UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
***
MEETING WITH
THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
***
PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, MD
Wednesday, February 3, 1999

The Commission met in open session, pursuant to notice, at 1:05 p.m., Shirley A. Jackson, Chairman, presiding.

COMMISSIONERS PRESENT:

SHIRLEY A. JACKSON, Chairman of the Commission
NILS J. DIAZ, Commissioner
GRETA J. DICUS, Commissioner
EDWARD McGAFFIGAN, JR., Commissioner
JEFFREY S. MERRIFIELD, Commissioner

STAFF PRESENT:

ANNETTE L. VIETTI-COOK, Secretary of the Commission
KAREN D. CYR, General Counsel

ACRS MEMBERS PRESENT:

DANA POWERS, Chairman, ACRS
GEORGE APOSTOLAKIS, Member, ACRS
JOHN BARTON, Member, ACRS
MARIO BONACA, Member, ACRS
MARIO FONTANA, Member, ACRS
THOMAS KRESS, Member, ACRS
DON W. MILLER, Member, ACRS
ROBERT L. SEALE, Member, ACRS
WILLIAM SHACK, Member, ACRS
ROBERT E. UHRIG, Member, ACRS
GRAHAM B. WALLIS, Member, ACRS

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P R O C E E D I N G S

[1:05 p.m.]

CHAIRMAN JACKSON: Good afternoon, ladies and gentlemen. It is a pleasure to meet once again with the members of the NRC's Advisory Committee on Reactor Safeguards, who plan to discuss a number of topics of interest to the Commission at today's session.

First, I would like to welcome Dr. Powers in his

new role as chairman of the ACRS. You join a long list of distinguished individuals who have held that post, certainly not the least of whom was your esteemed colleague and predecessor as chair, Dr. Seale. Dr. Seale, why don't you stand up for our --

[Applause.]

CHAIRMAN JACKSON: The Commission is appreciative of Dr. Seale's contributions during his two years as NR -- ACRS chairman. Freudian slip.

[Laughter.]

CHAIRMAN JACKSON: In addition, I welcome Dr. Mario Bonaca to the Commission's Advisory Committee on Reactor Safeguards. Welcome. We are pleased to have you on board.

Over the years, as you know, the ARCS has provided the Commission with very valuable and timely advice on the safety aspects of nuclear power plants as well as on related

policy matters, rules and regulations, and the Commission feels very fortunate -- I always say this because I think it's important always to take note of that -- fortunate to be able to draw upon the views, experiences and technical expertise of this select group as we try to solve and address many technical concerns in licensing and regulation.

For the record, I would like to express the Commission's appreciation for the significant contributions the ACRS made to the review and approval of the Westinghouse AP600 design in accordance with their duties in 10 CFR 52.53 entitled Referral to the ACRS.

During today's briefing, the ACRS will cover the following topics, and you were probably going to say this anyway, Dr. Powers: proposed revisions to 10 CFR 50.59; development of a risk-informed 10 CFR 50.59; options to make Part 50 risk-informed; proposed rulemaking on the revised source term; ACRS activities associated with license renewal; impact of PRA results and insights on the regulatory system; elevation of core damage frequency to a fundamental safety goal and possible revision to the Commission's safety goal policy; and finally, the NRC's safety research programs.

My fellow Commissioners and I welcome you to this meeting and anticipate another candid and informative discussion on some of the agency's highest priorities.

As we progress through today's briefing, I would ask that each ACRS member presenter highlight the key points for each of the issues in as succinct a manner as possible. This will allow the Commission more time to engage the committee on these important issues. And so you can assume that the Commission is familiar with the background associated with them and with the information that you have provided.

I understand that copies of the briefing material are available at the entrances to the room, and so unless my colleagues have any comments they wish to make, Dr. Powers, please proceed.

DR. POWERS: Thank you, Chairman Jackson, and I understand congratulations are in order for you for this prestigious appointment to RPI. I know that members of the ACRS are familiar with some outstanding technical work that is done in the nuclear fields at that institution, and quite frankly, some of us are very envious.

CHAIRMAN JACKSON: Well, eat your heart out.
[Laughter.]
CHAIRMAN JACKSON: Thank you.
DR. POWERS: And the ACRS, of course, is delighted to see Commissioner Dicus back in the fold.
COMMISSIONER DICUS: Thank you very much.
DR. POWERS: We actually missed you at our

Christmas party and hope that you can attend in the future. And we certainly hope Commissioner Merrifield has not found any cause to doubt his decision to come to the ACRS.
COMMISSIONER MERRIFIELD: Not at all. Thank you.
DR. POWERS: And you have introduced our new member, who may well have found reasons to doubt his decision.
[Laughter.]
DR. POWERS: Let me turn now immediately to the technical work, and my first comment is, wow. The groundwork that this Commission has laid with its PRA policy statement and the PRA research that the NRC has fostered over the years is really beginning to bear fruit. We see an absolute outpouring of work from the staff, beginning with Reg Guide 1.174, now going on even to inspection and assessment and enforcement. We're applying risk to regulations in a real sense nowadays.
The ACRS, as you noted, has historically spoken to the possibility of using risk more actively in the regulatory practices. Quite frankly, this outpouring of work has been breathtaking. In fact, speaking as one member, it may be more accurate to say it's taking our breath away or leaving us breathless because it is a monumental amount of work.
Progress is clearly being made in what I think

amounts to a revolution in the way we do regulation that may well stand as an example to regulatory agencies throughout the federal government. Still, I think it's important that we remember that there is a culture of conservatism within the nuclear community. At this point, it's really important that we not let conservatism be an excuse for being timid in what I think is a major step in the way we regulate nuclear power.
We also have pointed out in our research work that the fundamental technical foundations for risk-informed regulation are not complete, and we pointed out areas that need to be continued to understand and develop the technologies we'll have to have to completely use risk, and I do acknowledge the Chairman's recent paper in which she made essentially the same point.
I think our feeling is that it's important that this experiment, if you will, in using risk is an active tool for regulation succeed because it has implications that go beyond just the nuclear industry.
At the same time, the ACRS recognizes the Commission's need to have demonstrable progress in this area. To facilitate this progress, the ACRS has been working in much more of a participatory role in its reviews; that is, we're working much more with the staff in real time as they develop their products rather than waiting until

things are completed.

In that respect, the questions you've asked us to address, you're catching us very much at mid-stride in some of them. The products are still working. One of the most important issues that we'll discuss is 50.59, and we've just had another interim briefing literally hours ago, so you're going to get our current thinking, and probably not our final positions, on a lot of these issues.

Fifty-fifty-nine is one of the most urgent issues being faced by the nuclear industry right now because it's key to the stable operation of nuclear power plants. The ACRS has advocated a two-phase approach, a first phase to stabilize the 50.59 process; the second stage that would take it on to a more completely risk-informed status. We're going to be discussing primarily the phase one approach and our current thinking on that.

In phase two, we have actually begun to work on that and we have suggested a possible framework for making 50.59 completely risk-informed. Our thinking on that is in connection with frequency consequence curves.

We have discussed those primarily in their integral formulation. We have not had a chance to discuss them in what I would call the differential formulation that I think would be the one that you would actually use for small changes in plans associated with 50.59. This integral

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formulation may in fact be more appropriate for the bolder step of trying to make all of Part 50 risk-informed.

Professor Apostolakis will shall I say proselytize you a bit on this technology.

CHAIRMAN JACKSON: So his name is really Dr. Aprostylakis.

[Laughter.]

DR. APOSTOLAKIS: I will present a balanced view.

[Laughter.]

DR. POWERS: As he always does.

We will also discuss with you some of our early thinking on the strategies for approaching this bold step of making all of Part 50 risk-informed.

It's important to remember not all of the progress that we see the Commission making in reforming regulation stems from this current intense activity that's coming from the staff. Some of that progress actually comes from prolonged development of technology that the NRC has fostered.

A primary example of that is that prolonged development of severe accident research that was done to get a more realistic assessment of the magnitude and nature of radionuclide source terms associated with reactor accidents, and we're going to give you some thoughts on this step that has been long in the making and really represents a

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revolution in the way we look at severe accidents over what was done in the past.

Finally, we're going to discuss license renewal, which quite frankly I think this committee is beginning to look upon as, if not its highest priority, a very high priority. Because it's a very new activity, it looks very complicated to us. We've confronted complications -- complicated activities in the past. We're drawing upon our experience we've had with things like the certification of evolutionary and advanced reactors to develop a strategy for

approaching this new activity.

Clearly it's an activity of some importance because we anticipate many, many plants will be looking for license renewal, and it will become a major activity for the NRC in the future. The pilots we're conducting with Calvert Cliffs and Oconee then are crucial for the establishment of precedence. In other words, we want to do this one as best we possibly can.

We're certainly looking to assure that the ACRS does not introduce any unnecessary delays in the process, and quite frankly, I think we're a bit more ambitious. We're looking for chances to accelerate the process by culling out the issues that may not require such careful resolution at the beginning and focus on those that are really most important to safety.

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Unless you have any questions, I propose that we move right on to the discussion of what's becoming everybody's favorite topic lately: 50.59. I call upon Mr. Barton to lead that discussion.

MR. BARTON: Good afternoon.

CHAIRMAN JACKSON: Good afternoon.

MR. BARTON: As Dr. Powers said, the topic has been moving along at a fairly brisk pace over the past six months. The last report we sent was July 16, 1998, to the Commission. Basically, that's history at this time because of the pace that this rulemaking has taken place.

I would call your attention to the third and fourth bullets from that report. The Committee continues to believe that the 50.59 can accommodate risk-informed decisionmaking, and Dr. Apostolakis will be discussing that subject in a few moments.

The Committee also believes that the issuance of the regulatory guide is an important task in ensuring stability in the 50.59 process, and we continue to discuss the status of that effort with the staff.

The committee did have discussions with the staff this morning regarding the status of the proposed revisions and to discuss the comments that have come back in from the public comment period. However, we have not had, as a committee, the opportunity to deliberate on all the matters

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and to reach any conclusions regarding the comments and the -- to reach a final position on which to come to a conclusion and recommendation to the Commission on the final rule.

We do continue to discuss this issue. We are supposed to meet with the staff the first week in March. I believe we owe the Commission a report from our meeting in March which would lay out our conclusions and recommendations regarding the final rule on 50.59.

We are also continuing to discuss with the staff as they consider options to include risk-informed approach to 50.59. At this point, we have not reached as a committee any conclusions regarding the final rule.

COMMISSIONER McGAFFIGAN: Madam Chairman?

CHAIRMAN JACKSON: Let's let him --

COMMISSIONER McGAFFIGAN: Okay.

CHAIRMAN JACKSON: And then whatever you'd like.

MR. BARTON: That's --

CHAIRMAN JACKSON: You're done? Okay.

COMMISSIONER McGAFFIGAN: I just was going to encourage them to give us any preliminary conclusions because I think there are two issues that have been called to our attention that are the heart of the matter in a recent staff briefing, and that's the definition of change and how to deal with margin of safety. So if you have any

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preliminary views, you may want to give them to us because I think the goal at the moment, if I recall, is that the Commission still vote in the early March time frame on concept and then let the staff finalize by April. Isn't that right, Madam Chairman, approximately?

CHAIRMAN JACKSON: Yes. Exactly.

In fact, let me just piggyback on that. I mean, you have a, you know, a comment, and it was in a letter having to do with the ANSE standard. It's in appropriate for determining minimal increase and probability of malfunction. So, of course, you know I'm going to press you in terms of what you think would provide a better basis for that.

And then if you, as part of your presentation, Dr. Apostolakis, you know, talk about the differential approach, differential use of frequency consequence curves or whatever would allow us to talk about definition of change.

DR. APOSTOLAKIS: Sure.

CHAIRMAN JACKSON: And so -- but Dr. Barton, if you could speak to that issue.

MR. BARTON: I wish I were a doctor.

CHAIRMAN JACKSON: Okay.

MR. BARTON: I'm the only non-doctor. I think I'm the nurse on this committee.

[Laughter.]

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CHAIRMAN JACKSON: Let's put it this way: I confer upon you an honorary degree, so I'm going to call you Dr. Barton today.

[Laughter.]

MR. BARTON: We have done some discussion on the minimal increase. The reason for the ANSE is there was no technical basis, we felt, in the letter in 1995 for using the study that was in the ANSE as a justifiable reason for a minimal increase.

I think the definition of minimal, where the committee comes out is they would like to see qualitative decisions -- qualitative definition of minimal so licensees can employ PRA methods to show change has a minimal impact. But currently, that is not the definition of minimal. I think that's where we would like to see it come out, and maybe George would discuss that as part of the --

CHAIRMAN JACKSON: So let me make sure I understand. First of all, you want the language, you're saying, to be qualitative.

