000?

MR. CHINSEL: Yes.

DR. SIEBER: And that's probably why you are putting the metrics in there specifically as numerical value.

MR. HOLAHAN: I think we are also putting it in there --

DR. SIEBER: It describes the process that they are using.

MR. HOLAHAN: Yes. I think we are also somewhat constrained by the fact that this is an exemption, and that we have not been through a rule making process, and in fact we are making a finding that this is an appropriate substitute for the normal regulations in these areas.

I think we were probably somewhat more constrained in being less flexible in how a licensee can change this process than we may be at the time when the rule making is done.

If you think of it analogously, we have 50.59, and which allows licensees in other areas in effect to make changes and through a certain set of tests, they are basically saying that they judge that they are still in conformance with the regulations under this change situation.

In this case, if we were to allow additional flexibility, in effect what we are saying is that the licensee doesn't meet the regulations, but we have defined some other process.

And to allow them to change that process, and for them to decide that they still don't meet the regulation, but they have some other standard which they decided as good enough to grant them an exemption, it is not something that we would normally do.

I mean, we really don't have a process for doing that. So there are some constraints associated with the fact that this is an exemption, as opposed to a license amendment, or even a rule change.

DR. SIEBER: Okay. John, maybe we can move on.

MR. NAKOSKI: Okay. This is John Nakoski again. If we can get to bullet two on slide three. This deals with the conclusions that we drew on treatment, and what we concluded was that the alternative treatment program proposed by South Texas includes the necessary elements, and that if South Texas effectively implements them, can result in the safety-related low risk components remaining capable of performing their safety functions under design basis conditions.

CHAIRMAN APOSTOLAKIS: Why do you need to say if effectively implemented? I mean, was there any intended proposed alternative treatment program and was that effectively implemented?

MR. NAKOSKI: It is not -- it doesn't indicate that, but we believe that it would be ineffectively implemented. It is just that it is an indication that the burden for effective implementation remains with South Texas.

MR. NAKOSKI: This is Jack Strosnider, and just to point out that is where that burden always is. The licensee has that responsibility, and it emphasizes that, but it also was intended to point out the fact that the staff did not do a detailed review of how this treatment would actually be implemented.

Normally our more traditional approach is that we get down into looking at procedures, and we get down into a lot of very specific issues. We tried to avoid that in this review.

The reason for that is that recognizing that this is, given the robust categorization process, that this is low safety significant components, so that we didn't need to go into that level of detail.

But we wanted to make sure that the people understood that we didn't, all right? And what we looked at was the high level programmatic elements, the expected outcomes, and I will acknowledge that in some cases that we expanded on what was meant by some of that, in terms of what we thought needed to be in the FSAR.

But we tried to focus, and you have heard some of the prior discussions on the what's; that is, what is expected, versus how it is actually going to happen.

And it would have been a different review if we really had gone down into how are you specifically going to treat this piece of equipment or that piece of equipment.

DR. SIEBER: I think one of the interesting things is that the way that this is laid out is pretty good, because it actually quotes what is going to go into the FSAR, and when I examined the proposed treatment requirements, I noticed in a number of places where decisions are being made, or where things are happening, and engineering decisions, like equivalency, and that kind of stuff.

And in the training program, my program is just as good as the vendor's recommended program. The last sentence in every one of those is that no documentation is required. I don't see how you can manage your engineering department or your training department without documentation, which is the basis upon which you make decisions.

So I am wondering if you are putting the time in to make the decision, or to do the analysis, why can't you spend a little extra time and write it down.

MR. NAKOSKI: This is John Nakoski. It is not that we would not expect South Texas to have some sort of documentation. It is just that we would not require that to be documented.

For their business practices, you are right. They would need to have some sort of records.

DR. SIEBER: I don't understand how you could do a good job of organizing engineering without writing down the basis of the decisions that you make.

And I guess the other thing that strikes me then is what if issues come up where enforcement is necessary by the NRC, you wouldn't have a basis upon which an enforcement action could occur, because they wouldn't be required to keep the record.

MR. STROSNIDER: And there was actually a lot of discussion internally with regard to documentation. Of course, again trying to look at this from a risk-informed perspective, and looking at various areas where you can reduce unnecessary regulatory burden, the discussions were what sort of documentation is really essential and needs to be maintained in accordance with existing special treatment, and what can we let go of in a sense.

We talked about equipment qualification as an example, and that is one area where if you look at the special treatment rules, there are some significant requirements for documentation, and quality assurance, et cetera.

DR. SIEBER: Yes, I didn't discuss those.

MR. STROSNIDER: And if you accept the low safety significance of some of these components, then you might not need that same amount of rigor. Yes, the expectation as I said, and if you look at each one of the elements in this program, there is an expectation stated at the beginning of it in terms of maintaining functionality.

Whatever the licensee needs to do in order to keep track of that, they would have to do, but that is their determination at this point. EQ might be an example where you say if you want to understand the qualified life, and at what point do you need to deal with that.

And the expectation is that they would maintain the functionality of this equipment, and if there is something that needs to be checked at some period, then they would have to do that.

But we are not prescribing, like what is prescribed in the special treatment rules, what is necessary, so that they could get by with just what is necessary for them to meet these outcomes.

So it is a different approach and you have to look at it and recognizing its low safety significance components.

MR. HOLAHAN: I think you also have to look at this issue in the context of the new reactor oversight process, and which the expectation would be that because these are low safety significant components, it is very unlikely that they will ever be above the licensee response zone.

And so you would expect the licensee to find and fix these issues, but you wouldn't expect them to require any elevated attention by the NRC. I am not saying it is impossible, but normally you wouldn't expect that.

DR. WALLIS: You took the trouble to put in this phrase of "if effectively implemented by the licensee." That kind of implies that someone is going to check up on it. So what is the mechanism for checking up on this effectiveness of implementation?

MR. STROSNIDER: I think you are looking at the reactor oversight process. I don't think it would be the intent to focus our inspections on low safety significant components unless something drives you into that from the perspective of the oversight process, in which case then it would be dealt with.

DR. WALLIS: If you are going to take the trouble to mention it though implies that you are saying that someone has to check up on it in some way from time to time, and I am just wondering where it falls in the inspection process.

MR. HOLAHAN: In the reactor oversight process, because it is a low safety significance, they are not likely to be focused on. So the normal place to see them is in the inspection of the corrective active program, which is one of the central elements of the inspection program.

DR. SIEBER: And no exemption was requested from any element of that.

MR. NAKOSKI: That's correct. Corrective action requirements of Criterion 15 and 16 of 10 CFR 50, Appendix B, continue to apply.

DR. SIEBER: That's right.

MR. HOLAHAN: And the reason that the reactor oversight process includes corrective action is because obviously we have put a lot of these lower issues into the licensee response area, and so we need to have some mechanism -- and not just for these specific components, but for the whole program -- to see that they are responding effectively to all of the issues that are below the green light threshold

DR. SIEBER: So the documentation obviously for Risk 4, and also now for Risk 3, is of no regulatory concern?

MR. HOLAHAN: That's correct. Quality records would not be required.

DR. SIEBER: On the other hand the licensee has to understand that even in a coal plant that you keep records when you maintain things, and when you calibrate them, and what engineering decisions that you make, and operating difficulties, and that type of thing. That is standard business practice.

MR. HOLAHAN: I think we have talked about documentation, but this exemption does not remove documentation completely. There are certain areas --

DR. SIEBER: I know that, right.

MR. HOLAHAN: -- of design and corrective action and documentation will still be there.

MR. NAKOSKI: Okay. We can move off the third slide, and go to findings that the staff made. These are really findings that we have to make in order to grant the exemptions.

The first one is that we found that relaxing the special treatment requirements on these low risk components poses no undue risk to public health and safety.

We also found that the categorization process is a material circumstance that wasn't considered when the special treatment requirements were adopted.

And we may have considered risk insights when some of these regulations were adopted, but we have never I believe considered an integrated decision making process like proposed by South Texas.

We have also concluded that it is in the public interest to grant the exemption. That is primarily that we have improved efficiencies and effectiveness in the application of our oversight. We target our attention better on those risk significant components and functions at South Texas, and South Texas can do the same.

Now, we also found that the proposed SFAR section is a sufficient basis for granting the exemptions.

South Texas requested -- I believe it was 18 -- exemptions from 18 regulations, and to one extent or another, exemptions for low safety significant, non-risk significant components that fall within the scope of these regulations.

And the ones that are listed here on the slide are being granted. If I can talk just a little bit about some of the rules and where there are some limitations.

On 10 CFR 50.49(b), which would exempt essentially all of these LSS and NRS components from the scope of the environmental qualification rule, there are some design aspects that continue to apply, and it is covered in the safety evaluation.

