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NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

JULY 11, 2000

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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MEETING: RELIABILITY AND PROBABILISTIC RISK ASSESSMENT

USNRC

11545 Rockville Pike, Room T2-B3

Rockville, MD

Tuesday, July 11, 2000

The committee met, pursuant to notice, at 1:00 p.m.

MEMBERS PRESENT:

GEORGE APOSTOLAKIS, Chairman, ACRS

MARIO BONACA, Member, ACRS

THOMAS KRESS, Member, ACRS

DANA POWERS, Member, ACRS

WILLIAM SHACK, Member, ACRS

JACK SIEBER, Member, ACRS

ROBERT UHRIG, Member, ACRS

ROBERT SEALE, Member, ACRS

PARTICIPANTS:

MICHAEL T. MARKLEY, ACRS Staff Engineer

ERIC HASKIN, RES

T. KING, RES

MARY DROUIN, RES

BOB CHRISTIE, Performance Technology, Inc.

C O N T E N T S

[1:00 p.m.]

DR. APOSTOLAKIS: The meeting will now come to order. This is a meeting of the ACRS Subcommittee on the Reliability and Probablistic Risk Assessment. I am George Apostolakis, Chairman of the Subcommittee. ACRS members in attendance are: Mario Bonaca, Tom Kress, Dana Powers, William Shack, Jack Sieber, Robert Uhrig, and Robert Seale.

The purpose of this meeting is to discuss the NRC framework for risk informing 10 C.F.R. Part 50, described in SECY 0086 and related matters. The Subcommittee will gather information, analyze the relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full committee.

Michael T. Markley is the cognizant ACRS staff engineer for this meeting. The notice of this meeting was not published in the Federal Register in sufficient time to inform the public properly. Therefore, we will keep the transcript record open for ten additional days subsequent to the availability if this transcript to the public to enable persons desiring to have written comments and oral statements entered into the official record to do so. A transcript of the meeting is being kept, and will be made available as stated in the Federal Register notice -- as it is usually stated in the Federal Register notice.

It is requested that speakers first identify

themselves and speak with sufficient clarity and volume so that they can be readily heard. We have received no written comments from members of the public regarding today's meeting. However, Mr. Bob Christie of Performance Technology, Incorporated has requested time to make a presentation concerning the staff's proposed framework for risk informing 10 C.F.R. 50, Option 3, and the proposed revision to 10 C.F.R. 50.44.

We will now proceed with the meeting, and I call upon Mr. Tom King of the Office of Research to begin.

MR. POWERS: Bob, before we begin, I need to point out that I'll have an organizational conflict of interest over the discussions of 50.44.

DR. APOSTOLAKIS: So noted.

MR. KING: Okay. Thank you, Mr. Chairman. For the record, I'm Tom King from NRC's Office of Research. With me at the table are Mary Drouin, section leader in the PRA branch in research and Eric Haskins, who's I believe a subcontractor to Sandia, who's one of our prime contractors on the whole Option 3 risk informing Part 50.

We prepared a presentation to walk you through the framework, but I know when we set this meeting up, you said you had a number of questions on it, and I didn't know what the best way to proceed is. If you want us to just start through our high level presentation and you bring your

questions up at the right time, or do you have another way you'd like to proceed?

DR. APOSTOLAKIS: Unless the members have a different opinion, I think that would help us focus our attention. So, we can start with the prepared slides.

MR. KING: Okay. What we prepared was sort of at a high level to walk through what is the framework, what are the key elements of it, particularly things like defense in depth and the risk guidelines, and when we get to the end, some of the key issues, particular the policy issues. So, Mary will take the lead and walk you through the presentation. Thank you, Mary.

MS. DROUIN: Thank you, Tom. I'm not sure if it's thank you.

Starting with the framework at high level, in putting together the framework, we put it together such that, you know, it was going to apply when we looked at the regulations to risk inform them, but it would go beyond just the actual regulations, but also to help us when we looked at the regulatory guides and look at DBS's, et cetera. It was to help us both screen and formulate the technical requirements.

When I talk about screening, to decide whether or not a particular technical requirement should be in the regulation, whether it really had any risk significance, and

then looking at the concern that was on the table and in formulating the regulation, how should that particular requirement be formulated from a risk informed perspective.

So, given that kind of where we were heading, we put together a framework. We feel it's what we call a risk informed, defense in depth approach. Then you ask well, what do we mean by that, and that kind of leads into the next bullet. That is based upon the strategies of prevention and mitigation. In looking at those particular strategies, we were mapping those directly from the cornerstones from the plant oversight, the cornerstones for safe nuclear power plant operation. I don't know if I've quoted that directly, but we wanted to be consistent with the cornerstones, and so we're looking at prevention and mitigation. We'll come a little bit later because there's strategies for prevention and mitigation which we will also tie back to the cornerstones.