MR. BARTON: Quantitative.

CHAIRMAN JACKSON: Quantitative. I see. And then you want to be able to have PRA methodology be used from an impact point of view.

MR. BARTON: Yes.

CHAIRMAN JACKSON: To be able to define minimal.

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DR. APOSTOLAKIS: Can I say something?

CHAIRMAN JACKSON: Please.

DR. APOSTOLAKIS: Again, we have to distinguish between short-term and long-term.

CHAIRMAN JACKSON: Right.

DR. APOSTOLAKIS: For the short-term, if we could go back to the SECY and go line by line and delete the word probability, we would be in much better shape. You are giving a definition of minimal change in the probability of malfunction. You explicitly state if there is a new failure mode that is identified, then the change is more than minimal, the change in probability is more than minimal. Why don't we change that and say if there is a new failure mode, you are not allowed to make the change. Drop the probability.

Now, I was told this morning -- by the way, these are my personal views, they are not the committee's views. They were formed a few hours ago.

[Laughter.]

DR. APOSTOLAKIS: But I was told that it may not be possible to eliminate the word probability from everywhere. I think it's causing a lot of headaches because it has to be unquantified at this point. It has to be -- the judgment -- what is minimal has to be the judgment. So let's call it that. The idea is to preserve the integrity

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of the licensing basis. That's what we were told. I like these words. The original licensing basis was deterministic based on judgment; the minimal change should be based on judgment. We should not invoke terms that are not quantified or ill-defined in that context as probability. So if that could be done, I think the document would be much better off.

Now, in the long term, of course, then it's a different story. You go to PRA, you use probabilities and so on. But for the short term, that would make me much happier.

COMMISSIONER McGAFFIGAN: Madam Chairman?

CHAIRMAN JACKSON: Please.

COMMISSIONER McGAFFIGAN: The problem with that is that it's in the original rule, the use of the word probability, and the goal is stability. In the original rule is deterministic use of the word probability. And so I suspect what you're suggesting would require re-noticing and not getting the stability that people want. We have to do a better -- that's why the second step is important, I think we all agree.

DR. APOSTOLAKIS: I notice, though, that you are changing some of the words in the original rule, aren't you?

COMMISSIONER McGAFFIGAN: Yes, we are, but --

DR. APOSTOLAKIS: Yes.

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COMMISSIONER McGAFFIGAN: Right. But have you noticed these changes adequately that you might consider making them this late in the process?

DR. POWERS: I think it's my impression that we're struggling to find the right way to explain what probability is. We're quite frankly dealing with two scales of probability. There was probability considered in the deterministic days, those dark old days. The probability scale there was measured in units of two decades; that is, things of nominally one to ten to the minus two per year was high probability; things in the ten to the minus two to ten

to the minus four was a possible outcome; ten to the minus four, ten to the minus six was very unlikely. That's a very coarse scale.

Now I think when people use the word probability, they're saying, gee, is it four times ten to the minus four? Is it two times ten to the minus four? They're comfortable with making that kind of distinction, whereas in the past, they were uncomfortable making distinctions within the decades.

It is, I think, because of that radical difference in scale, Professor Apostolakis rightly calls, there's a confusion now because we've gone to a much finer resolution here. And if we can find words that eliminate that scale and return to the qualitative influence Mr. Barton was

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speaking of of, is it very likely, is it moderate likely, and are you making a transition between those two regimes an the scale, that we would be much better off.

CHAIRMAN JACKSON: Well, let me just ask a follow-on question. I mean, a criticism has been that when one has kind of words like that -- likely, moderately likely -- that that leaves open a door for a degree of arbitrariness that people would like to get away from. That's number one.

Now then you say, well, you have that, and in order to give definition to it, perhaps, you know, you have to have the guidance. But I note that your first bullet is that you feel that the revised guidance already is overly prescriptive, then that relates to the definition of margin of safety. We're talking, you know, minimal at this stage, but they're all tied up. I mean, these things, these are --

DR. POWERS: They are very closely tied together.

CHAIRMAN JACKSON: Right. And so my question is, how do we get there from here? I mean, if, on the one hand, you feel that we're not at a point of being able to have quantitative definitions in the rule as it is, you want to get to a point to finish this rulemaking so we can have stability. But if you leave open kind of very descriptive language, the question becomes, how do you give enough meaning to it to really allow it to be implemented in a way

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where it doesn't appear that there would be arbitrariness.

DR. POWERS: I think you have hit upon the critical juncture, and that is between the margin of safety and the definition of minimal.

CHAIRMAN JACKSON: Exactly.

DR. POWERS: And quite frankly, as an example, not to express a position, but an example that one can tolerate, if one said that the margin of safety subject to regulation is that margin that exists between the current tech specs and where actual damage to the core occurs, then the question of minimal resolves itself and can be eliminated actually from the regulation because you can say anything that does not affect the tech specs obviously has made a minimal change in the margin of safety, and it has made none at all. Okay. That's one clear-cut example.

If you take the other definitions of margin of safety, then you have other kinds of definitions of where minimal -- if we resolve this question of which margin -- and there are multiple margins, and that's one of the biggest problems that we have in the debate. We need to have margin sub-one, sub-two, sub-three, and all agree what

those mean. This issue of what minimal will resolve itself. And you can see I perhaps telegraph some of the debate that goes on within the committee.

DR. KRESS: I don't think the minimal will

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completely resolve itself when you resolve the margins issue because the changes that are normally made under Part 50.59 involve more than tech specs usually, and the margins issue I think is a tech spec issue.

So you will still have to be faced with some sort of definition of minimal even though you fixed the margins problem, even though -- that could be part of the definition. Once you fix the margins, that could be part of the definition of minimal, but you'll need to go further.

DR. POWERS: I think it only serves as a standard by which you can judge the other changes.

DR. APOSTOLAKIS: Yes. Coming back to the point you made, Chairman Jackson, regarding the subjective nature of these things, it's a trade-off. If we want stability, we want something out on the street as soon as possible, that's the price we have to pay. We have to live with subjective judgment for a while. If we want something more quantitative, well, it takes a little time to do this. And it's already -- I mean, the use of the word probability right now does not make it quantitative anyway.

CHAIRMAN JACKSON: That's true.

DR. APOSTOLAKIS: So it seems to me, by deleting it if possible, we're avoiding a lot of the headaches we're having now. That's not the committee position.

MR. BARTON: I think where the committee is on

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this, and the bullet that you referred to on the overly prescriptive had to do with option -- the staff's proposed option one, which is, in fact, the inputs to the tech specs. I think where the committee is, is between option two and three, but we haven't really explored option three and the industry's approach that goes along with that. So that's where we are with respect to the minimum -- I mean the margin of safety issue.

CHAIRMAN JACKSON: Have you been able to -- we are not able to identify a list of key questions, such that in answering them in a structured way, one would be led to closure, even if you yourselves haven't answered those questions?

I mean I'm really looking for a path through the forest here, because we have been talking around this for a long time, and this rule itself stayed with the Commission for six months last year. And the real issue is, is there a defined path with key questions or decision-making points so that if those got answered, if not by through resolution between the Staff and the industry, and other stakeholders, then the Commission answered them, but that would lead you to some resolution.

MR. BARTON: We do not have that currently, but we are working on that. It was an item that we discussed in our meeting last week planning programs meetings to develop

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such a list, and that will be available, we will have that shortly, so we will be ready for the March meeting.

CHAIRMAN JACKSON: Well, what I would just ask

then, you know, jumping ahead, that as soon as you have such a list -- I mean I encourage you to develop that -- that you promulgate it -- you propagate it, rather, to the Commission even as it may be being discussed, once you have settled on it as a committee, that you propagate that to the Commission. Because it may be that the Commission has to walk through these steps and answer the questions and, therefore, come out at the end with where we are going to be on 50.59 at this stage of the game, because we have got to come to closure here, and if you or others can't come to agreement on it, then that's where the Commission has to step in and make a series of decisions.

COMMISSIONER McGAFFIGAN: And the only additional -- I think a little bit of this discussion is confused, step B with step A. The risk-informed part, which we are about to listen to Dr. Apostolakis on, is something we want to get to, something that you all in your December 11th letter say is going to take some time, but on part A, I think our options are limited, legally, based on what we noticed, and we can't invent a lot of stuff at the end of the game. It has to be basically -- unless we are going to re-notice and not bring the short term stability, there is a constrained

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set of issues that are -- that we can work on in step A.

CHAIRMAN JACKSON: Karen, what do you have to say about that?

MS. CYR: Well, we clearly have to look at that issue, but it depends on whether you could go back and legitimately make an argument that given what you did notice, that you were really talking about fundamentally changing the way you went about that particular aspect of the rule. And if you went and did something like delete the word probability, that that is still within the scope of what you were doing because you were talking about really trying to come at it from a different perspective than you had ever used before.

Now I mean we haven't done that, and we'd have to do that, depending on what the Staff might come up with as a possible approach, to see whether in fact we believe it had really been noticed.

COMMISSIONER McGAFFIGAN: But the margin of safety and the definition of change issue, those are fair, totally fair, because we noticed multiple options and basically asked for a large dialogue, but some of what you are saying may well be for the second phase, I think.

CHAIRMAN JACKSON: What I'm talking about, in terms of defining a set of questions or key issues, that if answered would lead to a result. I'm talking about within

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the context of what has already been noticed, within the context of focusing on margin of safety and definition of minimum. But I think that, in and of itself, would be a big help, that if you could lay out such a pathway, that, you know, you decide this or this, you decide this or this, and then that allows the Commission to walk through and in the end a lot of this is policy, public policy, and that's what the Commission is here for, and if we are not going to come to closure in terms of going down a quantitative path now, based on PRA and risk assessment methodologies, then we just have to identify those key questions that have to be answered and move it along that way.

DR. POWERS: Again, I think the question that you

are talking about, we might know better as our strategy to resolution, and Mr. Barton has a draft of it, and it will get its fair share of debate in itself.

On the other hand, we are moving the direction, and we don't want development of those questions to become yet another --

CHAIRMAN JACKSON: Yes, long term project.

DR. POWERS: -- long term project itself.

COMMISSIONER DIAZ: But if dealing with the term probability provides clarity to the rule, you know, in the first phase, I certainly would like to see what the rationale behind it is.

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CHAIRMAN JACKSON: Well, and also, I mean if we are going to do that, then you need to be able to give us a quick legal opinion in that regard.

DR. APOSTOLAKIS: So my argument was that it does not, but --

CHAIRMAN JACKSON: We'll have to get a legal opinion also.

DR. APOSTOLAKIS: Yes, but I mean somebody else may argue that it does, and that would be an interesting argument.

COMMISSIONER DIAZ: And we'd like to hear both sides.

DR. POWERS: Why don't we move on to the discussion of the interesting frequency consequence curves, and Professor Apostolakis will outline some of the things that we have found out about them and whether they may or may not be useful.

DR. APOSTOLAKIS: The emphasis, by the way, has been on the frequency consequence curves, but there was more to that attachment, and I will point that out as we go.

Since last July, when I wrote the attachment to the letter, we have discussed it, these curves, among ourselves, and there were many questions raised, and last week we had a very useful and thorough subcommittee meeting with Dr. Barr, who is the president of Energy Research,

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Incorporated, and this company, which is in Rockville, has been working with the Swiss nuclear regulatory inspector, I believe is the name, to come up with risk-based, they call it, regulatory system using curves like these, using cesium as the consequences, equivalent grams of cesium, and the frequency, of course. So that gave us a good opportunity to discuss these things.

By the way, these have not been adopted by the Swiss regulatory body.

And also I am happy to say that the frequency consequence curves are one of the options that the Staff is considering in their long term effort to risk informed 50.59, so I am sure that there will be more to it.

So, as the Chairman said earlier, you already have the background material, so I think we should focus on slide 6-A, which will help us understand a few things or discuss a few things that are, as Dr. Powers said earlier, that are really relevant to the larger effort of informing Part 50.

What we see in the boxes with the heavy lines there is the basic steps in the PRA. You start from the left, where we identify a set of initiating events. Then we do a plant model, that's a Level 1 PRA, whether the various

cooling systems would work and so on, and we end up with the so-called plant damage states, and the frequency of the number of them -- some of the frequencies of a number of

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these plant damage phases is what we call core damage frequency.

Then we proceed to Level 2, which looks at containment performance, and we expand the accident sequences to include failures of the containment systems and we end up with the accident progression bins. And again, the sum of the frequencies of a number of these accident bins is what we call large early release frequency.