The exemption to 10 CFR 50.59, really it only applies to changes to treatment that result from the granting of these exemptions. For any other change to the FSAR or any other licensing basis document, the requirements of 50.59 continue to apply. The Appendix B --

DR. SIEBER: The change to treatment was to cease maintaining the item and turn it into a breakdown of maintenance, where would that fall under 50.59?

MR. NAKOSKI: If it was covered by the scope of an exemption that we granted, they would not have to seek prior staff approval for that. If it wasn't covered by an exemption that we granted, they would have to come in if when they were doing their 50.59 evaluation that it required prior staff review and approval. Did that answer your question?

DR. SIEBER: Even if it was Risk 3?

MR. NAKOSKI: If it was outside the scope of an exemption we granted, yes, they would have to come in for -- if it was for the threshold of 50.59.

In other words, if they have a commitment in their licensing basis that isn't part of this --

DR. SIEBER: Well, you have a commitment to the PM program, but you exempt portions of that, basically saying that just a PM program to match commercial standards, whatever they are.

Then there is a phrase that is in there a couple of times that the licensee is not obligated to list all the commercial standards, and what the State of Texas says they ought to do, which could be the State of Pennsylvania, or Maryland, or whatever. They all do the same stuff.

And so I could picture taking that to its extreme limit, and somebody deciding that I am going to save money and I am not going to change the oil except every 10 years.

MR. HOLAHAN: I don't think that you could make that decision and be consistent with a description of the program in the FSAR.

MR. NAKOSKI: That's correct.

MR. HOLAHAN: And what this is basically saying is that you can't change -- you can change the programs so long as it still conforms to what is in the FSAR, and there is probably a lot of flexibility for doing that.

MR. NAKOSKI: I think there is actually confusion, and this is John Nakoski again. The 50.59 process is basically -- the exemption that we are granting them for 50.59 basically applies to changes that they will need to make to their FSAR as a result of the exemptions that we grant.

There is going to be an addition. They are going to add a section to the FSAR that lays out their categorization and alternative treatment processes.

In there also will be a change control process for how they control changes to that Section

13.7 of their FSAR. It kind of lays over any requirement that 50.59 would impose on that section. So if the wanted to change the treatment that is described in Section 13.7 of their FSAR --

DR. SIEBER: They have to ask you first.

MR. NAKOSKI: -- and if it reduces the effectiveness, it has to come back in, because it will undermine or has the potential to undermine the basis for our exemption.

DR. SIEBER: And 50.65.

MR. NAKOSKI: And 50.65, the maintenance rule, there is recently 50.65(a)(4), which came into effect, and that continues to apply to all components within the scope of the maintenance rule.

DR. SIEBER: Maybe to help us, you could tell us what (a)(4) does.

MR. HOLAHAN: And I am drawing a blank. Well, (a)(4) requires licensees to assess and manage the risk associated with taking components out of service.

DR. SIEBER: Okay. And since these are low risk things, it is not hard to manage.

MR. HOLAHAN: Right.

DR. SIEBER: On the other hand, you lose again some of the tracking and records, like taking

20,000 components out of the maintenance rule, and that gets back to my --

MR. NAKOSKI: I will say that part of the South Texas monitoring program is if a low risk component impacted an HSS or MSS function, they would capture that failure. So that data would be captured.

But if its failure impacted or affected a low risk or non-risk function, it wouldn't be captured. So again it is targeting the attention on the high risk, medium risk functions that we want to focus on.

DR. SIEBER: And if I go through the deterministic screening questions, it would seem to me that there would not be a low risk component that would affect or disable a high risk frame, right, because it wouldn't get screened out. It would not get screened into a risk series.

MR. NAKOSKI: That is our expectation; that if it does occur that it would be infrequent.

DR. SIEBER: And it would almost seem like it was impossible. On the other hand, you are expecting functionality of even RSC-3 components, but you won't have a record.

MR. NAKOSKI: I'm sorry, but I didn't catch that.

DR. SIEBER: There won't be a record as to whether it was functional or not.

MR. HOLAHAN: But from a safety point of view, it isn't that important.

MR. NAKOSKI: I would modify that to say that there wouldn't necessarily be a quality record under an Appendix B program.

DR. SIEBER: You aren't requiring any record?

MR. NAKOSKI: That's correct.

MR. HOLAHAN: Except corrective action program and design basis.

MR. NAKOSKI: And design control. Under 10 CFR 50, Appendix B, quality assurance criteria, as we discussed previously, Criterion 3, design control, and Criterion 15, with non-conforming materials, components, and parts; and 16, correction actions, continue to be in effect.

The exemption to Appendix J is for type leak rate testing only; and the exemption to Part 100, the design requirements continue to apply as described in Part 100.

And the exemption is to the specific engineering analysis and testing requirements in Part 100.

There were some exemptions that we determined that we would not grant, and primarily the general design criteria -- really because what the licensee proposed met the regulations for GDC-1, and this relates to the other two at the bottom of the slide, 50.35(b)(6))ii), and 50.54(a)(3).

Early in the review process, we recognized and South Texas recognized that really we needed to have a quality assurance program updated to reflect the changes in treatment, and if for nothing else, as a record keeping tool.

And as a result, they submitted and we found acceptable as discussed in the safety evaluation their proposed revision to the operating quality assurance plan, and so that met the requirements of GDC-1.

GDC-2, 4, and 18, they deal with design requirements, and the design isn't being changed under this exemption or under Option 2. So really they don't fall within the scope, and there is no special treatments for which exemptions should be granted.

Now, as I said, the last two, we determined that an update to the QA program should be done and South Texas agreed. So we aren't granting those exemptions either.

And with that, that is the prepared material that I had for the meeting today, and we would be happy to answer any additional questions.

DR. SIEBER: I suspect there are no shortage of questions. If anyone would like to ask questions that are disturbing them at this time, this would be a great chance as we are ahead of schedule.

DR. POWERS: I guess my question is have we resolved the question.

DR. SIEBER: Well, it all depends on what you would call resolution, and that it may not necessarily be pertinent. On the other hand, I think that the question that I have asked will cover the areas of concern, and we are trying to decide now how important my feelings really are to the success of this project, and that will take a little bit more thinking on my part.

But I am sure that others have asked a lot of questions of me that seem to be pretty burning.

DR. POWERS: Let's come back to the question on the cut-offs for FSER vesely -- well, the issue is that they picked some values and used them in this application. But it seems to me that those weren't particular outlandish values that they picked.

In fact, they seem kind of common, but

there seems to be some interest in claiming that those aren't not be a template for others to use, and so my question is why not?

DR. SIEBER: Well, that was my comment of 10 days ago, and it was really responding to Dr. Apostolakis' remark about ossifying some methodology industry wide, and that was really the purpose why I said it shouldn't be bound to use those screening criteria for bound to use questions that they asked in the rating system that went alongside that.

And the general methodology was okay, and I basically say that because my personal opinion really is it doesn't make a lot of difference how you do the categorization provided that you have no heavy hitters in there, and that you meet the criteria of Reg Guide 1.174. And so it was an attempt to satisfy, and it could go either way.

DR. KRESS: My problem with that, Dana, is two-fold. One of them is that those importance measures have the absolute value of the CDF and the LRF, if you are using LRF also, in the denominator.

Therefore, almost automatically it makes them plant specific. Now, that may look like a simple fix. You just take the numbers and multiply them by the -- or ratio them by the CDF, and you have got another set of numbers.

MR. HOLAHAN: Or perhaps we should put the safety code quantitative objectives in the denominator.

DR. KRESS: That would be another way to fix it.

DR. SIEBER: But that may change categorization.

DR. KRESS: So that was one of my problems. The other problem that I had though -- and I think it is a deeper problem -- is that I am not quite sure that I agree with Jack that the categorization process doesn't matter.

You have got the expert opinion, and you could use a ouija board, and you could throw darts, and as long as you validate it with your sensitivity analysis, but I am not quite comfortable with that because I have a feeling that there is a way to decide what thresholds to use for RAL and FSER vesely that would give you a given change or a given percentage change in CDF and LRF.

I am not certain of that because I have a real problem -- what we found with each of these RALs is the individual RAL for each component, and I don't know how to combine those for a bunch of components.

You just don't multiply by a number of components, or you don't add them up, but what I am afraid of that we will quit here. When I think there may be somewhere in these definitions of RAL and FSER vesely a way to actually technically defend their use in bounding the group RAL, and the group LRF, and I just did not want them to quit here and say now it doesn't matter.

But if there is a way technically to come up with that group RAL, that would be a value for a lot of the risk-informed things that we are going to do later on, and we may want to use those things.

And it is extension of the technology of using RALs and FSER vesely, and other important measures, to the other risk informed processes that worries me.