Then looking at prevention and mitigation, what do you do with these? We also came up with what we call tactics, and that would go about telling you how you would implement those two strategies. The analysis under which you were going to formulate your requirements would also take into consideration both your design bases and your severe accidents so you were able to focus on, you know, your risk significant accidents.

DR. APOSTOLAKIS: Maybe this is a good time to raise some comments.

MS. DROUIN: Sure.

DR. APOSTOLAKIS: I'll try to also give you comments on the document.

MS. DROUIN: Right. We have copies of the document with us.

DR. APOSTOLAKIS: Which I understand you have already updated, but I'm sure the comments apply.

MR. KING: Yes, this has been a living document from the March version to an updated version, and ultimately in August, we hope to send the Commission sort of a final revision.

MS. DROUIN: You have the update. We gave you the updated last time, so I don't know which one you're going to be talking to.

DR. APOSTOLAKIS: I'm going to be talking to the one before, but I will give you the section numbers.

MS. DROUIN: Okay.

DR. APOSTOLAKIS: As I started saying at the previous Subcommittee meeting -- that was a Subcommittee meeting, right? It seems to me this is really what we call in the paper from the ACRS the preliminary proposal. It's not just defense in depth. It's defense in depth at the high level, but then it's rationalist at lower levels.

I believe the document itself says this because in chapter two, you do have discussion of the structuralist model, but then in chapter four, under the question number three, how will uncertains be accounted for in risk informing existing regulatory requirements. I think that survived. You have, in the paragraph there, decisions regarding lower level defense in depth in the form of redundancy or diversity are generally well suited to this type of analysis, and that refers to PRA, which is rationalist approach.

The other point, when I read chapter two, I mean, there was this discussion of the structuralist approach and that this is a high level defense in depth. There is sort of a vacuum there. It doesn't tell you what to do after that, okay? However, if you go to chapter four, realize that the rationalist approach is at the lower level.

So, I was wondering whether the discussion in chapter two can be edited to say look, this is structuralist at the high level, and rationalist to the extent possible at lower levels, which is a preliminary proposal, okay?

MR. KING: Yeah, I think --

DR. APOSTOLAKIS: So, that's all my -- I mean, it sort of leaves it hanging there, and then you realize, you know, two chapters later that it's really rationalist at lower levels. I don't know if anybody -- Dr. Kress will say

that it's rationalist all the way. The point is that the structuralist at the top, because of the uncertainties, are very large, but we don't want to push it that far.

The other thing about the structuralist, the discussion in chapter two, there is a lot of discussion that's borrowed again from the ACRS letter, but it seems to me that the primary point which should be made is that we have always tried to handle uncertainty, but before 1975, we really didn't have quantitative measures of uncertainty. So, defense in depth and safety margins was a way to handle them. After that, we've quantified uncertainty, so now we can use some quantitative measures to evaluate how good these defense in depth measures are.

I think we need a little paragraph here, somewhere in Section 2.2, the defense in depth approach, explaining that. It would fit very nicely because it says here defense in depth has evolved since the first research reactors were designed in the 1940's, you know, and go from there. Then it jumps too quickly into the rationalist instruction. Before that, we can say that it was a way of handling the uncertainties that people knew existed in these analyses, but they could not quantify it.

MS. DROUIN: George, have you marked up a version with these comments that we could --

DR. APOSTOLAKIS: Yes.

MS. DROUIN: And you will give those to us?

DR. APOSTOLAKIS: I usually don't, but I will turn to my cognizant federal official here.

MR. MARKLEY: George, you can share your comments with the staff.

DR. APOSTOLAKIS: I am sharing my comments with the staff now.

MR. MARKLEY: But did he share his mark-up with the staff. Well, as much as you can share in a public meeting.

DR. APOSTOLAKIS: Can I share it with my friend, Mary, offline?

MR. KRESS: We have done this in the past.

MR. KING: We have done it.

DR. APOSTOLAKIS: I have no problem sharing.

MS. DROUIN: That would help us.

DR. APOSTOLAKIS: You would probably need to call me to decipher some of these things here. These are what intended to be personal notes.

MR. KRESS: Well, you have to delete all the swear words.

[Laughter.]

DR. APOSTOLAKIS: No, some of it is in Greek. No, no.

MS. DROUIN: I have a Greek dictionary.

MR. POWERS: The ones of high praise for the senior author.

MS. DROUIN: No, I mean, I'm taking notes, and of course, there's a transcript.

DR. APOSTOLAKIS: I understand.

MS. DROUIN: But it does help to have your handwritten.