Then if we include the fission product transport and removal, we end up with release states, with release categories, where now we are saying we are releasing cesium, we are releasing iodine with this frequency.

And then if we go to the side model, which is 11-3 PRA, in other words, we take into account weather conditions and so on, and population distribution, we end up with what most people commonly understand as risk and probability of individual death and so on.

An important point here is that as we move from left to right, the uncertainties increase. It is a very important point. I have uncertainties of the plant damage state. As I move to the accident progression bins, I have to include accident phenomena that occurred in the containment, their probability that their containment functions fail, so my uncertainties are compounded.

The Commission right now has a safety goal policy

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statement out that refers to individual risk at the right-most part of the figure, the risk matrix. Now since the uncertainties increase, it becomes impractical to set criteria that are very far to the right, especially for something like 50.59, which really deals with very little changes, maybe you can think of them as changes in the system model of the containment performance.

You would like to have criteria that are as close to those actions as possible, okay. Now what do you lose that way? Well, if you look at the release states, you will have a contribution from the reactor itself, but also from other sources. So that's what you lose. Now you are dealing only with the reactor as you go into it.

On the other hand, one can make a very good argument that the overwhelming contribution to the release states does indeed come from the reactor. So that's really where you should focus your attention.

Another argument that was raised is that it took us a while to issue 1.174 and the other risk-informed guides, where we use a CDF curve as the matrix, so now by going to the right and go to the F-C curves, you are changing the paradigm again before we even had the chance to use the other one, and that's a good point as well.

So that's why I propose the F-C curves at the release state, because I felt that that would help us have a

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coherent set of regulations, including 50.59. But I do recognize that there are all these problems.

Another major contribution, in my opinion, of these curves, is that we will have to think in terms of sequences, not individual changes in initiating events and

the malfunction of equipment.

This is a bad legacy of the previous system. It's too intrusive, too prescriptive. What really matters is the sequences, the accident sequence.

Now, of course, it's not only the F-C curves where you have sequences. You can have sequences one step to the left at the accident progression bin, or at the plant damage state. So that is something for the future. In fact, the Chairman noted that the consequences can be defined any place you would like, and that's something that I did not address, and in fact, a lot of people thought that I was really arguing very strongly for the use of the F-C curves themselves.

Well, these are the starting point, in my opinion. You have to make it practical, so you have to devise or derive subsidiary criteria from these curves that will move to the left, and they will become much more practical.

Another thing that created panic was that this academic is asking us now to do all these calculations for 50.59 things. That assumes that the benefits are the same.

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The 50.59 I envision is not the 50.59 the industry is used to. The industry will get much more flexibility, depending on where we set the definitional criteria.

For example, people are saying, well, the F-C curves are so insensitive to 50.59 changes, so they are useless. Well, that's one conclusion. Another conclusion is if they are insensitive to these changes, why should the NRC review these changes. So you can change the argument there.

In other words, we want to have performance-based regulation. An essential element of performance-based regulation is licensee flexibility. Okay. So if my risk curves, if my risk method does not change in a significant way, well, then I don't have to review it.

CHAIRMAN JACKSON: What if you remove the containment?

DR. APOSTOLAKIS: Pardon?

CHAIRMAN JACKSON: Nothing.

[Laughter.]

DR. APOSTOLAKIS: By the way, this is risk-informed in the spirit of 1.174. Decisions will not be made only on this.

CHAIRMAN JACKSON: Right. I just thought, you know, I'd bring it up. It's an interesting discussion.

DR. POWERS: Let me interject that one of the ACRS

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initiatives is in fact to find the appropriate relationship between defense-in-depth and risk-informed regulation, and I hope that in the near future, you will get a communication from us on exactly that issue, and whether you can remove the containment or not.

CHAIRMAN JACKSON: Well, I just thought I'd check.

DR. APOSTOLAKIS: So the current effort to risk-informed inspection and enforcement process has proposed these cornerstones which are one way of implementing defense-in-depth. You have initiating events, mitigation systems, barrier integrity, and then on the right emergency preparedness.

Well, we could set the criteria there, working backwards from the F-C curves, so it will be easier to work,

plus we are implementing defense-in-depth.

So but the important point really is that people should realize that if we do this, it will take extra calculations, but the benefits will be there. It will not be just preserving the current 50.59.

Now if we go with CDF and LERF that is the paradigm that people like now -- well, on slide 7 you see a set of frequency consequence curves, and we really scrutinized them. It turns out that the flat part that you see there is controlled by the core damage frequency, and then the other part, the steep decline there, is LERF, so

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there is a real question really whether you need the whole curve if you have already controlled CDF and LERF. That's something we are investigating.

But if we decide to go that way, then we already have 1.174, and if we go to slide 10, I have taken figure 4 from 1.174 and added the fourth region which was not there, that would be the 50.59 region. In other words, if -- and again, this is just a proposal. I mean some of my colleagues feel that region 4 should include region 3, the current region 3, in other words, should go all the way to the right, so that 50.59 changes would not depend on the current status of the plant. That's something that I consider a minor point to be discussed.

The idea is to have a region 4 that would say as long as your delta CDF or your delta LERF is in that region, then we will not review it, we will not review it. That would be a risk-informed -- assuming, of course, that there are adequate defense-in-depth and safety modules are also satisfied, as stated in Regulatory Guide 1.174.

So --

CHAIRMAN JACKSON: So that could be done today?

DR. APOSTOLAKIS: You would revolutionize the system if you adopted this today because that would allow many more changes without prior approval. So I guess the implications would have to be investigated, but it certainly

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wouldn't take five years; along today, let's put it that way, today is --

DR. POWERS: In truth, you'd have to say that there is some groundwork that has to be laid as far as what are the standards of the PRA that you are going to do the evaluation. But have we got a first step that you have to have? The first step is 1.174, and Professor Apostolakis is adding to that, rather than creating a revolution by himself.

Now I understand there is still this very legitimate debate of 50.59 or its descendant still should be applicable to all plants, regardless of their risk status. Now it would still be possible to make changes in plants that are of minimal regulatory interest, even if the plant is up in a region that 1.174 would require lots of regulatory attention.

COMMISSIONER DIAZ: I think a year ago Commissioner McGaffigan and I were, say, not fighting, but arguing with the Staff why couldn't we do just this then. Now we were beaten to a pulp. You know, they had to drive us out of the room, you know, bloody, because the Staff said absolutely you cannot mix the two processes. But I always wondered if that was the right --

DR. KRESS: I think the problem, the debate we

have had among ourselves, is that when you get down to that

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level of delta LERF, you are reaching an area at which the PRAs are insensitive.

CHAIRMAN JACKSON: That's right.

DR. KRESS: And that is the crux of the problem.

CHAIRMAN JACKSON: That is the crux of the problem.

DR. KRESS: How do you really know whether -- how do you believe the PRA.

COMMISSIONER McGAFFIGAN: But at some point -- maybe it doesn't matter if it's 10 to the minus 7 or 10 to the minus 7, if they are below that threshold.

The other point I will make, though, that -- and the reason that Commissioner Diaz and I were having this discussion with the Staff, is this viewgraph as originally proposed had a negligible region, which is essentially your region 4 and region 3, I believe. And the negligible region, or maybe it was one order of magnitude below, one of the Staff commented to us that the license amendments in that range would be approved in a nanosecond with the second nanosecond for OGC concurrence.

So if they are indeed -- that then raises the question why are we even looking at them, but the fundamental issue is how this risk-informed regime marries up with the deterministic regime, and we never could square that, because --

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CHAIRMAN JACKSON: I think they called them different things --

DR. POWERS: Right.

CHAIRMAN JACKSON: -- that we insist upon, that I don't want to go over. But all of us have been stuck -- not all of us, all of everybody else, that somehow 50.59 has to -- the issue is how do you preserve the design basis, but not have us stuck in design basis, what we call design basis space. Okay. Can one overlay cornerstones that relate to design basis integrity onto this and then around those apply something like this?

DR. POWERS: Let me make a prognostication, without having much support, that when we go to this step of risk-informed, we will find our biggest debates having to do with how do we marry this negligible and sensitive risk with the preservation of the defense-in-depth philosophy. And we will continuously run into a problem of defense-in-depth trumping all risk analyses, and we will have to resolve that marriage in some more definitive fashion in saying where is the appropriate for these defense-in-depth concepts which in some respects are your design basis concepts appropriate to preserve, and where is appropriate to defer to the new technology of risk assessment to make the decisions.

CHAIRMAN JACKSON: That's right.

DR. POWERS: And I think you will find we have had

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several members and a fellow working on statements on exactly that issue, and what we have called the need for a defense-in-depth policy statement.

DR. KRESS: And if you were to happen to read the transcripts of our meeting this morning, you will find that one member made a really radical statement, that we should

quit dwelling on the concept of preserving the design basis. There's lots of reasons that that gives us a great deal of problems, and maybe should not be a regulatory intent in the first place. It's just something for you to think about.

DR. POWERS: They probably have more than enough to think about, Tom.

COMMISSIONER DIAZ: But, of course, it just depends on how robust our PRA is.

DR. POWERS: Absolutely.

COMMISSIONER DIAZ: What we are saying is there comes a time when a robust, really well-set PRA based decision will be dominant compared to whatever comes from defense-in-depth.

CHAIRMAN JACKSON: And we haven't gotten there yet.

COMMISSIONER DIAZ: And we haven't gotten there, and that is the point that we are approaching.

DR. KRESS: And it has to be related to the uncertainties. We are not quite sure how to do that, but it

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has to be.

DR. APOSTOLAKIS: We have addressed the issue in one of our letters, and slide 35 addresses it if you want to jump there, but I don't think we will have to go to the actual presentation. Where we listed in that letter on impact of PRA results and insights on the regulatory system, the strengths and limitations of defense-in-depth and PRA --35.

DR. POWERS: It's under --

DR. APOSTOLAKIS: Pardon?

DR. POWERS: 6, 6-A.

DR. APOSTOLAKIS: So, and I think this will be the starting point for addressing the questions that Dr. Powers and Dr. Kress raised. But you have to understand the strengths and limitations of each approach.

Now the recommendation we had in that letter is that defense-in-depth should be invoked when PRA uncertainties are a major issue, in the sense that you cannot make a decision because the uncertainties are very large, and they may be -- and these uncertainties will be primarily due to incompleteness, very poor modeling of something, and so on. We are not talking about some parameter being up and down. I mean we are talking about big things. So there is something already in the books, and I have finished my presentation.

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DR. KRESS: I would like to add one more comment on the F-C curves before we leave them. The current LERF acceptance value in 1.174 really is just a surrogate for the prompt fatality at an individual reactor. There may be other regulatory objectives, such as latent fatalities, total fatalities, land -- you could name a great many of them. LERF will not give you much of an insight as to whether or not those are being met.

The F-C curves, on the other hand, can encompass any one of those objectives that you wish to choose because they focus on the right thing, the fission product release, which is a common ingredient of all those risk matrices at the end. So if one wanted to expand his look at what our regulatory objectives are, beyond just prompt fatalities, then one would have to go the route of F-C curve somehow to develop new acceptance criteria that would relate to the

regulatory goal -- there may not be a regulatory goal for some of those, like land interdiction, but if you had one, you could derive surrogates down at a lower level, at the fission product release level, using F-C curves. And that, to me, is where their attractiveness lies.

CHAIRMAN JACKSON: You know, one could make the following statement, or I will make the following statement; that by focusing on core damage frequency and/or large early release frequency, that that is in fact how one de facto

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puts defense-in-depth into risk --

DR. APOSTOLAKIS: Yes.

CHAIRMAN JACKSON: And so that is a justification within the current framework for doing things like what Reg Guide 1.174, in fact, has built into it.

COMMISSIONER DIAZ: If I may piggyback on the Chairman, if we actually look at the center of what -- or let's call it the focal zone of what PRA is now capable of doing, which is center on structures, systems and components, CDF becomes a much more predictable and much more closer and less uncertain, you know, quantity in which --

CHAIRMAN JACKSON: That's right. And that's the reason for focusing in that arena, because you both de facto have, you know, built in your defense-in-depth, and you are dealing in an arena in PRA space where the uncertainties are at a point where you are more comfortable with.

DR. KRESS: That, in fact, is why we originally talked about elevating CDF to the fundamental zones.

DR. APOSTOLAKIS: And if you look at the cornerstones, that's a further statement of defense-in-depth.

CHAIRMAN JACKSON: Exactly. Exactly.

DR. APOSTOLAKIS: As long as we don't overdo it, Chairman Jackson. I mean what do we do then? Do we take

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one cornerstone and put another layer and another layer? Somewhere we have to draw the line and say enough defense-in-depth.