And I just did not want them to quit because while we have got this sensitivity study or an uncertainty analysis, whichever you want to use, to validate it, because it doesn't matter how you got there.

I think it does matter because I think it is going to be used in other processes and it could be misused, and I think it is an opportunity to further develop the concept so that it is technically defensible. That was my worry.

DR. SIEBER: And I guess if I were South Texas, I would wonder why I am getting stuck with doing the extra part.

DR. KRESS: And that is the other part. I didn't to penalize South Texas, because I do agree that they have jumped through enough hoops and that I do believe that the sensitivity study does confirm that their process fits into the 1.174.

I just didn't want to -- I think this is an additional research project that needs to be done, and I didn't want to bless the process as it is for a group RAL or a group FSER vesely, and I wanted to be sure in the whole letter or whatever we do that we don't bless that, because I don't want to stop with that.

CHAIRMAN APOSTOLAKIS: Isn't that a little related, Tom, to the issue identified with respect to the risk-based performance indicators?

DR. KRESS: It is related definitely, and I am afraid that there may be other places in the risk-informed process where it is related. I didn't want to leave the impression that just because it is okay to give South Texas their exemption because they did this that we have a process that is technically defendable, in terms of actually determining -- well, the process is here because it was confirmed by the sensitivity analysis. That is the technical defense of it. You may not have a sensitivity analysis for all these other things.

DR. SHACK: You are always going to have to compute, or bound, or estimate Delta-CDF for it to work.

DR. KRESS: Well, this is what I am saying.

DR. SHACK: The sensitivity study in this case is a substitute for computing Delta-CDF.

DR. KRESS: What I am saying though is there may be a way to use RAL, and FSER vesely to determine that bound without going to the sensitivity analysis if you did it right.

That is what I am saying ought to be developed. You wouldn't have to do the sensitivity because we were able to do the sensitivity here because we got a good warm feeling that Factor 10 really does bound the effects.

We may not have a warm feeling about some other thing, and we may not be able to do this calculation. It would be useful to have a RAL and a FSER vesely that you actually knew did bound a group effect, and that is what I am saying.

CHAIRMAN APOSTOLAKIS: We can put it in a different way. I think it is defensible the way it is, but we wouldn't want it to stay that way. I mean, we want it to stay defensible. We would not want the methodology to be frozen for all these reasons.

DR. SHACK: Well, I would agree with that. I would look at it in a different way. I mean, we --

CHAIRMAN APOSTOLAKIS: There is always a third way.

DR. SHACK: When you select these components, you are satisfying other things other than the Delta-CDF and the Delta-LRF, and you get other things.

You know, as we argued, the FSER vesely looks at the risk significant components, and the RAL looks at the stuff with the low failure rates if it is really safety significant here.

You are gathering things together, and so those populations that you do gather and test, and see if the Delta-CDF have different characteristics, and I think that should be researched.

DR. KRESS: Well, I also felt that this was a one-way test, and that you took those components that were downgraded and did all of them with a factor of 10. But you had 40,000 other components that you didn't do that to.

And if you did the FSER vesely and RAL correctly for group components, you may find out that some of those actually would have been risk significant; whereas, they weren't even -- you didn't --

DR. SHACK: The reason that you had a FSER vesely for a RAL was in the PRA.

CHAIRMAN APOSTOLAKIS: Well, let me give you another example and a possible improvement. Did you consider at all the idea -- and this question is addressed to South Texas -- of surrogate components like they use in risk-informed inspections?

DR. KRESS: And that's what I had in mind. You could surrogate some of those other 40,000.

MR. GRANTUM: There are some components that are surrogate components when you look at the components like diesel generators that encompass large skid mounted equipment.

CHAIRMAN APOSTOLAKIS: And how about the thousands of components that are not in the PRA? Just like pipes are not in the PRA, but in the risk-informed inspection program, they consider -- well, at least the Westinghouse approach, considers the surrogate component.

So you look at the impact of the failure of that pipe on that component and that super component isn't in the PRA. I mean, that is a lot of work, and you don't necessarily have to do it in your case. But did you consider it at all?

MR. GRANTUM: Yes, that has been considered whenever we have talked about the applications of risk-informed in-service inspection and that was in fact some of the discussion on how robust the categorization process was, because there was an issue about -- well, we contended that we did look at surrogate components.

And taking out a section of a pipe or several piping segments could be the same as assuming that the pump has failed, but have the same impact on the CDF.

CHAIRMAN APOSTOLAKIS: And that is an inspection problem?

MR. GRANTUM: Right. But it is also in the PRA, because we had the FSER vesely of that component failing, which one could make an argument that the piping segments would be the same.

I would say that the staff had concerns about that because they indicated that they didn't think that accounted for dynamic effects; pipe failing and special interactions types of effects.

CHAIRMAN APOSTOLAKIS: But the exemption request, this one, and not the risk-informed inspection program; did you do any of these surrogate component business?

MR. GRANTUM: Not --

CHAIRMAN APOSTOLAKIS: Or is it strictly based on the expert panel --

MR. GRANTUM: It is based on the series of sensitivity studies that PRA comes up with a statement of the importance based on the 21 sensitivity studies, the working group combines the deterministic questions, and the expert panel approves that.

So the surrogate components that you are referring to weren't directly done as part of the categorization for this.

CHAIRMAN APOSTOLAKIS: If I take a component that is not in the PRA, and the expert panel categorizes it based on the five questions, and there was no further analysis to see whether that component could belong to a bigger component that is already in the PRA so I could have some sense of what would happen if we do it the same way for the --

MR. GRANTUM: Well, yes, we answered the

five questions, and we are asking the question could it fail a function.

CHAIRMAN APOSTOLAKIS: And then one could conceivably find the RAL for that system and somehow come up with an intelligent method that Tom is asking for.

MR. GRANTUM: Right.

CHAIRMAN APOSTOLAKIS: Again, this not something that you might have done, but that could be an improvement in the matter.

MR. GRANTUM: Well, with a series of sensitivity questions, I would say the answer is yes. I mean, for looking at all the questions that we asked, it is subsumed in those answers.

DR. SIEBER: When I think what Dr. Kress said, that he could eliminate the sensitivity studies and have the proper definition of the thresholds for the importance measures, I guess then that I would object to that.

DR. KRESS: I don't know if it is possible or not.

DR. SIEBER: I think the regulatory basis -- what you are doing here is Reg Guide 1.174, and without the sensitivity studies, it can't apply.

DR. KRESS: Oh, yeah, because you are

bounding the delta, if they actually bond the delta, but I don't know if it is possible or not.

DR. SIEBER: I guess you could, but I would still like to see it directly applied the way the regulation states, as opposed to --

DR. KRESS: But you may not be able to do that all the time.

MR. HOLAHAN: Those two could come together, if for example, you could calculate the Delta-CDF contribution at the component level, and then you simply add them up, and that is equivalent to doing the sensitivity study.

So you pick a bunch of small ones, but you make sure that the cumulative effect is still small.

DR. SIEBER: Well, I guess I still don't believe that South Texas ought to get that rock in their knapsack.

DR. KRESS: Well, I actually wasn't proposing that either.

DR. SIEBER: Well, nobody is proposing that.

MR. GRANUM: Dr. Apostolakis, I have been asked to clarify something. There are comments over here that, no, we didn't explicitly go and take a component, and extrapolate out in the form of a super component to look at the impact of that.

On the other side of the coin, when we looked at a component deterministically, if it was going to fail a function or it would have failed a risk-significant function somehow, it would have gotten the same ranking as the highest significant function that it was associated with.

CHAIRMAN APOSTOLAKIS: It was the panel that did this?

MR. GRANUM: Right. I wanted to clarify that, and I will allow my colleague here to further clarify that if you would like.

MR. SCHNIZEL: Glen Schnizel, South Texas. Now, again, if a component's model is in the PRA, we looked at it from the function standpoint, and if there are other components that are necessary to satisfy that same function, if those components would fail, they received essentially the same categorization as would the PRA reflected. So, from that perspective, that is how we captured that.

MR. HOLAHAN: Let me say something on this subject, and that is that I share some of the committee's concern, but not another part of it.

I am not a particular fan of FSER veselies and RALs. I think there are a lot of limitations and difficulties with them, and I think there is room for improvement, and we ought to be encouraging that.

And I am supportive of that, and I think the fundamental goal is to identify components issues to be focused on, and also to be judging whether the small change standard in 1.174 is met. I don't share the committee's concern over ossification.

DR. SHACK: Well, Appendix T is the place where ossification is concerned.

MR. HOLAHAN: Amen. That's right. I think before we get to that point that there is plenty of time to lay those issues out. Plus, the way that we have been thinking of Appendix T, it would say that you can do it this way, or you can propose something else.