DR. APOSTOLAKIS: We can easily run a copy, in fact, right now so you have it in front of you as we talk.

MS. DROUIN: That would be even --

MR. MARKLEY: We can do that.

DR. APOSTOLAKIS: Yeah.

MR. BONACA: Can I get --

DR. APOSTOLAKIS: Now, there is --

MR. BONACA: I would like to make a comment to that?

DR. APOSTOLAKIS: Yes.

MR. BONACA: I have no objections. I as a member don't particularly care about this discussion of structuralistic position, at least in this document. I mean, I understand where we're going. We're discussing at length. It sounds as if the world is divided into two type of people that think differently. I believe there are historical reasons why regionally people have structuralist thought, because they didn't have risk analysis.

DR. APOSTOLAKIS: That's what I just told you.

MR. BONACA: Yeah. I'm saying that the way this has developed --

DR. APOSTOLAKIS: It was a matter of handling uncertainty.

MR. BONACA: -- you know, somewhat makes you believe that, you know, like two different religions.

DR. APOSTOLAKIS: Yeah, that's why we need this bridge.

MR. BONACA: Yeah, and I believe I'm in both religions.

DR. APOSTOLAKIS: Yeah. The reason was, you know, essentially handling uncertainty, and in the first 20 years or so, we didn't have the benefit of quantification. So, people resulted to these two principles.

MR. BONACA: I don't think that we should encourage almost a conflict today, just recognize the reality of where we can from. We didn't have risk analysis. We didn't have the ability of evaluating that. So, that's all I wanted to say.

DR. APOSTOLAKIS: Well, there's no conflict. The point is that even after risk analysis came along, there are still big holes. So, you have to go back and revert to the original approach of defense and depth in margins. It's very simple idea. We're not talking about anything which is

deeply philosophical here. I think it's important, especially for people who haven't seen these things before. You have one paragraph explaining.

MS. DROUIN: I agree. Let me translate what I think I'm hearing, and if what I heard is incorrect. I mean, what I'm hearing is that at a basic level, in the way we have developed this framework with this structuralist and this rationalist, that the concept is not in question.

DR. APOSTOLAKIS: No.

MS. DROUIN: It's a good explanation of how we've done it.

DR. APOSTOLAKIS: Right.

MS. DROUIN: So, I welcome any comments that helps clarify and explain that better.

DR. APOSTOLAKIS: Yeah.

MS. DROUIN: But I'm not hearing that there's a basic disagreement with the concept of how the framework has been --

DR. APOSTOLAKIS: There will be some more comments as we go along, but fundamentally you're right.

MS. DROUIN: Okay.

DR. APOSTOLAKIS: I mean, you're not going to hear no, throw this out of the window, at least not from me. Subcommittee member, of course, may have different views, but I thought, and I believe the committee itself had seen

the overall framework months ago.

MS. DROUIN: Yes.

DR. APOSTOLAKIS: And there was praise. So, you can certainly change your minds today, but it's not my comment.

MR. BONACA: My only comment was, again, that on page two. Maybe there is, would be a full recognition of the fact that there are historical reasons why, I mean, there were more structuralists before and there are more rationalists today.

DR. APOSTOLAKIS: They agreed to do this. That's what Mary said.

MR. BONACA: That's all I wanted to point out.

DR. APOSTOLAKIS: The historical reasons is the lack of quantification of uncertainty.

MR. KING: There are a number of places in here where I think some additional explanation would be useful, some better packaging.

MS. DROUIN: Yes.

MR. MARKLEY: I'd just like to say one thing. The version that George has is the same one that was issued for public comment. So, anyone that's referring to it from the transcript discussion as best we can reference the sections, it would help people better understand that because that particular document is available in the PDR.

DR. APOSTOLAKIS: Okay, that's what I'm using.

MS. DROUIN: But the only difference between the version that was in the SECY and the May version is chapter five.

DR. APOSTOLAKIS: Okay.

MS. DROUIN: Any differences in chapters one, two, three and four would have been editorial. Maybe we caught typos, but it didn't change.

DR. APOSTOLAKIS: If I bring up a point that you have already responded to, just tell me and we'll go on. The only reason I haven't read the new version is I was out of the country the last week, so I didn't have time to do it. So, basically that was my comment, that chapter two, especially 2.2, where we talk about the defense in depth approach. Actually -- yeah, it should be edited to accommodate, you know, my comments, Mario's comments, and create a better package. The other question --

THE COURT: Can I ask one more question?

DR. APOSTOLAKIS: Yes.