CHAIRMAN JACKSON: Well, I think that there was a line drawn and a line is being drawn in the work the Staff is doing in the assessment and inspection program, and relating it, and what the levels are in which --

DR. POWERS: We definitely see a tendency -- perhaps well articulated by the Chairman in her comments on 50.59 -- that to utilize defense-in-depth as a basis to retain control over issues that have previously been part of the Staff's domain, and we have, I think, now collected several instances where issues that you would think would be resolved by a straightforward risk or availability analysis, that the PRA is supposed to be very good at, but the redundancy or diversity is retained, despite PRA saying it's not necessary because we have this defense-in-depth.

So you have to be careful that we don't end up in a situation of where we have developed a marvelous technology, but its predictions are always curtailed or constrained because we do this for defense-in-depth. You have to have a criterion for applying it, and the necessary and sufficient criterion is the things we are going to do, the committee itself is trying to prepare for you.

CHAIRMAN JACKSON: Well, the way you have to get

at that is to be able to answer the question of if you draw the line at a certain place -- core damage frequency, LERF -- how much of what we traditionally call defense-in-depth is covered by that. And then are we comfortable with that. And if so, then that's the place to start.

DR. APOSTOLAKIS: That's correct.

CHAIRMAN JACKSON: You haven't walked away from quote, unquote, defense-in-depth, but you are not overly hanging onto things that you could let go. But that's what I mean about a series -- and this is in a different context -- of questions that you need an answer to. That is, how much defense-in-depth does drawing the line here provide versus here provide, versus here provide, and then given that information, it's a public policy decision that a Commission is meant to make.

DR. APOSTOLAKIS: And I think the guiding force there should be the quality of the PRA, the uncertainties. As you go down, if you find that something is not modeled, you should immediately go back to the traditional way, prescriptive way of controlling things.

CHAIRMAN JACKSON: Well, I think the fundamental is not one on -- see, the quality of the PRA should not drive the public policy. The public policy is rooted in how much one wants to hold onto defense-in-depth, and where does one draw the line in terms of where the focus should be, in

terms of how much defense-in-depth is preserved.

Then there is a separate question in terms of applicability of a methodology, in terms of how good it is to allow you to do that. Those are two separate things.

DR. APOSTOLAKIS: And I understand that.

CHAIRMAN JACKSON: Okay.

DR. APOSTOLAKIS: But I think this thinking is probably more applicable at the high level, where you are saying I don't care what the technology can do, I will have a criterion on LERF and CDF. Why? I want the containment, period. It's a principle of mine. I want defense-in-depth.

CHAIRMAN JACKSON: Well, that's a public policy.

DR. APOSTOLAKIS: Yeah, it's a public policy.

CHAIRMAN JACKSON: Okay.

DR. APOSTOLAKIS: But what I was referring to was at the much lower level --

CHAIRMAN JACKSON: No, but what you are talking about is at an implementation level.

DR. APOSTOLAKIS: Yes.

CHAIRMAN JACKSON: But to set the policy, you have got to be clear on what defense-in-depth really means and what the -- given -- drawing the line or what you are going to use as the decision point, how much defense-in-depth, if that's a fundamental principle, that provides. So there are two questions.

DR. APOSTOLAKIS: Yes.

CHAIRMAN JACKSON: Do you want to preserve defense-in-depth? And if you do, you know, where are you willing to draw the line. Then you come to the next question having to do with what do you use to implement it, and how well does a given methodology, you know, allow you to do that, and are you comfortable enough with any uncertainties to use it.

DR. APOSTOLAKIS: I agree.

CHAIRMAN JACKSON: And that, to me, is where you -- but the point is, as you yourself said, the more to the left you are, the smaller the uncertainties.

DR. APOSTOLAKIS: That's correct.

COMMISSIONER McGAFFIGAN: Could I ask, the quality of the PRA issue came up earlier, and now it's just come up, and I'd like to just focus on that for a moment because I can give you a chance to respond to some criticism that Mr. Loughbaum from the Union of Concerned Scientists has delivered to the Commission, and more is coming. But basically he told us last month that any self-respecting analyst out there in the industry can tweak a PRA and make it as least as obscure as any deterministic analysis and get it to come out any which way he wants.

He further said that there are -- the quality of the PRAs out there isn't high, in his view; not just things

left out, but almost identical plants in one case will have something making a large contribution to core damage frequency, and another plant, a practically identical one, won't even look at it in its IPE, and vice versa. And he cited, I think, Wolf Creek and Callaway as two that are practically identical and yet in -- so, you know, the question for a Commissioner who is not a practitioner in PRA is are we building a house of cards here, and when is this quality issue actually going to get addressed. You know, because the Staff, I think in the IPEs, a retired staffer told me when I was first here, a lot of these IPEs were crappy. We've never said that as a Commission statement, but he was about to walk out the door, so it's easy --

[Laughter.]

COMMISSIONER McGAFFIGAN: So what do we do?

DR. POWERS: Let me interject, first thing.

I would like to call your attention to your IPE insights document which brings up a lot of these issues, and it will remind you that it's unfair to equate IPE with PRA.

CHAIRMAN JACKSON: That's exactly right.

DR. POWERS: They have two different missions.

Then the issue of quality, of course, has been in front of the Staff for some time and, in fact, the Staff is now engaged in an ASME/ANS exercise to define what are the standards for PRA and, indeed, the industry itself is

actually ahead on this game on saying what is an inadequate PRA with their certification program, where they are certifying PRAs, not blessed and go forth and use it for everything, but they have said we will bless it for particular types of applications. It's a very attractive possibility because some plants want to be part-way pregnant, that is they would like to use PRA a little bit --

CHAIRMAN JACKSON: Doesn't work.

DR. POWERS: Not a whole lot, and in this case I think you can be partially pregnant, in that you -- and it is appropriate to be because we have plants with different forecasted lifetimes and different interests in extending a license renewal.

Now the general issue, or the specific issues of completeness and comparison between identical plants is an issue that I believe you have approved the Staff to go in and look at further, and they recognize that this occurred

in the IPEs and at least one that I was promptly familiar with, or the one I asked about, the Staff emerged and said it turns out they are identical only up to the point that causes the differences in the risk.

So just because you can find two plants that they say, well, they are almost sisters, does not mean that they have the same exact risk profile.

CHAIRMAN JACKSON: That's right.

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DR. POWERS: And similarly, let me be very cautious about equating IPE and PRA because there was such a specialized expectation of the IPE and some plants, quite frankly, some institutions, quite frankly, minimalized that, and some institutions have just gone way beyond that and, in fact, they have exploited the technology to its fullest.

CHAIRMAN JACKSON: Please.

DR. POWERS: Oh, I'm sorry, Commissioner Diaz.

COMMISSIONER DIAZ: Well, I was just going to actually make a statement for you which I'm sure that you will enjoy because, you know, you are so balanced in your views.

[Laughter.]

COMMISSIONER DIAZ: When you said a while ago how much defense in-depth is enough, of course, you also meant how much PRA is enough, and that the issue is, where are the confidence limits of each one.

DR. APOSTOLAKIS: See, I think again we're getting into a pitfall that is very common. We are asking Mr. Lochbaum this. There was a design error someplace. Your PRA didn't catch it, okay? There was some line there that was unavailable and so on, it's not in your PRA. That's not the right question. Did you find that out using -- I mean, was it in the traditional deterministic framework included the fact that that line was unavailable? That's the

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question. Are you enhancing the ability of the system to make rational decisions by bringing PRA into the system or not? That's the fundamental --

CHAIRMAN JACKSON: Well, I think --

DR. APOSTOLAKIS: But to say that the PRA had a problem doesn't mean anything.

CHAIRMAN JACKSON: Well, I don't think we're here to debate that point as such. I mean, I think the Commission has essentially gone on record with the PRA policy statement, the implementation plan, with the risk-informed changes that we're making. We're moving down a certain track. Nonetheless, these are valid questions --

DR. APOSTOLAKIS: Yes.

CHAIRMAN JACKSON: -- relative to the degree of comfort the Commission and Commissioners may have in terms of how broad-based a use of these methodologies can be made.

DR. APOSTOLAKIS: Right.

CHAIRMAN JACKSON: Right.

DR. APOSTOLAKIS: And on slide 35, it says what if we are wrong.

CHAIRMAN JACKSON: Right.

DR. APOSTOLAKIS: So that gives you a way out of it.

DR. POWERS: I think we have touched right -- moved right to the heart of the issue of Part 50, and I

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think we might let Dr. Kress speak to the options for making Part 50 risk-informed. He is --

CHAIRMAN JACKSON: Sounds good.

DR. POWERS: -- somewhat insufferable lately since Tennessee won the National Football Championship, so you might excuse him if he gloats just a little.

DR. KRESS: I won't inflict any more of that --

[Laughter.]

CHAIRMAN JACKSON: Well, since the Denver Broncos won the Super Bowl, I'm in a mellow mood.

[Laughter.]

COMMISSIONER DIAZ: But I would say that Tennessee winning the National Championship was outside the realm of probability.

[Laughter.]

CHAIRMAN JACKSON: I will go further than that, and for those of you who have ever studied physics, I would say it went off the --

COMMISSIONER McGAFFIGAN: I think the Chairman at the moment is more concerned about RPI winning the hockey championship.

[Laughter.]

COMMISSIONER McGAFFIGAN: I see all these large 18-year-old Canadians going into the Chairman's office. No, I'm just kidding.

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[Laughter.]

CHAIRMAN JACKSON: Let's be clear. Don't go there.

[Laughter.]

DR. KRESS: I have about 50 percent of my master's courses from RPI, so I can --

CHAIRMAN JACKSON: Well, then you have total credibility.

[Laughter.]

DR. KRESS: I thought that might help a little. Anything I can do to help.

The discussion we just had, of course, is relevant mostly to a large extent to Part 50. The discussion I'm going to have is going to be a very short one, though, and not because we don't think this is an important issue -- in fact, we think it's one of our highest priority, most important issues at the moment -- it's because for the ACRS, it is still a work in progress. It's one of these participatory reviews that we talk about.

So we really haven't formulated our full position and the best approach to do it yet. We've had only one full committee meeting, and that was to discuss the number of options that you've already seen on certain policy issues, and we wrote a letter to the EDO, and even in that, we only put forth some of our preliminary positions on just a couple

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of items, one of which you I'm sure will have great interest in is we came down on the side of voluntary versus mandatory conformance if you had a Part 50 that's fully informed, and that was strictly pragmatic.

We didn't have a strong technical basis for that; it was pragmatic in the sense that we felt that here was a case where a regulatory analysis would be almost impossible to make, and more than likely, if you could make one, it would fail the backfit requirement.

We're not certain of that. This was a judgment. We work on judgments, too. And we also felt that there will be a number of plants out there with a very small amount or a little amount of time left on their license which would like not to be part of this because it will cost some money to implement.

CHAIRMAN JACKSON: Let me ask you a question about that, if I may. I hate to interject. But if we move down the path, what about for new plants?

DR. KRESS: I would make new plants --

CHAIRMAN JACKSON: Mandatory.

DR. KRESS: Yes, ma'am. Certainly would. And there's a real argument, I think, --

CHAIRMAN JACKSON: Mandatory for new plants.

DR. KRESS: -- for mandatory for existing plants, really. You know, if you're going to go risk-informed, you

need to go risk-informed, and carrying a two-tier system of regulations gets to be a real burden to NRC, frankly, and part of the purpose of this is to help NRC do their job better.

So there's a real argument for that. We just think in this case, it probably -- you would probably end up in court and not be able to defend it. But we can leave that up to the legal people on things like that.

We did not even discuss selective implementation, parts of it, if some -- if they're willing to pick and choose the parts. We haven't even discussed that at all, so we have no preliminary position at all.

COMMISSIONER McGAFFIGAN: Madam Chairman, could I just note that it sounds like Chairman Powers did from what he said about five minutes ago, that --

DR. KRESS: Partly pregnant?

COMMISSIONER McGAFFIGAN: Well, allowing selective implementation might be a pragmatic thing to do.

DR. POWERS: I think it's fair to say that historically, we have always come down on --

DR. KRESS: We've come down on that side. But here's a little bit more of a magnitude of change, and it may be a little more difficult to determine the risk implications of a selective application. In fact, if we write the Part 50 rule correctly, the risk-informed one,

there may not be a way to do a partial implementation. I'm not certain of that because I haven't figured out how to write it myself, but it is an issue and we haven't discussed it and we don't really have a position on it yet.