And the purpose of an Appendix T is to say we are sure that this is okay, and so you can do it without review and approval. I don't see that the staff is in a mood or is not receptive to new and good ideas. The whole reason we are here is -- this whole thing is a new and different idea.

CHAIRMAN APOSTOLAKIS: Well, what happens, Gary, until we have a new -- which could be some time, and let's say you have three other licensees, and they hear that South Texas was granted the exemptions, and they go line-by-line, and they try to reproduce what South Texas did.

Now, they might have problems because of the extreme redundance that those guys would get, but the --

MR. HOLAHAN: That could happen. As a matter of fact, we are granting this for Unit 1 and Unit 2. I mean, so you already have two. So what is wrong with that?

DR. POWERS: Well, I'm ready to ossify them.

CHAIRMAN APOSTOLAKIS: What?

(Laughter.)

DR. KRESS: Too late.

DR. POWERS: For the life of me, I have not seen anything here that is going to change or that causes any heartburn to people. The only thing that looks at all suspectively is this business of okay, suppose I take a low safety significant component, and let's say it is dead and died.

And now I do the raw for the other components and one or two of them might come up, and we don't find that out. We don't know that. I don't know why we don't do that. It seems like an easy job to do.

MR. HOLAHAN: Except the number of combinations is astronomical.

DR. POWERS: It is a modest common editorial problem.

CHAIRMAN APOSTOLAKIS: It is modest when you want to calculate a number, but actually doing it is different.

DR. POWERS: I am sure that these things could be imaginatively done.

MR. HOLAHAN: This is getting simpler all the time.

DR. POWERS: I mean, that seems to be the only thing that would represent a significant improvement in the technology. Otherwise, I am ready to ossify. Why not have somebody do it line by line.

CHAIRMAN APOSTOLAKIS: Wait. Wait. Has anyone come to you yet or hinted that they might come with Option 2 exemptions request using the top event prevention methodology? That is really different.

MR. HOLAHAN: No.

CHAIRMAN APOSTOLAKIS: Nobody has done that?

MR. HOLAHAN: I have not heard that. We have had discussions of the top event methodology in other contexts, and not as an exemption.

CHAIRMAN APOSTOLAKIS: Well, that would be very different.

MR. HOLAHAN: I have not heard it. Tim Reid, have you heard anything?

MR. REID: Top event prevention has been discussed at some of our meetings, and those individuals have attended our meetings, but I haven't heard any exemption or any idea like that being proposed so far.

CHAIRMAN APOSTOLAKIS: Okay. Because that would be a very different approach. Okay. Thank you.

DR. SIEBER: Any further questions?

CHAIRMAN APOSTOLAKIS: Or comments.

DR. SIEBER: If not, Mr. Chairman, I think we have concluded. Thank you very much, and I thought it was very productive.

CHAIRMAN APOSTOLAKIS: Thank you, gentleman. Well, we are due for a break. So we can go with a break. We will recess until 3:35.

(Whereupon, at 2:53 p.m., the meeting was recessed, and was resumed at 3:35 p.m.)

CHAIRMAN APOSTOLAKIS: We are back in session, gentlemen. The last presentation of the day is by Mr. Sorensen, ACRS Senior Fellow, and he will talk to us about the general design criteria, and some work that he did the last few months for us. Jack.

DR. SORENSEN: Thank you. This assignment actually had its genesis during the ACRS planning session, and the scope was basically to take a look at the Federal design criteria and Appendix B from the standpoint of their place in the grand scheme of things if one is going to risk-informed regulation.

There was sort of an underlying thought that Appendix A and Appendix B would be key to risk-informed revisions to the regulations, and that probably is not quite true.

The questions that I tried to address and will touch on in this presentation -- and in the paper which follows it -- are the GDC risk-informed as written, and the answer to that question is yes, insofar as that concept was understood at the time the criteria were written.

The second question is are they an impediment to risk-informing Part 50, and the answer to that is that some are, and many are not, and we can go through some examples of it later.

How can they be made risk-informed, and I have addressed that in a very general way, and in a somewhat naive way perhaps, but I hope in a way that will be useful.

And the final question today apply to new reactor types or non-light water reactors, and the answer to that is that some do and some don't, and I will try to touch on these.

The general design criteria as they exist right now, and have existed since about 1971, are 55 individual criteria in six groups. The overall requirements protection by multiple fission product barriers and protection and reactor control systems, and fluid systems, and reactor containment, and fuel and radioactivity control, and the scope and content of the individual criteria, vary very greatly from one to the next.

DR. KRESS: What happened to 6 through 9?

DR. SORENSEN: Funny you should ask that. I think I actually touch on that in a later slide, but the earliest -- the GDC, as they exist now in Appendix A to part 50, were published in February of 1971, or incorporated into Part 50 in 1971.

The earliest version that I could find was written in 1965, I believe. I found a memo from Harold Price, who was then the Director of Regulation to the Commissioners, forwarding general design criteria for consideration. There were 27. And the evolution of the criteria as far as I can tell was primarily in negotiation between the staff and the ACRS over a period of several years.

Following that 1965 version, I know that around 1969 that there was a version published for comment that contained 70 criteria, and they were numbered consecutively from 1 through 70.

When they were finally incorporated in Appendix B, some had been combined with others, and some had been dropped, and for reasons which are a bit mysterious, they tried to maintain something of the original numbering scheme.

So there are gaps in the numbering scheme. They reflect the state-of-the-art in reactor design at the time that they were published, and when we get into looking at individual criteria that becomes very evident.

Another observation is that they reflect the phenomenology important for light water reactor safety. The early version that I mentioned, the 1965 version, clearly made an attempt to cover other technologies that are references to unclad fuel, vented fuel, and other features that are not typical of light water reactors.

What evolved into the 70 criteria and later into the 55 is clearly focused on light water reactor technology, and indeed the introduction to Appendix A says that.

And the criteria contained 4 or 5 different kinds of information, and in hopes that it might at some point be useful, I tried to characterize them in that sense.

Typically, each criteria either establishes a need for conservatism, a list of things that need to be accounted for, which I have decided to call completeness. They call for a capability to be provided.

They call for reliability of some of the systems or functions that are required, or they simply require a defense in depth feature of one kind or another.

In the package of material that I gave you, at the end of that, there is a spread sheet that summarizes all 55 criteria, and some of the different ways that I have tried to characterize them, though I don't plan to use that directly in the presentation. But it might be a useful reference at some point.

I have also included in what I gave you verbatim copies of the text of Appendix A, the general design criteria, and Appendix B, the QA criteria, in case you want to refer to those.

In the introduction to Appendix A are the following major -- or what I would call the major points. The application for construction permit must include the principal design criteria for the system. That is a requirement in Appendix A.

And by implication one option would be to simply play back the general design criteria that are listed there. The criteria to establish requirements for structure, systems, and components important to safety, and again this is from Appendix A directly.

Important to safety is defined as those systems, structures, and components that provide reasonable assurance of no undue risk; and what that means is that what we are dealing with in Appendix A is an adequate protection standard, because there is a legal equivalence established between the phrase, "No undue risk," and "adequate protection."

So the standard is not risk. It is adequate protection. And the criteria as written establish minimum requirements for water cooled nuclear plants. That is specifically stated.

It is also stated that there are considered to be generally applicable to other types and can provide guidance in establishing criteria for other reactor types.

Appendix A also goes on to say, or the introduction goes on to say, that the development of the general design criteria is not yet complete, and that there are four issues enumerated that need further consideration, which are:

Single failures of passive components; redundancy in diversity requirements for fluid systems; type size and orientation of primary system breaks; systematic non-random concurrent failures or redundant elements. As far as I know, those words have been since 1971 unchanged.

Also, within the introduction there are two exceptions listed, the first two points on this slide. The introduction specifically says that the general design criteria may not be sufficient for some plants, in which case the applicant is expected to propose additional criteria.

And it also says that some general design criteria may not be necessary for some plants, and again the applicant is in principle to propose his own set.

One observation that is kind of interesting is that we really don't know without examining individual license conditions to what degree the operating plants comply with the general design criteria.

Over half of the currently operating plants received their construction permits before the GDC were made part of Part 50. There are some important definitions in Appendix A, and specifically definitions for loss of coolant accidents, which that has been discussed in a number of presentations today, earlier, and in the previous couple of days.

And they define loss of coolant accident as including all pipe breaks up to and including the double-end break of the largest pipe in the system. There is a definition for single failure and there is a definition for anticipated operational occurrences.

So those phrases are self-supported within the appendix. Before we get into this possible specific changes to Appendix A, I think there is some observations that are worth making.

One is that past regulatory reform efforts, and I am thinking specifically of the marginal safety program that was conducted during the 1980s, and the regulatory review group in the early '90s, judged the GDC to be important to safety and to not be a significant burden, insofar as the regulatory structure was concerned.