COMMISSIONER DICUS: Can I ask you a question? If we were to make a decision to make this voluntary, have you thought about or do you have any thoughts you would like to share on then how do we handle Part 50? Because we're going to have our current Part 50, we'll have a risk-informed Part 50. So do we have two Part 50s or do we make the risk-informed part just folded in, or do we make it a separate appendix, or how would you -- do you have any ideas on how we would do this?

DR. KRESS: A very good question. We thought when we discussed this that it would be a two-tier system, that you would almost keep your current Part 50 as is and have a different Part 50 for voluntary, and it would be almost two-tier.

COMMISSIONER DICUS: 50-A and B.

DR. KRESS: Otherwise, you're doing this partial implementation, --

COMMISSIONER DICUS: Right.

DR. KRESS: -- which -- because you're mixing the two.

CHAIRMAN JACKSON: But if you pick one path, A or

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B, you have to go all the way.

DR. KRESS: You have to go all the way.

COMMISSIONER DICUS: Right.

DR. KRESS: That was our feeling.

We did think it was a good idea to have a couple of pilot plants to try out a risk-informed Part 50, and that's because we think that has been traditionally a good way to understand all the implications, consequences, the risk, and you can do it in a way that you can manage the risk if there is any. You can --

CHAIRMAN JACKSON: By using Reg Guide 1.7.

DR. KRESS: Yes, that would be our approach. You would have -- each -- what you're going to come down to is changes to the plant, and --

CHAIRMAN JACKSON: Well, we can't do it, then, until we get 50.59 done.

[Laughter.]

DR. KRESS: That's part of Part 50, you're right. We'll have to have that done, too.

But this is a way that the staff can manage the risk on a basis until they -- you learn to walk before you run in this kind of a magnitude of change. So we thought that was a good idea --

CHAIRMAN JACKSON: But tracking cumulative risk.

DR. KRESS: Pardon?

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CHAIRMAN JACKSON: Tracking cumulative risk.

DR. KRESS: Yes. Yes.

CHAIRMAN JACKSON: Should the plants that receive these exemptions be subject -- or be required to meet a subsequent final rulemaking?

DR. KRESS: Would you repeat the question again, please? I'm not quite sure I --

CHAIRMAN JACKSON: You could grant exemptions and there could be differences in regulatory positions approved in the plant specific --

DR. KRESS: The pilot plants being exempt.

CHAIRMAN JACKSON: Right.

DR. KRESS: Yes. Okay.

CHAIRMAN JACKSON: But then all of this is going to lead to some wisdom that presumably will lead, you know, to some final formal rulemaking, and the question becomes, if once these plants receive exemptions, should they be subject to whatever the subsequent final rule requires?

DR. KRESS: We haven't discussed that, but my personal opinion is yes, they would -- should be. I don't like the idea of having half of our plants out there subject to a different set of rules, and I think you would make them revert to the new rule at the end --

CHAIRMAN JACKSON: Right.

DR. KRESS: -- when you've got it. Yes, that

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would be my --

DR. POWERS: One has only to look at the cost and difficulties of fire --

CHAIRMAN JACKSON: Protection?

DR. POWERS: -- inspection and fire protection to understand what happens when you get a diversity of plants, --

CHAIRMAN JACKSON: Exactly.

DR. POWERS: -- and then look at the amount of hours spent in debating interpretation and guidance on those things to see you really don't want to have any more of a proliferation of classes of plants than is absolutely necessary out of fairness and protection of the public safety.

COMMISSIONER MERRIFIELD: Chairman, I have a question on that score. You mentioned that having a voluntary nature is appropriate for some classes -- for a class of plant where they may be being decommissioned in a relatively short time down the road, so there's no sense to transition into something new for that time period.

Would it make sense to bring us back to some unity at some later point to require as a contingency of relicensure that they go into this program?

DR. KRESS: Yes, I think that might be a good place to put a mandatory requirement. I think that would be

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a good place to think about it, yes.

DR. POWERS: Recall, of course, that if -- you would need to look and make sure that you did not again get into the kinds of problems we got into when we imposed Appendix R where there were some plants that simply physically could not tolerate the rule and we had to grant a plethora of exemptions and things like that. You would want to look at it very carefully. It's one of those things that requires lots of groundwork and, quite frankly, that's the kind of groundwork we've not done.

COMMISSIONER MERRIFIELD: But you would agree it's worth exploring.

DR. POWERS: It's definitely worth exploring. A caution from what we've learned out of Appendix R is not a bad idea.

COMMISSIONER McGAFFIGAN: I would just point out that two viewgraphs down, they say this is a very long-term project, and so I hope there will be a fair number of plants all the way through license renewal before this becomes an issue, and certainly doing something near-term isn't even conceivable, I suspect.

DR. KRESS: As a matter of fact, that's the reason we came down on being in favor of a two-phase approach. This also impacts on the question of two tiers of regulation. We think you can change the current regulation

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to be a little more risk-informed by changing the definition of what's in the scope of important safety, and that would give a lot of regulatory relief without -- and you can demonstrate, we think -- well, before you do it you would have to demonstrate that it wouldn't change the risk status an undue amount.

So we think that would be a good thing to look at to see to do while you're going through this longer-term process of making the whole thing risk-informed, and we do think that's going to be a long-term process for a number of reasons, and we think there are a lot of things that need to

be done up-front that maybe are not being done just yet, and they relate to our discussion on defense in-depth.

We think you need to really define what your regulatory objectives are -- are they just LERF and CDF or are there other things like preventing a certain dose level or a certain injury level, because a lot of the deterministic regulations relate to dose levels, and those are injuries. Is that part of your regulatory objectives?

Defense in-depth is clearly a philosophy, and you will want to maintain some of it. The question is, how does it fit in with the risk-informed system and what are the necessary and sufficient limits?

I think all this ought to be done ahead of time, because that will determine the form that you make this rule

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risk-informed. You need to know those things, and we don't really see that being done.

CHAIRMAN JACKSON: See, risk-informed is not risk-informed versus defense in-depth.

DR. KRESS: No, it's --

CHAIRMAN JACKSON: Risk-informed --

DR. KRESS: Yes.

CHAIRMAN JACKSON: -- as opposed to risk-based means that by definition, you have to address how you resolve the use of risk assessment with defense in-depth.

DR. KRESS: Yes. And we don't really see how the thought process in place to put necessary and sufficiency limits on defense in-depth in particular, but -- and there may be other issues, like do you want to preserve some dose limits? This will be frequency fission product release, at low levels of fission product release, do you want to preserve some of that in your regulatory objectives? Do you want to really revisit the safety goals in the sense that are our only regulatory objectives latent -- individual risk of latent and prompt fatalities, or should we -- in reality, we are concerned about land interdiction, we are concerned about total deaths. You have a rule that limits population because of that. We're concerned about injuries and ALARA.

I think you need to think out how much of that and in what manner we'll preserve in a risk-informed Part 50,

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and that needs to be done up front before you can change the rule, and that was our -- that was the reason for this quote that I put on that last slide.

CHAIRMAN JACKSON: Thank you.

COMMISSIONER DIAZ: I'm trying to reconcile in my mind the statement on slide 16 with a lot of the other comments, and let me see if I can take an exercise in here that will bring me back to many years ago.

I remember Dr. Urich used to call me to the classroom and say, now, you know, it's very difficult to solve the transport equation, because it has seven dimensions in it, and so it's going to be a terrifically complex problem. However, this morning we're going to drop the angular distribution, and then tomorrow morning we will drop the time dependency, and then eventually we will reduce it to a one or two-dimensional problem, and then we can solve it. And isn't that what we're saying, that we need to make this problem into a problem that we can chew on, resolve it, practically, and then add another dimension to it?

DR. APOSTOLAKIS: Yes. But when we go from the full class-perfect equation to the diffusion equation, we know very well what approximations we are making. And I'm not sure we know --

COMMISSIONER DIAZ: Shame on you, George.

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[Laughter.]

DR. POWERS: If the PRA people would just do their job, George.

[Laughter.]

COMMISSIONER DICUS: I have a question. Would you care to give us some idea how long "very long" is on slide 16?

COMMISSIONER MERRIFIELD: Actually, if I can layer on top of that, could you also discuss the resource implications that would have on the agency, given the other activities we have underway with relicensing and license transfers, and all the other important things on the tasking memo?

DR. KRESS: Well, since I wrote the statement, in my mind, I had in mind five to seven years as a long term, that it's going to take at least that. Now, that --

CHAIRMAN JACKSON: How long?

DR. KRESS: Five to seven years.

CHAIRMAN JACKSON: That long, huh.

DR. KRESS: And unless you can do a great deal of effort to expedite it.

CHAIRMAN JACKSON: Let me ask you a question. You know, there were experimental programs and accident analysis codes developed that were necessary to, you know, undergird and achieve a certain qualification level vis-a-vis the

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existing design basis accidents. If we completely overhaul Part 50, would that potentially require any new analysis techniques and/or experimental testing programs, or do we know all we need to know?

DR. POWERS: Well, what I can tell you is that, first of all, this idea that's built into much of the regulation of here is an approved conservative analysis tool is something you're moving away from when you're moving toward a risk-informed regulation. You're trying to get to a much more realistic analysis.

Now you pose this question of okay, we have superior analytic tools, and what is their experimental validation. Well, in many cases, we do have some experimental validation, but it is very far from complete, and in fact it's becoming a -- repeatedly coming up to be a concern to us is that when is it in an area when experimental work is taking a second seat to improved analytic models, that experiment comes forward and you have to validate these codes, that you can't rely on the persuasive quality of your approximations. And that's becoming a concern to us. We certainly see it, and we have seen examples of it coming forth, and you will see examples of issues related to exactly that. The examples that come promptly to mind is when people start applying to have fuel go to higher burn-ups than 62 gigawatt days per ton.

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There's going to be a tendency to say surely by now we have seen all the physics that will occur. Well, maybe not. It seems to be capable of surprising us.

You will see it again in resolution of circuit analysis with surely we have seen everything that fire can do with circuits. Well, maybe not.

I think the answer is that as you more aggressively go pushing the margins, as you start deviating farther and farther away from what is known as a conservative bound, based not an Aviar-Stokes equation, but on mass balance and energy balance arguments. As you move away from that, you are going to find people more and more uncomfortable with magnitude of the uncertainties and whether you have left -- whether the omissions, the incompleteness is more severe.

I think we need to spend some time thinking about those kinds -- a criteria of that, what is the magnitude of deviation between a bound based on incontrovertible and easily evaluated physics, mass balance, energy balance, and is that measure -- when does that measure get big enough that I really do need an experiment that is a prototypic validation of that. Surely we will -- we can formulate something in a conceptual basis. Can we formulate something on a practical and useful basis? I don't know. But it is certainly an issue that has not escaped the attention just

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based on the number of examples that are coming to us of where relying on computer codes and experiments have taken a second fiddle.

As soon as I say we need an experiment, the next question is, who is responsible for getting that experimental data?

DR. FONTANA: Let me add something here. I think one advantage of doing it is that you would do the experiments for whatever additional information you need, you would do them on a basis of risk and basis of need. In the past we have had a real imbalance, we have had a tremendous amount of work on open-ended pipe break, and that, as you know, is not for risk-significant accidents. So I think planning here experimental programs, whatever it need to be, on a basis of risk thinking will put things in the right priorities.

DR. POWERS: I think what we see is in fact that at the onset of the nuclear industry, models and calculations were expensive to do; experiments were fairly easy to do. We are seeing a reversal of that trend. Computing power is becoming wildly capable -- I mean each one of you probably has the equivalent of a Cray on your desk nowadays. Whereas experiments, because of a much greater caution, but also because the kind of experiment that has to be done now to qualify as useful and prototypic

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has just become really amazingly expensive. In fact, within this agency there's a general concession that any major experimental program can't be done by this agency alone, it has to be done in cooperation with your counterparts in a large number of countries, and they too agree with that, that it's much more comfortable for them, and it has certain advantages to that. You get much better scrutiny of the experiment to say yes, verily, this is definitive.

DR. KRESS: I don't think you got a fully definitive answer to your question. In coming down on the side of saying we think one should go to risk-informed regulation, this committee has already made a judgment that

the PRA technology, which includes the severe accidents and the containment codes, is good enough to progress in that direction, in spite of the fact that there are very large uncertainties. But we have also said that those uncertainties need to be accounted for, and that's why it should be risk-informed and you account for those uncertainties somehow in your defense-in-depth provisions.

And so I think we have made the judgment that we are already there. That's not to say you can't improve those things, those severe accident codes and the PRAs -- in fact, they probably should be improved in a number of areas. Dana's high burn-up fuel is one. That should affect fission product release. I know it will, for a fact. There may be

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other physics that will affect it. We have always said the ESO codes are good enough because the uncertainties are so large elsewhere. Well, that may change now that we have a different use for them, other than just to get severe accident insights. Now we want to regulate, to fission product release, say. You may have a different view then. You may need to be able to pin those down a little better.

I think the decision will depend on a balance between defense-in-depth and the uncertainties in these codes, and I'm not sure where that balance is at the moment, or how to do it, but that's where we need to focus.

COMMISSIONER McGAFFIGAN: Madam Chair, mentioning the severe accident codes and someone mentioned citing earlier, reminded me of a quotation in Nucleonics Week a couple of months ago by the head of Framatome who was bemoaning the fact that the European regulators, presumably using the same PRA techniques, the same severe accident codes, were requiring a European pressurized reactor to put on what he regarded as expensive bells and whistles, like containment liners and corium spreaders, et cetera, and the evil Americans, yours truly, and I guess you, based on your advice, did not require similar things of the advanced American reactors which would put them at a competitive advantage.

How do you get such different -- if everybody's

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using the same severe accident codes, the same -- how do you get such different judgments? And if that's the case -- I mean, again, you know, I'm trying to figure out how firm the ground is underneath my feet.

DR. KRESS: I have an answer for you.

COMMISSIONER McGAFFIGAN: Okay.

DR. KRESS: It stems from what your regulatory objectives are. The Europeans would laugh at our prompt fatality safety goal. They just discard it. They do not like that goal, it's not severe or strict enough. They have goals that are much more strict than ours. Their acceptance value, so to speak. And they involve a high population in regions around their plant in which their goal is not to have any emergency response at all, no evacuation. Nothing but sheltering. When you put those constraints on your regulatory objectives you're trying to achieve, you're going to have a LERF that's much different than this 10 to the minus 5, much lower. And in order to meet that, you have got to have better bells and whistles. Your codes are the same. The codes have relatively the same amount of uncertainty, but in order to meet a different regulatory criteria, you've got to have the bells and whistles.

CHAIRMAN JACKSON: Well, but, see, that goes back to my point of them playing off of these surrogates to how much defense-in-depth. But how much defense-in-depth is a

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public policy decision that's related to societal values? And as the Europeans point out to me all the time, you know, they live on top of each other in ways that we don't, and that goes -- comes into play in terms of what your regulatory objective is. If it is rooted in the fact of life, what the societal values are, that translates into what your regulatory objectives are, and then that tells you essentially how you play off the surrogate to the defense-in-depth.

COMMISSIONER DIAZ: Their regulatory oversight is completely different than ours, so they actually deal more -- I hate to use the word, defense-in-depth insight because their regulatory oversight is not as strict as ours is.

CHAIRMAN JACKSON: Right. But that also goes to societal values, and it goes to how the nuclear business is organized. When you have shareholder-owned, market-capitalized nuclear power plants, what the cost-benefit calculation is is different, than when you basically have a country, a national decision, and the way the business is organized is that essentially you have para-statal companies. Those are very different than shareholder-owned market-capitalized companies in this country. So these things -- that's why it's not so easy to do these kind of back-of-the-envelope comparisons.

COMMISSIONER McGAFFIGAN: But if I could just pin

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Dr. Kress down, if he could give me a guesstimate, given that they have this different societal goal, if you are guesstimating what they, in the back of their minds, CDF delta LERF or their overall goal is in deltas -- I guess their overall goal for CDF and LERF, what is it? What is it that they are designing the EPR to achieve?

DR. KRESS: They have quoted CDF at 10 to the minus 5, with goals of 10 to the minus 6. The LERF, they don't even bat it around at all, but if you were to look at this regulatory objective of nothing but sheltering, no evacuation, and relate that to our goal of prompt fatalities, if you had to meet our prompt fatality goal with that constraint, you are bound to I think almost 10 to the minus 7. I'm not certain of that, because they run the numbers, but it's between 10 to the minus 7 and 10 to the minus 8.

COMMISSIONER McGAFFIGAN: So it's two orders of magnitude --

DR. KRESS: Something like two orders of magnitude.

COMMISSIONER McGAFFIGAN: And that becomes the constraining thing in some ways, or at least it forces these containment --

CHAIRMAN JACKSON: That's the play-off between that surrogate, and I remind you, defense-in-depth, and

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that's why I -- the containment is, you know, the ultimate defense-in-depth.

DR. POWERS: Also remember that they have different kinds of criteria that sounds a lot more like

defense-in-depth, where they say we are going to physically eliminate the possibility of early containment failure. I mean they are looking for zero there, and that creates lots of bells and whistles, because they defined another issue that they encountered, one that I think we have to face up to is that they have difficulties with public acceptance of risk-based arguments, and it is one that is coming to the fore to us, it is --

CHAIRMAN JACKSON: You have made that point.

DR. POWERS: And I will try to make it again and again, perhaps in a little more complete description.

CHAIRMAN JACKSON: Well, you have caught my attention.

DR. POWERS: And I think we'd better pay attention to it big time.

I am mindful of your schedule, and I am --

CHAIRMAN JACKSON: Of what schedule?

[Laughter.]

DR. POWERS: And so I perhaps need some guidance. We have other topics --

CHAIRMAN JACKSON: Why don't we try to walk

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through and hit the high points, and I will even constrain myself, difficult though it may be, and we will try to constrain ourselves and let you at least walk through it with the high points.

COMMISSIONER MERRIFIELD: Chairman, not to go in contradiction to constraining ourselves, but there was a question I asked Dr. Kress to answer, and I just wanted --

CHAIRMAN JACKSON: Well, that's part of the previous discussion, so you're still constrained.

COMMISSIONER MERRIFIELD: Oh, okay.

Going back to your statement, you said five to seven years for the complete overhaul. But under that, in your thinking, what dedication of resources of the agency would that require?

DR. KRESS: I'm afraid I would really be speculating beyond whatever I thought if I give you a real number, so, you know, I really don't know what that means in terms of NRC resources.

COMMISSIONER MERRIFIELD: Well, you say five to seven years, you said you have a very long-range project, difficult policy decisions and extensive rulemaking.

DR. KRESS: Yes. It sounds like a lot of resources to me, but, you know --

COMMISSIONER DIAZ: And that's a qualitative statement.

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[Laughter.]

COMMISSIONER DIAZ: Dr. Apostolakis, do you agree with that -- five to seven years?

DR. APOSTOLAKIS: Again, we're back to fuzzy concepts here. It depends what it means to revise to make it risk-informed, it could take 15. I mean, it depends --

[Laughter.]

DR. APOSTOLAKIS: But that was just a comment. Let me complete the sentence. I think we can do a lot of useful things maybe in a two-year period, a lot of useful things. We may not complete the revision, but I think a lot of the good stuff can be done in the first two years.

COMMISSIONER MERRIFIELD: Using what resources? I mean, I don't mean to keep harping on this, but we have --

I'm just trying to grapple with this because this directly relates to an issue that we have before us right now in terms of what direction we're going to go, and you can say, you know, we can do a lot in one or two years, but what does that mean relative to the other resources we have in --

CHAIRMAN JACKSON: I don't think they can answer that.

DR. APOSTOLAKIS: I cannot answer that question, but I can tell you one thing: If you put together a team that has -- like the team that is working on the inspection and enforcement program, you're going to go a long way in

two years. It's one of the best things this agency ever put together.

DR. KRESS: You have Gary Holahan involved, also. That ought to speed it up.

CHAIRMAN JACKSON: Gary is having a headache over that.

[Laughter.]

DR. POWERS: I want to make it clear that you're talking about a new vendor taking a change in culture, and I know of no company in America that has discovered that to be a painless process, and I know of no company in America that has not underestimated the amount of time it takes to change a culture. Since you're looking at changing not only your culture here but those at a large number of other institutions, don't underestimate the amount of time that it takes to change cultures.

COMMISSIONER DIAZ: But if you put that statement, you know, at page 16, and you put it, you know, right after TMI, I would agree wholeheartedly with it. But we have been 25 years changing the state of the art, the philosophy, dealing with stakeholders, moving step by step painfully, carefully, okay, and many times not even moving, okay, you know, in this direction is not a new issue, is not confronting the public, the Congress or stakeholders, the licensees, or the agency with an issue; it's just actually

trying to develop the benefit from it, and in probably an aggressive fashion. So, you know, it is not possible to say this is a new issue. It is not.

CHAIRMAN JACKSON: It is not a new issue, but in terms of a step function change for NRC and, by implication, for the nuclear power issue, it is -- you know, there's a lot of groundwork that forms the basis of where we are as a 20-year tale. But in point of fact, if you're really talking about managing change, unless you're going to kill off everybody that runs the current nuclear facilities and all the current people we have at NRC, I think we can accelerate it, but we can't think it's coming in six months' time, no.

DR. POWERS: I think I usually respond to the statement on 25 years -- and it has been, there's no question about it. The first inklings in what you could do with risk came in 1974 for some of us, some of us a little later than that following TMI. And I usually respond to my colleague, yes, the PRA people sure are slow getting their message across.

[Laughter.]

DR. POWERS: But on the other hand, I was there during that debate and I know what it was taking. It was

taking a change in the mindset.

CHAIRMAN JACKSON: Exactly.

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DR. POWERS: And let's not underestimate that.

DR. APOSTOLAKIS: I don't think Dr. Kress in his seven-year estimate included a change in culture, so let's leave culture out. And I think Commissioner Diaz refers to the actual change in the regulations, and that's of interest. I mean, the culture will take a long time.

CHAIRMAN JACKSON: Well, let me just put it to you like this: I came here in 1995, as you know, and in the Fall of 1995, I asked the staff to look at 50.59 relative to, you know, the very issues at the heart of the issues we've been talking about. 50.59 had been looked at by a task force before my time, you know, before I even thought about or anybody even thought about my coming to NRC, and now this is three-and-a-half years later, and we're still here, and we've narrowed it, and we've come a long way down the line. This has to do with one rule change, not really risk informing it in the sense that we're talking about. One rule change. A key rule, critical rule, one that we and the industry cannot live without, but it's three-and-a-half years. And I'm hoping to get this Commission to make some fundamental decisions on it before I go. And even so, that will be bringing it close to the four-year line, and it will not be a risk-informed rule at that point in time.

So let us be clear --

DR. APOSTOLAKIS: But the processes are very

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linear, Chairman Jackson.

CHAIRMAN JACKSON: Agreed. Agreed.

DR. APOSTOLAKIS: You have already addressed the steep part of the curve, I think, with risk-informed initiatives, and especially after Regulatory Guide 1.174 was released, I think now we know much more. Things should go faster. They should. I don't know whether --

CHAIRMAN JACKSON: Thanks, Gary.

[Laughter.]

DR. POWERS: Well, let me proceed forward by just stepping through both source term and license renewal. Tom, you wanted to say some quick words about the source term?

DR. KRESS: Sure. I'll be very brief and just hit the highlights. I'll assume you're already quite familiar with source term issues. Just to remind you that the revised source term was because the old traditional one was unrealistic, and unrealistic has problems, but the revised source term was meant to be for future plants, and the new rule addresses whether or not to let voluntary usage for operating plants.

There's a number of issues one might have to face in deciding whether that is acceptable or not, and if you move to slide 21, I have listed what some of those issues are. The two major ones are the two middle bullets. That's if you allowed voluntary change, what would it mean in terms

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of plant changes? What does that relate to? Because you have to know what the plant changes are before you can determine the implications with respect to risk or other objectives. And given those plant changes, what would be the individual plant risk status change, and if it's increased, would the magnitude be acceptable?

There are other issues there. I did want to mention that I felt in this case the staff did a very good job of addressing these issues and did about all you could expect, all you could ask them to do. So their findings --I would like maybe to jump to slide 24 -- they did identify some likely plant changes through a process of interacting with the licensees and industry, and here are some of the most likely plant changes listed.

The thing I wanted to point about these is that, number one, they are all containment related items, which you might expect when you're talking about changing the design basis source term, and that the changes that are anticipated are all relaxations on these, they are reductions in burdens, and any relaxation in these would have the potential to increase fission product release to some extent. The question is how much and is that acceptable.

The staff did a great deal of effort to address those. They did it on a limited basis. They did some risk

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analysis at Grand Gulf and Surry to represent PWR and BWR in which they looked at these likely changes one at a time to see what effect to expect, and they found out, not surprisingly, that there was insignificant effect on the CDF and LERF matrix. I think that could have been anticipated because these changes are containment, they don't address CDF and LERF almost automatically includes containment failure, which these things don't involve.