In support of that thought, one can

observe that there are 160 division one regulatory guides, and of those, 129 support some aspect of one or more of the general design criteria.

I think an additional 10 of those are QA related, which in a sense also supports the GDC, because the first criteria is a QA criteria. Part 50 incorporates a lot of material by reference. So specifically the ASME code, Sections 3 and 11, and I think Section 8 now as a matter of fact.

Several IEEE standards, and so the GDC are a relatively small part of the total volume of regulation that one has to deal with, and in reality risk-informing the GDC only makes sense in conjunction with other changes in the regulations.

The reason for making particular note of that is that from this point on, and in order to keep the scope of what I was doing reasonable, I had looked basically at the GDC in isolation. I didn't try to look at all the tentacles from each of the criteria.

There are basically three options for risk-informing the general design criteria. The first and simplest is to modify the scope, and I will give an example of that in a second.

The second is to modify the individual requirements. The third is basically to replace the

GDC as a body with safety goals, and/or risk acceptance criteria, and move something like the GDC into the realm of guidance documents.

What I mean by modifying the scope is something akin to what the approach that the staff is taking on Option 2 for risk-informing special treatment requirements.

As we will see in a minute, a number of the criteria incorporate the term, important to safety. Equipment important to safety must be treated in a particular way. The simplest change you can envision is replacing that phrase or redefining it with perhaps the phrase, "important to risk."

And then you have to agree on what that means. One possibility, of course, is to use the risk-informed classification safety class scheme that the staff has come up with as part of Option 2, where one might put risk one and risk two components into the important to risk class, and then subject them to the criteria, and whatever special treatments that is implied there.

And we will look at some examples of where that might be the case. The second element or second option, modifying the individual requirements, is similar again to what the staff is doing in Option 3 to risk-inform the technical requirements in Part 50.

And where you look at each regulation, each provision, each design criterion, and try to determine how it might be changed to improve its risk focus.

There is actually a number of things that you can do there. The simplest thing is to look at the criterion and tender to find the minimum change that you have to make to shift the focus from important to safety, or safety related, to important to elements important to risk, but not change the basic intent of any of the requirements.

CHAIRMAN APOSTOLAKIS: I thought in Option 2, Jack, when the staff speaks of the importance to safety, they really mean work risk.

DR. SORENSEN: Yes.

CHAIRMAN APOSTOLAKIS: Tool safety significance components is really low risk significance?

DR. SORENSEN: That's correct. They have come up with this four box scheme.

CHAIRMAN APOSTOLAKIS: That's right.

DR. SORENSEN: But I think the path involves actually changing the words, because they didn't want to -- they do not want to have important to safety to mean one thing for people who have not adopted risk-informed options, and another thing for applicants who have.

CHAIRMAN APOSTOLAKIS: It is a mystery to me why they went that way, although you might say that core damage is not really risk. It is core damage frequency.

And to say something is an important risk because it is core damage, most likely it is, but strictly speaking, it is not risk. It is categorization. But what is confusing, of course, is that they talk about safety related, and the importance to safety. They are two different things.

DR. SORENSEN: And as far as the path they are on in Option 2 as I understand it, they are kind of taking those two definitions -- important to safety and safety related, and then replacing them with the words, "important to risk" in certain of the requirements.

And using this four box scheme to classify components, the systems and components that are important to risk. Okay. So that is a second way of doing this and modifying individual requirements is actually going in and rewriting every requirement in risk terms, which one could do.

And the third possibility would be to go a step further and not only rewrite them, but make them technology independent.

One of the projects that NEI has embarked on is to have by the end of the year a proposed draft of general design criteria that are technology independent. I am going to be interested to see what they come up with.

CHAIRMAN APOSTOLAKIS: Did they give us an example yesterday?

DR. SORENSEN: Well, in Adrian Haymer's presentation yesterday or the day before, he had one example which was kind of an easy one. I mean, he picked one of the easy ones, and as Dana observed I think in one of the sessions on Monday, at some point you have got to talk about the phenomenology, and it is a question of whether you talk about that in something called the design criteria, or someplace else, but it is obviously very hard.

CHAIRMAN APOSTOLAKIS: Are these criteria sort of principles of good practice when you design them?

DR. SORENSEN: Some of them are, yes.

CHAIRMAN APOSTOLAKIS: So you can't really replace them --

DR. SORENSEN: Well, it is a question of where you put them, I think. If I were starting over, a lot of them I would adopt pretty much the way they are.

Whether I left them as part of the regulations, and whether I put them in the guidance documents is another question.

CHAIRMAN APOSTOLAKIS: Well, the ones that refer to, for example, to water, and design, and so on, I don't see how one could put those in a safety program.

DR. SHACK: Well, commensurate with the importance.

DR. SORENSEN: Yes, most designers do not start with a blank sheet of paper. They start with something that has worked in the past, and good design practice evolves in any technology.

CHAIRMAN APOSTOLAKIS: How about in a purely risked-based, or risk-based, it seems to me that there would still be a place for something like the general design criteria.

DR. SORENSEN: Absolutely. Somebody will have to go from your regulatory requirements to a set of design criteria that a designer can work to. You can't just hand the safety goals to the designer of every system in the plant and say, okay, come up with a design.

At some point, you have got to allocate your safety budget amongst systems, and whether you like risk allocation or not, that happens at some point in the design process, and it is just a question of how.

So you have got to have a place to start, and I think there is a fairly good argument for these general design criteria or something very much like them being or staying as part of the regulatory structure.

This may become a little bit easier to talk about when we look at a couple of specifics. I don't have any particular or any specific proposal to offer with respect to replacing the GDC with safety goals.

Conquest, a couple of months ago, I guess, when I was trying to get some advice from him on how to proceed with this project, came up with an E-mail proposal that I think he sent to everybody involving risk-accepted or safety goals, and risk-acceptance criteria.

I think that would certainly work, but somewhere in this hierarchy of design documents, you have to have something equivalent to the general design criteria.

Just a couple of other thoughts, and then we will look at some individual criteria. Going back primarily to Option 1 and changing the scope.

Of the 55 criteria, 13 of them have a scope that is now defined as important to safety, and with a change of a couple of words could be redefined in terms important to risk, and change virtually nothing else, and have I think a good impact.

The single failure criterion which was mentioned in this morning's presentation appears specifically in nine of the criteria, and if you decide what to do about it in the context of one of those criterion, you could probably make a similar change in others.

But that is basically a reliability consideration, and there are probably better ways to state that now than the single failure requirement. And overall 13 could be changed from important to safety to important to risk.

And 30 probably would require no change, although I think all of these judgments are arguable at this point; and 19 could be recast in risk terms by looking at the individual requirements. And I think now I would like to go to looking at a couple of --

DR. WALLIS: I was wondering about that. There are many things that are important to safety which aren't included in risk, if you think of risk as being simply a typical PRA.

There are other things that have some effect on safety. That is always the problem. I think risk is only interpreted in terms of PRAs.

DR. SORENSEN: Yes, and in my thinking on these, those are the terms that I was thinking in. Some of these you might examine closely and decide that you don't want to change important to safety to important to risk. I'm not sure.

But in a first reading or a second reading even, it looked to me that that would be a straightforward change. And there is one other point that I wanted to bring up.

In terms of applicability to non-light water reactors, there is 36 of them that are probably applicable to virtually all reactor types, and there are 19 that probably are not applicable to some reactor types.

And again I think that judgment is in the case of some criteria could go either way. Some of them are clearly general, and some of them the intent applies, but you might end up with an inappropriate word in the criterion, a reference to cladding, for example, where you might in fact not be dealing with clad fuel. And I will try to touch on these in the examples.

Okay. A good example of criterion -- this is not in your slides, but in the text of Appendix A immediately behind the slides, you will find each of the criteria.

And the significant words here from a risk standpoint, and I think this is one where you could change important to safety to important to risk, and perhaps improve the focus.

DR. SORENSEN: What is this thing tsunami? What is it?

DR. SORENSEN: Tidal wave. The source may be different.

DR. POWERS: It is on a lake isn't it?

DR. SORENSEN: You're right. One is an ocean and one is a closed body of water. This one, I think simply changing the scope would be pretty straightforward. I am not sure that the changes that were in Haymer's examples provide much benefit frankly.

DR. POWERS: Well, he left that nice

prepositional phrase, "With sufficient margin."

CHAIRMAN APOSTOLAKIS: So what was the difference with yesterday?

DR. SORENSEN: I should have brought that with me and I did not. I'm sorry. Basically, the three numbered points have been combined and generalized in some way, which I have now forgotten. I apologize for not bringing that along.

CHAIRMAN APOSTOLAKIS: So what would you do to this one?