There was little effect on defense-in-depth, essentially no effect -- it depends on your definition of defense-in-depth -- and that the dose requirements that you get out of the deterministic rules are still met, but, of course, that was part of the definition of the changes. You have to meet those dose requirements or you can't make the changes.

So what it appeared to us was that all of the Reg Guide 1.174 like thinking provisions or strictures are met with the usage -- with voluntary usage of the new source term at that plant. So it was basically a no-brainer. Here's a chance to give a great deal of regulatory burden reduction on the plants, with a very minor impact on risk. So it really seemed like a no-brainer to us to endorse the voluntary usage of this at the operating plant.

COMMISSIONER McGAFFIGAN: Madam Chairman?

CHAIRMAN JACKSON: Please.

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COMMISSIONER McGAFFIGAN: There are two benefits other than burden reduction that I saw in the paper that ultimately came to us, and one was cutting down on unnecessary plant exposures. So we're having real safety benefits for plant workers. And secondly, some cases, and you make the point in one of your slides, there's actually risk benefits in going to --

DR. KRESS: Very likely, you get a risk decrease.

COMMISSIONER McGAFFIGAN: Right. So you get unnecessary burden reduction, risk decreases and plant worker safety improvements. I mean, it's --

DR. KRESS: I went over these things quite hurriedly.

COMMISSIONER McGAFFIGAN: Right.

DR. KRESS: Another benefit is with the old

unrealistic source term, we actually had a perturbed view of how severe accidents progressed, and you don't want to have an unrealistic view because it ruins your insights. And so you might as well allow those insights to be carried over to the operating plants.

CHAIRMAN JACKSON: Let me ask you two quick questions. Are there any changes to the revised source term, I mean that would change what we know if MOX fuel were used instead of uranium oxide base fuel? And if you look at issues such as the one Dr. Powers raised about higher

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burn-ups, how do these statements then --

DR. KRESS: We're already using MOX fuel.

CHAIRMAN JACKSON: You know what I mean.

DR. KRESS: Yes.

[Laughter.]

CHAIRMAN JACKSON: Don't play that game.

[Laughter.]

DR. KRESS: But I think there will be a difference in behavior. The fuel we have built up is plutonium to a pretty high level, and it can be called MOX fuel.

CHAIRMAN JACKSON: That's right.

DR. KRESS: And when we talk about the fission product release and meltdown behavior of fuel and the severe accident codes end up giving you a source term, we're talking about the behavior of a pretty high plutonium --

CHAIRMAN JACKSON: Content.

DR. KRESS: -- content, except I personally think that starting out with a centered MOX fuel made up with the plutonium put in in the first place gives you a different animal than building it in by absorbing burn-up --

CHAIRMAN JACKSON: That's right.

DR. KRESS: -- and that they may behave quite differently, the physics may be different. I don't think we know that. I don't think we have enough information to make a judgment.

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My guess is that it won't make very much difference in terms of the uncertainties we already have in meltdown behavior and in fission product release behavior, and that the source term that was chosen --

CHAIRMAN JACKSON: Have such analyses been done anywhere?

DR. KRESS: No.

CHAIRMAN JACKSON: I mean, have the Europeans done it?

DR. KRESS: I don't know of any. But my guess is that the source term we have chosen as a design basis source term is sufficiently conservative anyway; it can probably incorporate that.

Now, from the -- your second part, the high burn-up, I feel differently about that. I think high burn-up can make a significant difference in both meltdown behavior and fission product release, and I do not think we have the database for that.

Dana, you might want to comment.

DR. POWERS: I would just comment on the available database on MOX. There has been quite a lot of work at the Transuranium Institute on fission product release, the nature that we call gap release that figures in the source term area. There is some work in the NSRR reactor planned. They may have actually done a couple of experiments already,

again looking at more the gap release. There is some work going on in France for what you would call the in-vessel release where they're actually heating fuel pellets up.

There has been discussions on utilizing the MOX fuel in a PHOEBUS type experiment which would carry you completely through core degradation. I don't think those have resulted in a decision to do a MOX fuel experiment.

I think the reluctance to do lots of MOX fuel is MOX per se just isn't behaving enough differently in these harsh steam high-temperature environments to really detect a difference. If you were in a fast reactor environment with liquid metal coolant, then you see a very distinct difference. But steam and high temperatures are great equalizers among fuel.

CHAIRMAN JACKSON: So high burn-up is more of an issue than MOX per se, although the isotopic content of the MOX is different than --

DR. POWERS: I understand that the more trouble --

CHAIRMAN JACKSON: -- than the one at the end of life currently.

DR. POWERS: More troublesome with MOX is actually the neutronics and the --

CHAIRMAN JACKSON: Right.

DR. POWERS: -- reactivity insertion accident.

CHAIRMAN JACKSON: Right.

DR. POWERS: And staff does have an activity going on now to see if their codes for doing neutronics are sufficiently well understood to handle MOX, and I believe they're interacting closely with the Europeans on that, who have a good deal more experience with MOX than we do.

But high burn-up is much more interesting from a phenomenological point of view because now you get into things where steam really does affect you. Certainly the gap releases go way up. But in the core degradation area, there has always been a discussion on what's called fuel foaming, which is radically different than the way we model core degradation now, and it seems like it's enhanced when you go up to higher burn-up.

There seems to be room here for experimental investigations. Our own research program here within the United States as sponsored by the NRC doesn't address these questions. It is addressing questions of have the decisions made to allow burn-up to 62 gigawatt days per ton still preserve adequate protection to the public health and safety. They don't go into severe accidents. But they will rely on the industry to provide information if you wanted to go higher.

I have to say I think the staff is coming up with a very clever approach on defining what kind of data the industry should be bringing forth to justify going to higher

burn-up and to decide whether they need to go into severe accident space on that.

We'll be hearing more on that proposed approach at our next meeting and we'll be writing you a letter on that, so I don't know that it's worth going into now, but I think they have a very clever approach.

COMMISSIONER McGAFFIGAN: Madam Chairman, just to

-- I don't want to delay at all -- the Nuclear Control Institute, Dr. Lymon, put out something recently about MOX and actinides being a larger element of the source term or whatever. At some point, I think it's DOE's responsibility to respond to that, but at some point, we may need -- perhaps years down the road -- but you all to comment one way or the other on that unless you already have looked at it.

DR. POWERS: Well, there is a change in the spectrum of fission products that are produced. Fortunately, it's not very big of a change for the kinds of things we worry most about.

DR. KRESS: It doesn't have much of a consequence effect, the change.

CHAIRMAN JACKSON: So if I took a summary of what you said, you know, it's a little bit off the mark, but that MOX use per se, although, you know, some of the analysis TBD, is probably not of, you know, the greatest consequence

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from a fission product release perspective, but it is probably more in terms of a reactivity control and neutronics perspective, which in itself is non-trivial.

DR. POWERS: Non-trivial. You get real nervous about losing control, yes.

CHAIRMAN JACKSON: Absolutely.

DR. POWERS: And it really has to do with a delayed neutron fraction.

CHAIRMAN JACKSON: But high burn-up does come into play vis-a-vis the fission product.

DR. POWERS: It's a bit more of a challenge to us because we really don't understand all the physics that's involved there.

CHAIRMAN JACKSON: Okay.

DR. KRESS: What we do know is that in general, you will expect greater releases, faster releases, at higher burn-up.

CHAIRMAN JACKSON: That's right. I know.

DR. KRESS: That we do know.

CHAIRMAN JACKSON: Well, I think those -- I just happen to believe that from a safety perspective, that these are non-trivial --

DR. KRESS: I think we would agree.

CHAIRMAN JACKSON: -- you know, the MOX side and on the high burn-up side, and I'm only bringing them up more

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to bring them to light and say that that's something that I think you have to help the Commission work through.

DR. POWERS: And it is an area that we have a subcommittee that pays particular attention to the fuels.

CHAIRMAN JACKSON: Great.

DR. POWERS: Let me ask Dr. Fontana if he would quickly go through our plans on this very important issue of license renewal, where we really are in the strategy development more than the --

CHAIRMAN JACKSON: You have to Marios on the committee.

DR. POWERS: We do now, and we're going to have to develop some sort of a strategy for handling that.

[Laughter.]

DR. FONTANA: I've got a stiff neck from snapping my head when I hear my name mentioned.

Let me walk you through very quickly on what we're

doing with respect to license renewal. I presume that you -- well, I know that you've had briefing from the staff, so I'll jump right into what the ACRS is doing.

CHAIRMAN JACKSON: Could you talk closer into the microphone?

DR. FONTANA: Sure.

We're developing a process and identifying assignments for review of the license renewal products, and

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the activities to date have been understanding this really rather arcane process and receiving overviews of the industry and NEI approaches to license renewal, receive summaries of the status, and obtaining an overview of the environmental assessment requirements, reach an agreement with the staff on a review schedule, and identifying the license renewal generic issues.

We also have received one technical report which we have reviewed informally and have not presented anything on it, the Calvert Cliffs license renewal application, a generic environmental impact statement, a list of generic issues, list of generic license renewal technical issues, which is not the same list as the generic issues that we had with us for 20 years or more.

The next viewgraph shows the schedule for the Calvert Cliffs' review and the intent of showing this is that there are many intermediate milestones that don't show here.

The main point to get across, the best way to assure that a final review is completed without delay is to conduct intermediate meetings, and we learned this particularly in the success of the participatory reviews that we've had with developing Reg Guide 1.174 and also the benefits of the mid-course inputs that we got from the AP600 review.

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Although the schedule is very tight, staff -- and the staff is going to be really hard-pressed to meet this schedule -- they have agreed with us that meeting -- having interim meetings like this will minimize the potential for a delay at the end because of some issue that came up late in the review.

As you see in the viewgraph, the intermediate points occur after the staff completion of the safety evaluation report and after the public meeting, and we have the final meeting in February 2000.

The next slide shows you the Oconee schedule, and I won't go through that because it's essentially the same.

The next one shows license renewal of generic technical issues. The staff and the industry have agreed to 98 technical issues that are generic with respect to license renewal. They have grouped this into four priority rankings, and I won't get into this. There are four priority rankings; the important point is that there are 18 issues in priority one which must be resolved before issuance of any renewed license. And we have not looked into these in-depth, but I appear to be in general agreement with them.

All the ACRS has at this time with respect to the issues is a one-paragraph description, and we'll develop a schedule and assignments for review of these issues.

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The next viewgraph shows that we plan to review the generic technical issues, as I said before, industry topical reports, and these are generic reports that, once they get reviewed, the future license renewal applications can refer back to them, so it's important that we do this. The updated standard review plan and regulatory guide, aging related research.

Other reports that are under review by the staff that we don't have yet is RCS piping, pressurized reactor vessel internals. We have reports from the Owners' Group, and I won't get into that list. And we still need to determine the extent to which we're going to review these reports. I mean, are we going to have to review them all or will a spot check be adequate? And as you can see, our resources are limited here.

As you know, the Reg Guide will remain in draft form throughout the process of the first two reviews and will be issued in 2001 according to the present plan.

We have very close interest in aging related research, and that is crucial to the understanding of extended operation of these plants. Some of these issues are well known and I won't get into them.

The staff and the industry feel that license renewal can be accomplished on the basis of present knowledge, which is really quite extensive, and we intend to

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review this area with respect to the impact on long-term operation. Of course, we will review the license renewal applications themselves.

Now, there are no more viewgraphs, but I think we should summarize that the basic philosophy is that a plant that meets the current licensing basis is in pretty good shape and that the current regulations provide an adequate assessment that those components and structures -- those are the active components -- that are covered by them will remain functional. So the license renewal focused on passive components and identifying them and showing that they will maintain their functionality throughout the period of the license renewal.

There is a very strong reliance on current regulations, and that means that any changes to these regulations must be considered with respect to their potential impact on license renewal and extended plant life. They have to be tracked from that point of view.

Further, successful long-term operation depends on maintaining corporate memory for safe, efficient operations as utility and regulatory staff and cultures change over the lifetime of a plant. We have seen some of these effects over the lifetimes of the plants that are operating now.

The ACRS has not reviewed these in-depth, but from my own point of view, I think the approach developed by the

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staff and the industry appears to be appropriate, and as you know, we have a statutory responsibility to provide our findings on license renewal just like we did for initial licensing, and this will require a lot of work and the resources of the entire committee. We take that responsibility seriously and will report to you as time goes on.

CHAIRMAN JACKSON: Thank you.

DR. FONTANA: So that's about all I had to say.

COMMISSIONER MERRIFIELD: One brief question. We're going to testify before the Senate Environment Committee tomorrow. Is there anything -- and there's a preferred answer to this question -- is there anything that you have found so far that would lead you to conclude that we will be unable to make the Commission's self-imposed deadline of 30 to 36 months for the renewal of the Oconee and Calvert Cliffs licenses?