DR. SORENSEN: I would simply take the phrase, "important to safety," and replace it with "important to risk." And use whatever definition of risk that I had decided to use in my regulations in general. I think the staff proposal --

DR. POWERS: It seems to me that this is where the absolute has to be confronted. I think you have to come in and address the absoluteness here.

DR. SORENSEN: Well, my thought on that, Dana, was that in fact is done in the numbered points, where it says, appropriate consideration. I saw those words as softening the requirements in the first paragraph.

DR. POWERS: I see that as non-helpful, because you come down and say, well, how do I define appropriate. Well, I define that based on risk. I am still stuck with the problem that I can at any site, if I am willing to go back far enough in the geological history, I can find an earthquake that the planet simply cannot withstand, that no structure could ever withstand, because far enough back there were some pretty horrendous earthquakes. So it seems to me that the absolute term here shall be designed to withstand has to have something in it that puts it within the context of some sort of probability here.

DR. SORENSEN: I guess it was not clear to me that that had to be done here, as opposed to someplace else in your regulatory structure.

CHAIRMAN APOSTOLAKIS: What I would suggest is that this would be eliminated in a risk-informed, because you would naturally consider the contribution from --

DR. POWERS: Well, it is the naturally part that I have a little trouble with.

CHAIRMAN APOSTOLAKIS: Why?

DR. POWERS: It is not so obviously to me that that would be natural.

CHAIRMAN APOSTOLAKIS: In a PRA?

DR. POWERS: In a PRA, and I use that -- I substantiate that by pointing out that in all of the applications of 1.174 that have been presented to the committee, when they go to set the horizontal access value, the CDF value, they don't use the seismic contribution of risk. They have not at any time that we have come up here. And when asked to do that, they said, oh, it moves it up a little bit.

CHAIRMAN APOSTOLAKIS: If you read Option 2, they do refer to it. They do. And they say the reason why they did the --

DR. POWERS: George, I am saying that it is not natural. I am not disagreeing with you that there places where it says take into account seismic risk.

CHAIRMAN APOSTOLAKIS: But we are confusing now two issues. What I am saying is that in a risk-informed licensing regulatory system --

DR. POWERS: You would want to have a design criteria that said that shall make it natural to include seismic contributions to risk.

CHAIRMAN APOSTOLAKIS: No, no. This says design, and what I am saying is that if it is risk-informed, you are going to have -- if you submit a PRA that does not have external events, and you are regulating on the basis of core damage frequency or something else, then that PRA would be unacceptable.

In fact, all three refer to the load from the earthquake and not the strength. So you still have the problem with what does withstand mean.

DR. SHACK: Let's put it this way. Lawyers have not interpreted this to mean that you have to withstand the effects of tectonic plate shifting.

DR. POWERS: The problem is that it is like an EPA criterion. The better I get at my geology, the more that historical record in fact is appropriate and it seems to me that appropriate consideration gets me out of it.

DR. SORENSEN: Possibly.

DR. POWERS: But, George, that is not useful unless you tell them what a good PRA is. That is what the good general criteria would be for a PRA.

CHAIRMAN APOSTOLAKIS: Well, it would state all modes of operation and contributors and all causes of failure.

DR. POWERS: If you say those things, then no PRA is adequate, because no PRA currently takes into account sabotage, and that is clearly contributable.

CHAIRMAN APOSTOLAKIS: And I would exclude sabotage.

DR. SORENSEN: This is fairly typical of the discussions that one would get into in virtually every one of these. I would with your permission move on to a couple of examples.

CHAIRMAN APOSTOLAKIS: Sure. So we can repeat the arguments.

(Laughter.)

CHAIRMAN APOSTOLAKIS: The PRA doesn't tell you that you should design things to the quality standards that industry has, and the PRA will just assess the risk, and since we were told that there is no difference between --

DR. SORENSEN: Well, I think the function of something like the general design criteria in a risk-informed system is the same as it is in the old deterministic system. It is to give the designer a road map, a path that he can go down and be reasonably assured that he will end up with a design that is acceptable.

CHAIRMAN APOSTOLAKIS: Is it general principles or a road map? There is a difference, Jack.

DR. SORENSEN: Well, a road map is perhaps the wrong word.

CHAIRMAN APOSTOLAKIS: Is it the

constitution or is it the law?

DR. SORENSEN: But I think you can establish a hierarchy of design documents that includes the regulations at the top here, and then going down perhaps to the next step, something like the general design criteria, and then to industry codes and standards.

And functional requirements and so forth, and I think that something like this belongs somewhere in that hierarchy, and whether you put them into the regulations or you put them someplace else is probably not of great import.

Part of what is embedded here is a list of all the things that the designer has got to take into account if he is going to end up with an acceptable design.

CHAIRMAN APOSTOLAKIS: Right. And that's doing a good PRA.

DR. SORENSEN: In a sense it is a checklist.

DR. POWERS: But is this guidance for the designer or for the PRA guy?

CHAIRMAN APOSTOLAKIS: No, the designer must know that eventually his design would be subjected to a PRA, and go back and forth. So he has to know.

VICE CHAIRMAN BONACA: Well, many of these criteria actually are defense in depth.

DR. SORENSEN: There is five that I see that where the primary purpose is defense in depth, and there is another half-a-dozen where there is an embedded defense in depth requirement; and then there is quite a few where defense-in-depth is perhaps the underlying thought.

The second one that I wanted to take a quick look at was environmental and dynamic effects design bases. Again, this is a list of things that the designer has to take into account.

But the thing that I especially wanted to take note of here is that this is one of the few criterion that has been modified since 1971, and specifically the however, "however, dynamic effects associated with postulated pipe ruptures," and so forth.

And this obviously is the leak before break consideration. The only other one where the criterion itself has changed is control room criterion, which we will get to later, but that was changed to accommodate the new source term. But this has the same kind of arguments that I think --

CHAIRMAN APOSTOLAKIS: Is there a criterion that says or refers to human error?

DR. SORENSEN: No. These are design criterion.

CHAIRMAN APOSTOLAKIS: Well, the control room design affects human error.

DR. SORENSEN: Possibly. But the straight answer to your question is no.

CHAIRMAN APOSTOLAKIS: Well, the point that I am making is that if you start writing down GDCs and trying to figure out dynamic effects, and this and that, you are going to be incomplete, because you can't predict everything. So that's where you make a blanket statement and whatever is important.

DR. SORENSEN: But again between that statement and the designer executing the design has got to be something like this that lists everything that you know about it. You don't want them leaving out things.

CHAIRMAN APOSTOLAKIS: If I do a PRA wouldn't I naturally consider dynamic effects?

DR. POWERS: None of them do.

CHAIRMAN APOSTOLAKIS: Gus, you are so unfair. The good ones do. This is called spacial common cause failure analysis. We did it for Indian

Point, for heavens sake, 20 years ago.

DR. POWERS: How many other PRAS have it in it?

CHAIRMAN APOSTOLAKIS: Well, I can't, but in fact people have experimented at that time using the sense code that were developed, and you ended up with something that was three feet high. It is the spacial analysis that you do for fires, for floods, for dynamic effects. Sure, otherwise it is not a good PRA. I am talking about 20 year old technology now.

DR. SORENSEN: Okay. Criterion 5. This one is interesting for primarily because it is the only one that I saw by inspection that is probably counterproductive as far risk information is concerned.

The decision of what functions to share or not share seems to me to be exactly the kind of question that modern PRAs could help answer, and this criterion as written biases the designer against sharing.

It is kind of interesting to note that in the Manshan station blackout event of a month or two ago, one of the options that was not available to the operators was to cross-connect the unit one diesel with unit two. And the reason was that that plant was built to the general design criteria.

That particular plant was built to satisfy Part 50. Those were the criteria that they adopted. And it was noted in the one of the incident analysis reports that I read that they did not have the option of cross-connecting the units.

DR. WALLIS: Well, why not, because it would actually help the orderly shutdown and cool down of the remaining units.

DR. SORENSEN: Well, this criterion biases you against establishing that connection.

DR. WALLIS: Unless it can't be shown.

DR. SORENSEN: So the designer, to satisfy this easily, says don't do it.

DR. WALLIS: And doesn't read the rest of the sentence.

DR. POWERS: Well, if you are a designer, you are sitting there saying I can do one job or I can do two. Gosh, let me think. Which should I do.

DR. SORENSEN: Obviously, we have 55 criterion, and we are not going to get through all of them. I will try and finish up in the next few minutes, but let me touch on one that I think is the next one, which I think is probably all right the way it is written. I am not sure that I would change that from a risk-informed standpoint.

Basically what it says is that you shouldn't have a design that is going to incur fuel damage during normal or anticipated operational occurrences.