DR. FONTANA: I really can't comment on that because it's going to be a tight schedule, and we haven't gone to the depth to really answer that question. But I understand from talking with the Staff that that schedule was put together under the assumption that everything goes like clockwork, and it allows, I think it's six weeks for --

DR. UHRIG: External review?

DR. FONTANA: Pardon?

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DR. UHRIG: For hearings and that sort of thing, and that's normally pretty tight.

DR. FONTANA: So, as you know, most things don't go like clockwork, so I don't know what -- I really can't answer your question. It's a tight schedule, and it probably could be made, but if someone really throws a monkey wrench into the works, it's problematical.

COMMISSIONER MERRIFIELD: But there is nothing you have found so far that would lead you to a conclusion other than that?

DR. FONTANA: I don't really think so.

COMMISSIONER MERRIFIELD: I mean you say -- it could be a situation where we may encounter something that we force a delay?

DR. FONTANA: Yes.

COMMISSIONER MERRIFIELD: But so far you haven't seen anything that would cause a delay?

DR. FONTANA: Nothing obvious.

COMMISSIONER McGAFFIGAN: The issue of resources for you and for us comes up, as you just mentioned, in passing. We are budgeting I think in 2000 for four renewal applications. We know we are going to get one from Arkansas Nuclear 1, and others will come in. If these first go well, and fairly promptly, how much of a diversion, and a very important diversion, is this going to be for you all, as you

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-- in the next year as you deal with Oconee and Calvert Cliffs applications, what fraction of your time is going to be taken by those two?

DR. FONTANA: I'll answer and defer to our chairman, but it's a very high priority activity for us, and I think it will take our resources and needs. There is some other work that's trying to tail off, but there are obviously other things that we have to do. We may have to make some priority determinations on some things that we simply won't look at because it's of probably lesser importance.

CHAIRMAN JACKSON: Do you have an operating plan?

DR. POWERS: We sure do, and we have a self-assessment, and we are doing an update on that and a report on that.

DR. KRESS: We think the reviews of the technical documents being produced by the industry, they will used probably for reference, will be a great help, because it

will take a lot of up-front review on our part of those technical documents, and once we are through with that, I think the later reviews will go a lot faster. It will be slow at the start, but I think it will speed up.

CHAIRMAN JACKSON: Okay.

DR. POWERS: Well, that takes us through the first line items. We have three what I would call, if there's

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time available, items. Did you want to go on through those? We have destroyed whatever schedule you had.

CHAIRMAN JACKSON: Well, I'll poll my colleagues. I mean we could potentially devote maybe 15 more minutes and see if we can close them out.

DR. POWERS: Sure. I think Dr. Uhrig has some important points he wants to make on our report on research for this year, so I'll ask, Bob, if you could hit the high points on that.

DR. UHRIG: Thank you. In Staff Requirements Memorandum dated September, the Commission requested that the ACRS review a number of issues. This resulted in an extensive review last year under the leadership of Chairman Powers, and the result was NUREG 16.35, Volume 1, which I'm sure that you are all familiar with, and I won't spend the time repeating the recommendations which are in the slides for the information of anyone who does not have access to that report.

I'd like to take about 30 seconds and talk about the report we are looking at for this year. We have a number of candidate topics listed here. PRA research for risk and performance-based regulation; high burn-up fuel performance; thermal hydraulics code; and the integration of the in-house capabilities; advanced instrumentation and control; license renewal; and there may be some work in

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decommissioning through the ACNW, that's yet to be determined; and the last one listed here is the shutdown of low power operations risk.

Now we do not expect this to be anything remotely as extensive as the last report because of the limited scope as well as the nature of the report that we are preparing here. We have been meeting on a regular basis with the Staff and the management of the Research organization within NRC, and we expect momentarily to get feedback upon the report from last year. And I think that's very important in terms of our addressing continuing the dialogue with the Research.

And that's basically where we are.

CHAIRMAN JACKSON: You mentioned that the NRC should adopt a systematic framework for the design and engineering of the research program that enforces a close tie between the research activities and agency needs. And you ran through a list of things, but do you feel that there could have been a better balance or coupling in the past between the conduct of aging research in preparation for license renewal, or the work on high burn-up fuel prior to licensees requesting conversion to higher burn-ups?

DR. UHRIG: The research by its very nature is long term.

CHAIRMAN JACKSON: Of course.

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DR. UHRIG: And the problem you run into is that

an applicant comes in, he has a problem, he wants it addressed immediately, and if you have waited to start your research program until you get that request, you are already behind. And it's a very difficult issue. You do need this anticipatory research, and we can in hindsight say, well, we should have been able to see ahead that we are going to need this. Well, I think the Commission did a good job in a number of areas, for instance, in the aging area. I think they did a fine job of anticipating what was going to happen as license renewals came in.

CHAIRMAN JACKSON: Well, the reason I raise the question is I mean you yourself just mentioned anticipatory research, and there always is that question, and sometimes controversy, in terms of the balance. And if you make a statement about enforcing a close tie between research activities and agency needs, then I assume you mean by that anticipated as well as current agency needs.

DR. UHRIG: Yes, absolutely.

CHAIRMAN JACKSON: Because if that is not clear, there is a tendency to have user needs driven, today's user needs driven by research programs, and some of us might argue that's not research at all, that it's technical analysis. But it's not necessarily research.

So but you do mean both current and anticipated --

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DR. UHRIG: Yes, ma'am.

CHAIRMAN JACKSON: -- needs, but one has to be clever about trying to anticipate; is that a fair statement?

DR. UHRIG: Yes, it is.

CHAIRMAN JACKSON: Okay.

DR. POWERS: You will recall that we asked for a much more comprehensive planning and felt that the users need system itself needed substantial revision, yet a proper appreciation of what the agency's real mission needs are.

CHAIRMAN JACKSON: Okay.

DR. POWERS: We now come back to the area that's becoming our crusade, in the area of risk-informed regulation and Professor Apostolakis --

CHAIRMAN JACKSON: Well, let me just ask you to do something, because I think to some extent, Dr. Apostolakis, you have talked to some of the issue of the impact of PRA results on the regulatory system.

DR. APOSTOLAKIS: Yes.

CHAIRMAN JACKSON: And so what I would prefer you focus on is VI.B, since that is not a topic that's been explicitly addressed today.

DR. APOSTOLAKIS: Okay. The elevation of CDF from a safety goal and possible revision of the Commission's safety goal policy statement.

The reason why we felt core damage frequency goal

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should be elevated from this level is on slide 41. Well, the reason is not there -- well, it is. It's No. 3, that if you work backwards from the qualitative health objectives that the Commission has promulgated, and use reasonable ranges for a site model and the containment failure probabilities, you end up with core damage frequencies that could be tolerated and still meet the goals, in other words, that are maybe 10 to the minus 3 for some plans, and we believe that for defense-in-depth purposes again and so on, that would not be acceptable, 10 to the minus 3. So -- and,

in fact, we have been using 10 to the minus 4 for year after year as sort of a given, and we are bothered by the fact that this is really a policy statement -- a policy issue that the Commission should address, and should not become de facto out of the way we are doing business. So that's why we are recommending that this be elevated.

CHAIRMAN JACKSON: Are you could say validated --

DR. APOSTOLAKIS: Or validated, yeah. Yeah, sure.

Then, of course, if you start looking at the safety goal policy statement, there are other things that would be useful to reconsider and maybe include. So it's 42, we are saying that the measures of societies should be reconsidered. We want to talk about the number of fatalities, talk about environmental contamination, and so on, since we are revisiting, or proposing to revisit the

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safety goal policy statement.

Then there is the issue of how to formulate them. I'm sorry?

CHAIRMAN JACKSON: Please.

COMMISSIONER McGAFFIGAN: We opened up the safety goal policy statement, you just said in a conversation earlier that Europeans have a de facto, much tighter safety goal. It's conceivable that public comment will come in strongly on the side of adopt that European standard; if it's good enough for the Europeans, why isn't it good enough for us. Are you ready for that debate?

DR. POWERS: It's almost assured to happen, that somebody will make that comment. Unfortunately, there is not a European standard, there are lots of European standards. I think you just have to concede they are going to --

CHAIRMAN JACKSON: Well, one could argue that in promulgating the reg guides and having them out for public comment -- and that's what you're saying we need to come around, with the de facto; we've done some of this, if it's being memorialized in those reg guides.

DR. APOSTOLAKIS: Now on site 43, we are addressing something that is a reality again but has not been recognized in the books. I think there are really two numbers, again they are not crisp numbers, but numbers that

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are being used by the Staff to decide on action. A goal of 10 to the minus 4 for CDF, for example, is what everybody is talking about, but if we exceed the goal, we would like to know why, and whether to take any action, and we have 19 BWR units that according to the IPEs are above the goal.

The moment you get down to 10 to the minus 3, though, you see immediately action. People are flying over there to find out why and what's going on and so on. So there is this trigger effect up there. So why not then think about formulating the safety goals in terms of three regions, which is not a very novel idea, other people have tried it and I found out recently rejected it.

But the idea is this: if you are above the goal, you are necessarily unsafe. You are not unsafe, in fact, not necessarily. I don't need the word necessarily. You just -- there will be increased regulatory attention. Why are you there? Can you do something, you know, on a cost-benefit basis, to reduce the core damage frequency? The moment you hit the upper limit, though, that of course is not a factor any more. Now you are unsafe and we want

you to correct that. Otherwise, we will shut you down.
COMMISSIONER McGAFFIGAN: Can I just ask -- every time they come in, we talk about the total number versus the differential numbers, and which we should have more faith in. But we recently had an AEOD study that said initiating

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event frequencies are indeed lower than assumed.
DR. APOSTOLAKIS: Yes.
COMMISSIONER McGAFFIGAN: In various PRAs and IPEs and maybe a factor of five -- did everybody get a factor of five, are all these BWRs no longer above 10 to the minus 4?
DR. APOSTOLAKIS: No, they are not
COMMISSIONER McGAFFIGAN: Okay. I was just hoping.
DR. APOSTOLAKIS: I don't think so.
COMMISSIONER McGAFFIGAN: But how do you use a number which everybody admits is not as good as a differential number, as something that's a regulatory tool?
DR. APOSTOLAKIS: Oh, I wouldn't treat it any different from the goal itself. I mean we do know the 10 to the minus 4 is not really a crisp number, that it should be -- the 1.2 10 to the minus 4 work is not over. So I would treat it the same way, but I think the --
CHAIRMAN JACKSON: Well, I think the problem is to be talking about mean values. You never talk about it without really talking about --
DR. APOSTOLAKIS: I would talk about mean values.
CHAIRMAN JACKSON: -- confidence intervals and uncertainties. I think we --
DR. APOSTOLAKIS: That may be a part of it, but even --

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CHAIRMAN JACKSON: The discussion needs to be a little more sophisticated.
DR. APOSTOLAKIS: That's right.
CHAIRMAN JACKSON: In application.
DR. APOSTOLAKIS: That's correct.
CHAIRMAN JACKSON: Maybe not in a Commission meeting, but in application.
DR. APOSTOLAKIS: But even if you want to work only with mean values, there is still this different attitude between the two numbers. And all we are saying here is maybe we ought to look into it and come up with a three-region approach. And then -- this is basically it.
DR. POWERS: I think that covers the topics that we wanted to talk to you about, besides asking if you have any additional questions?
CHAIRMAN JACKSON: No, I think that is -- well, let me just thank you for another very informative briefing. I think we covered a lot of ground, and I think sometimes we have given short shrift in worrying about the time, but we thought we'd do it faster. But I think it was worthwhile because the topics of today's presentation really are focused on a number of issues critical to our maintaining and improving our ability to regulate effectively. So I encourage you, the ACRS, to continue to provide your perspective to the Commission on these issues important to

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our mission, and I look forward to continuing to hear from you, but ask you to be forward-looking. But I will ask you

if you would specifically think about this issue of relative to 50.59 and focusing on what some key questions are whose answers would lead us to some resolution, if you can't see a specific way or if the Staff and the NEI can't come to some resolution, and to do it on the short term, as soon as you can. And then I think there needs to be some amplification of this playoff of what I'll call the surrogate, CDF, LERF, and others that may not have been discussed with defense-in-depth, where it puts you along the line, because I think that's a very helpful discussion in terms of our being able to rationalize the one system to the other and potentially to make progress, given our existing framework, and given that we do have containments over all of our nuclear plants.

So on that note, we are adjourned. Thank you.

[Whereupon, at 3:20 p.m., the briefing was concluded.]