DR. POWERS: And that is where you get into a risk problem again. Is something that has some probability of occurring an anticipated operational occurrence. At the time that these were written that meant something that would happen in the lifetime of the plant.

DR. SORENSEN: Right.

DR. POWERS: Do you want to extend that definition as you move into a risk-informed environment, and if you do, then you run into an absolutism problem.

DR. SORENSEN: I think you have to reach for it.

DR. POWERS: A little bit.

DR. SORENSEN: But if I understand your comment, the underlying concern is really dealt with in other criterion here. I mean, it becomes evident.

DR. POWERS: It could be, but what I am saying is a lot of this have this anticipated operational occurrence phrase in now, and we knew from the definitions someplace that that means within the lifetime of the plant.

DR. SORENSEN: Right.

DR. POWERS: It is a 10 to the minus 2 probability. Do you in a risk-informed world want to extend that, and say that okay, rather than having an absolute thing for anything that is 10 to the minus 2, have something that has some sort of a rated characterization for incredible, which I am reliably informed now is 5 times 10 to the minus 7.

DR. SORENSEN: I think you are reading more into this criterion than I would read into it, but as I noted earlier, we can generate these kinds of discussions on virtually every one.

CHAIRMAN APOSTOLAKIS: The last line there doesn't belong, anticipated occurrences.

DR. POWERS: What it is saying is that you are precluding something or certain kinds of high probabilities.

CHAIRMAN APOSTOLAKIS: Right.

DR. POWERS: Well, there is nothing wrong with that.

DR. KRESS: This is one of those things where I keep talking about high frequency, lower fission product release.

DR. POWERS: Well, you can imagine doing something that says, okay, with a high confidence level, which we could define as 95 percent or any other number, you precluded.

Or we could also take it and say now you preclude it, but the confidence level and reliability of doing it varies as the probability goes down from this 10 to the minus 2 level.

DR. KRESS: Well, if you had the FC curves as the regulatory thing, it would automatically do that.

DR. POWERS: They could do that for you, yes.

CHAIRMAN APOSTOLAKIS: It seems an option that it does not ask for margins. But ultimately it seems to mean in a risk-based system that it would be a combination of margins and defense in depth that would give you the wrong numbers. They are not separate things. I don't see why you should limit yourself to the anticipated occurrences.

VICE CHAIRMAN BONACA: Well, this was purely a word that was tied to it that meant it would happen 40 years ago in an operation.

DR. SORENSEN: Okay. Well, let's take a look at another one that is interesting, and this one

I think is a clear illustration of how these criterion reflect the state of knowledge at the time.

I have never understood why this one exists. It seems to me that it is completely covered by Criterion 10, which we just looked at, and I think the answer is that the phenomena had become of possible power oscillations and spacial power oscillations in large cores had become recognized in the preceding few years.

Interestingly enough the 1965 criteria, the earliest version that I found, that this was not addressed specifically in power oscillations. It was addressed to process variable oscillations, which would include flow, for example.

DR. WALLIS: Isn't this just another anticipated operational occurrence?

DR. SORENSEN: Yes, I would consider that this is completely covered by Criterion 10, which preceded it. But I thought it was an interesting example of reflecting the state of the art. I guess we have time for one or maybe two more.

DR. KRESS: What does it say about containment?

DR. SORENSEN: Okay. That is the next one that I thought that I would look at. Actually, there is probably 12 separate criteria that deal with containment, and the basic requirement is here; "Reactor containment and associated systems shall be provided to establish an essentially leak tight barrier."

And this is one of those where clearly there is some advocates of some reactor types that say this should not apply. I would suggest that if we were starting over for light water reactors, we probably would not want to specify essentially leak tight containment the way this one does.

You may want to allow other concepts since the early containment failures seems to dominate risk as far as we already know.

DR. POWERS: What this does is preclude confinement.

DR. SORENSEN: Yes.

DR. POWERS: And when you preclude confinement, then you are condemning yourself to eventually having an uncontrolled release in the event of an unmitigated accident.

DR. SORENSEN: This would as worded would, yes. Of course, the containment bypass, you have to deal with containment bypass sequences anyway.

But this is one that I think I would give some thought to, and I would hasten to add that I don't have the expertise in either PRA or severe accident phenomenology to know how to rewrite it. I just suspect that if you were to redo the GDC that you might decide to rewrite this one.

This criterion, of course, is supported by another 12 or 15 criteria that deal with containment related phenomena and containment heat removal, atmospheric cleanup, and penetrations, and isolations, and system isolation, and so forth.

But this is pretty unequivocal as to what is needed.

DR. KRESS: Mine would have been very equivocal. I would have said thou shall provide a reactor system such that the frequency is at least to a 95 percent confidence level.

CHAIRMAN APOSTOLAKIS: Well, yes, some language like that, because that allows you to take credit for the release that you want. The probability of it.

DR. SORENSEN: Just as a last offering here, I would suggest looking at Criterion 17 on electric power systems. This is the first one where the single failure criterion is specifically invoked, and the first one that you come to if you go through them in numerical order.

It is also, I think, the longest of the criteria.

CHAIRMAN APOSTOLAKIS: Does a single failure have a definition somewhere?

DR. SORENSEN: Yes, it is defined up in the introduction in terms of inability to perform the specified safety function.

CHAIRMAN APOSTOLAKIS: If what happens? If it fails? Assuming a single failure.

DR. WALLIS: If you have a hundred batteries, that means that one battery will disable the safety function that you are trying to deal with?

DR. SORENSEN: Yes. But the other thing to note here is that this gets to be a very specific criterion, electric power supplied by two physically independent circuits.

You can have a common switch yard, and that is acceptable. There are underlying assumptions as to where the unreliability is, or where the risk might be.

And again this seems like a perfect candidate for recasting, in terms of a reliability goal that could be supported by modern risk analysis techniques. I would not attempt such a wording.

VICE CHAIRMAN BONACA: Jack, if we could go to Criterion 55.

DR. SORENSEN: Sure. You are talking about monitoring releases.

VICE CHAIRMAN BONACA: No, it is one that tells you that you would have penetrations of pipes that would be -- well, it --

DR. SORENSEN: Well, that is clearly one that I think you might end up rewriting in terms of risk considerations. It is very specific. In fact, criteria 50 through 55 I think you would rethink in a risk-informed environment.

CHAIRMAN APOSTOLAKIS: No, the question here is what do we do with all of this? I mean, we if have Commissioner Diaz come down here and talk to us, are we going to write a letter, or how does the committee feel about this? And if we write a letter to whom do we address it and why?

DR. SORENSEN: I have a couple of thoughts that might go in to the committee's thinking on this.

CHAIRMAN APOSTOLAKIS: Go ahead.

DR. SORENSEN: One is that it seems to me that Appendix A, and Appendix B for that matter, are not keys in any significant way to risk-informing the body of regulations. They are a part of it, but they are no more important than a lot of other things.

So I think sort of the underlying implication in Commissioner Diaz's comments that they were key to proceeding I think is simply not right.

CHAIRMAN APOSTOLAKIS: But you also I think claim that you could not risk-inform the regulations unless you go back to the GDCs and change them.

DR. SORENSEN: That is probably true.

DR. POWERS: And I agree with him on this. If I look at Part 50, and I imagine anything in there that is changed to be somewhat risk informed, and I say now what do I do different, it ends up that I do nothing different, because I get controlled by the GDCs.

And if you hit this one first just to get it out of the way, then you can go and look at the regulations and know that you are not going to run contrary -- you are not going to get into this mouse trap, and where the guy does nothing different.

CHAIRMAN APOSTOLAKIS: So what would be a wise course of action for this committee; to raise the issue with the Commission or support Diaz?

DR. POWERS: Well, it depends a little bit on how aggressive you want to be. It seems to me that your options vary.

CHAIRMAN APOSTOLAKIS: Well, should this be part of Option 3?

DR. POWERS: Well, it is part of Option 3.

DR. SHACK: It should be, but it is just that they have prioritized it in a different way. They have chosen to do it a different way.

CHAIRMAN APOSTOLAKIS: So does the committee feel otherwise?

DR. POWERS: Well, right now they have got them -- I mean, we don't know what they are going to come back with, but they seem to have themselves in a conundrum on 46. They are going to try to get out of it, but I don't see how to get out of it with the approach they are taking, but maybe they will.

But if they are going to continue to be boxed on 46, it seems to me that you go the other route.

CHAIRMAN APOSTOLAKIS: What does that mean for us now?

DR. POWERS: Well, that is one way to approach it, is to ask the staff what they are going to do about that, and then engage in these debates that Jack wants to cut off.

The other approach it seems to me is that you go through and say pick the juicy, easy ones. And there are a couple of them. I think 17 and a couple of others in there that seem particularly ripe to make risk-informed, and send the Commission a letter and say, gee, we can do these, and do one for them.

CHAIRMAN APOSTOLAKIS: Well, we really shouldn't write a letter without hearing more. We have to give them an opportunity.

DR. SORENSEN: Both Option 2 and Option 3 will, if pursued to their logical conclusion, will end up touching the GDC. In Option 2, in the first sense, I talked about changing the scope in some way, and in Option 3, in changing individual requirements, and which you have no way of knowing right now is how many actual changes they will end up recommending.

Now, my own thought is that the option three process in particular is biased against making changes to the GDC. The process starts with what they call the defense in depth concept or philosophy, and it doesn't lead easily to specific changes.

And that's because defense in depth rules that framework, and I think there is a little more hope for option two.

CHAIRMAN APOSTOLAKIS: Well, they interpret defense in depth differently. It is their justification for failing for different values, which as releases and core damage, and so on. I don't think this is the kind of defense in depth they refer to.

DR. SORENSEN: You may well be right. My reading of the framework document is that the process ends up being biased against change.

CHAIRMAN APOSTOLAKIS: Okay. So that brings us again to the question; what do we do now?

DR. SORENSEN: But clearly the staff would argue that they are on a path where both option two and option three deal with some aspect of this, and will presumably come to some recommendations to the commission.

VICE CHAIRMAN BONACA: It seems to me that some individual applications, unless you deal with some of the principles, you have no idea if you are still going to have the confusion like here. And it seems to me that if you want to have a radical rewriting on a risk-informed basis, you should start from the top, and first attempt to see how they could be converted to risk-informed criteria.

CHAIRMAN APOSTOLAKIS: Well, is it worth doing this now, or do other things that are more practical?

DR. SHACK: Well, what do you gain if your goal is ultimately to have a whole new risk-informed regulatory system. If you are looking at the moment to try to identify the things that have the largest impact on safety and reduce regulatory burden, unnecessary regulatory burden, I am not sure that starting with the GDCs would rank terribly high on that list. They never show up on the NEI --

DR. KRESS: I think risk-informing the GDCs, I agree with Bill first that what he just said, that risk-informing the GDCs probably is important for the advanced reactors, if they ever have one.

That's where there is a collision, and a discontinuity in things, and what I would -- my choice of things would be to don't do these one at a time, except in the context that Bill said, where you are trying to -- you have picked the ripe ones, and you see where you have to change the GDCs so they are not in conflict.

And you do that like they are progressing, and to have a parallel effort, and have somebody say I want to rewrite these GDCs completely, starting from a blank page. This was my recommendation to Jack actually when I wrote it.

And I would start out with writing down all my regulatory objectives that I want to achieve, and figure out to do them in a risk-based way that includes the prior definition of defense in depth, and the proper use of uncertainties, and to cover the whole range of fission product releases that I am interested in.

And I would work my way down on how do I achieve this type of design that would meet this criteria by specifying it in a risk-based way, but risk-informed because I am going to have a proper definition of defense in depth.

And end up with a whole new set of design criteria that are not very prescriptive like this, but may end up saying things like redundancy and diversity, and may even have things like you shall be sure to be able to shut down the reactor, and you may be sure to have emergency cooling. You may be sure to have long term cooling.

You may have things like that in it which are --

CHAIRMAN APOSTOLAKIS: So what you are saying is that the Gen-4 guy --

DR. KRESS: Yes, put this off to the Gen-4 system.

CHAIRMAN APOSTOLAKIS: But NEI told us that they are working on these things, and they would have something by December.

DR. KRESS: Yes, but I suspect they are going to pick out --

CHAIRMAN APOSTOLAKIS: But that might be the first good opportunity for us.

DR. KRESS: To have a letter, yes. But I am in favor of sort of approaching it like Bill said.

VICE CHAIRMAN BONACA: But looking at the other side, you know, if you leave this stuff behind, I agree they are more important to certainty if they have priority in many ways, and it seems to me that ultimately we are going to have patch work to patch work.

DR. KRESS: That is exactly what we are doing. That's why I wanted to have a parallel effort to get away from that.

DR. POWERS: There is a perception, George, that these things are past history. They are not. I mean, GDC-3 is actively invoked regularly.

CHAIRMAN APOSTOLAKIS: But I think in Bill Shack's world that that would be singled out where they try to reach some benefits by risk-informing fire protection requirements. So the question is should we do it as the need arises or shall we have an all out attack of the GDCs?

DR. POWERS: Well, it seems to me that coming in that you have got two approaches. The staff chose an approach and now you are boxed. They are getting boxed right now.

DR. KRESS: It may not work is what you are saying.

DR. POWERS: Well, if their approach is not going to make substantive program progress, it seems to me that the alternate approach, which I happen to think is what should have been the approach all along, is to go after ANB.

VICE CHAIRMAN BONACA: Well, the thing that troubles me about the whole thing is that all they can us is Reg Guide 1.174, and I wonder how many of the changes that will happen at South Texas will conflict with some of this GDCs. I could bet you that there will be some conflicts.

And we have not gone back to what is the foundation of the original of the existing systems are, and so we are changing things here, and I think they can go only so far.

DR. POWERS: Well, you have maintained function, and you have maintained all your Chapter 15s.

CHAIRMAN APOSTOLAKIS: Did you guys raise the issue of containment earlier with South Texas?

DR. KRESS: Yes, it came up. Somebody mentioned it.

CHAIRMAN APOSTOLAKIS: So it is not an issue anymore?

DR. KRESS: Well, I think Sam Lee did.

CHAIRMAN APOSTOLAKIS: So again what do we do here with this thing? Should we let it rest until December and see what NEI comes up with?

DR. KRESS: Yes, I don't think we are ready yet.

CHAIRMAN APOSTOLAKIS: I really don't think we should be writing letters without hearing from the staff, and to ask them to come and talk about the GDCs, they will love us for it.

DR. SHACK: Do you have another presentation on Option 2 scheduled?

CHAIRMAN APOSTOLAKIS: Option 2? Not in the near future. Option 3 doesn't come to mind, except in 50.46.

DR. POWERS: But Option 2 follows along somewhere.

DR. SHACK: Right. It is a few months behind.

CHAIRMAN APOSTOLAKIS: But South Texas is done.

DR. POWERS: But it is the generalization of the rule.

CHAIRMAN APOSTOLAKIS: Oh, that is going to take --

DR. SORENSEN: That originally was the quick fix.

CHAIRMAN APOSTOLAKIS: Okay. If we don't write the letter now, how do we make sure that Jack's work is documented and reviewable?

DR. SORENSEN: There is a paper that I can put out as soon as --

CHAIRMAN APOSTOLAKIS: A paper or report?

DR. SORENSEN: It is 20 or 25 pages of this kind of discussion, one criterion at a time.

CHAIRMAN APOSTOLAKIS: So why don't we get a report from you and maybe wait until NEI does something. And if we find there another opportunity where there is a reason to bring it up, then we bring it up.

DR. SHACK: And Jack's conclusions aren't so different from what the NEI people said.

DR. POWERS: And GDCs were not such a problem.

CHAIRMAN APOSTOLAKIS: Okay. So let's

recess -- oh, I'm sorry.

DR. KRESS: I have another view of what the GDCs are before we leave them and while we are on it.

CHAIRMAN APOSTOLAKIS: Okay.

DR. KRESS: If I think about it, and if I had a system of this risk-based concept that I mentioned, and if I viewed defense in depth as being an allocation of the risk contribution through both the sequences and things like initiating events and mitigation, if I were reviewing defense in depth as an allocation among those things, then I would view the general design criterion as almost wholly defense in depth, because what it does is do that in a prescriptive constructionist way of doing it.

So I think if you had the proper definition of defense in depth, in terms of this allocation and in terms of related uncertainty that you would end up with something like -- if you carried it on down to lower and lower tiers, you would end up with something like the GDCs, and that's why I say that if they could start over from a top level concept, they might end up with a different type.

CHAIRMAN APOSTOLAKIS: I think the Option 3 guys have already done some of that.

DR. KRESS: They may have.

CHAIRMAN APOSTOLAKIS: But they didn't call them GDCs, but by the mere fact that they started by assigning values, upper bounds to intermediate events, that is a structural manifestation of defense in depth at that top level. Okay.

Thank you very much, Jack. It was very informative and we look forward to your report. And send it in draft form to all the members at some point.

DR. SORENSEN: I had planned to do that, yes.

CHAIRMAN APOSTOLAKIS: And seek comments. Okay. And we will recess until 10 minutes past 5:00.

(Whereupon, the meeting was recessed at 4:58 p.m.)

**CERTIFICATE**

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: 483rd ACRS Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Paul Intravia
Official Reporter
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