MS. DROUIN: Because I got a sense at our last meeting, and maybe that was incorrect, that even the organizations from chapters two and chapter three to chapter four could really be completely repackaged. It wasn't just adding paragraphs here and there. I got the sense that certain things and certain chapters, whole parts of it

should come out and be moved elsewhere. I just wanted to revisit if that was --

DR. APOSTOLAKIS: Ask me which ones. I wouldn't be able to tell you right now, but I didn't find that problem when I read it.

MS. DROUIN: Okay.

MR. KING: Well, you mentioned we overemphasized that, you know, we're not to rely too much on the numbers. We kept saying it over and over again.

DR. APOSTOLAKIS: Yeah, there were editorial comments throughout.

MR. KING: That kind of thing.

DR. APOSTOLAKIS: Yeah. I mean, starting right away in Section 2.1, however, quantitative objectives would not generally appear in specific regulations, and then that's repeated every chance you get. So, immediately I thought of a common cause there. I mean, there must be a reason. Somebody was scare that numbers might appear someplace and commit a cardinal sin.

MR. KING: Like NEI.

DR. APOSTOLAKIS: Huh?

MR. KING: Like NEI.

MS. DROUIN: Well, NEI had the exact opposite interpretation. They read it saying numbers were going to appear in the regulation, so it may be in the eye of the

beholder.

DR. APOSTOLAKIS: Before we leave the issue of defense in depth, I realize some of these things come from our paper, and I suspect that paper is not perfect. The structuralist says here, or traditionalist model asserts that defense in depth is embodied in the structure of the regulations and in the design of the facilities built to comply with those regulations.

I've heard many people tell me that this is a lousy definition. If you want to define the structuralist approach, you are not doing it.

MR. KRESS: That's a description of it, not a definition.

DR. APOSTOLAKIS: It's a description, really of why it was. So, I think in the context of the historical context of lack of quantification and handling uncertainty by adding successive compensatory measures, I think that would go a long way towards explaining the structuralist approach. And then it was embedded into the regulation. We did that everywhere. Okay? You see that paragraph?

MR. KING: Yeah.

DR. APOSTOLAKIS: The other thing that's missing here, and I think that's a more important point. Do you want to say anything about safety margins, because defense in depth and safety margins were really the cornerstones

handling uncertainty the traditional system, were they not? Not just defense in depth. So, the question might come up, why is this new approach an overemphasizing defense in depth and not safety margins?

MR. KING: To me, safety margins are an element of defense in depth, and maybe we'll talk about that.

DR. APOSTOLAKIS: You can view them as such. There's no question.

MR. KING: At the high level, it's defense in depth. Safety margins are maybe a tactic. We call them tactics, to implement defense in depth and to account for uncertainties in some things. I mean, to me, safety margins really are more applicable when you're talking about I want to do a deterministic calculation and meet some acceptance criteria, but I've got some uncertainty in how good my code is, and I've got some uncertainty in how good my acceptance criteria are, so I throw some margins in there. I back off on the acceptance criteria. I do a conservative calculation. I do 95 percent confidence. When you're getting into things like reliability and availability, the term safety margins to me doesn't fit that well.

DR. APOSTOLAKIS: No, it doesn't.

MR. KING: And then you're getting into redundancy, diversity, that kind of stuff.

DR. APOSTOLAKIS: Well, the whole point is that in

regulatory guide 1174, as you know, safety margins have their own box.

MR. KING: Right.

DR. APOSTOLAKIS: Alongside with defense in depth. So now, this new document takes margins and puts them under defense in depth, which is fine with me, but maybe we should say that. I don't know, maybe we shouldn't.

MR. KRESS: The safety margins I'm familiar with mostly apply to success criteria, which deal with, in an uncertainty sense, very well in PRA's.

MR. KING: Right.

MR. KRESS: So, you know, that's why we have safety margins, because you -- but maybe you could tie it in that sense together.

MR. KING: But George is right in that in 1174, they're sort of two equal separate things.

MR. KRESS: Yeah.

MR. KING: But in the framework, they're not separate.

MR. KRESS: I don't think they should have been equal in the 1.174. I like them better being part of defense in depth, actually.

DR. APOSTOLAKIS: I have no problem with that.

MR. KING: I mean, to some extent, the framework represents an evolution of thinking since 1.174 was put

together.

DR. APOSTOLAKIS: And I think it would be perfectly all right to say that because, you know, not everyone is up to speed, you know, with these documents as you guys are. Just explaining, I mean, when you say 2.2 defense in depth, maybe somewhere there you say that by the way, defense -- I mean, safety margins are considered an element of defense in depth.

MR. KING: Yeah.

DR. APOSTOLAKIS: So the last comment on 2.2 is this, you know, bring back the rationalist at lower levels with the uncertainties, which is as I say, the preliminary framework we purport. In section two on -- I just saw my notes -- there is a problem that I think we have to resolve once and for all, though.

The first paragraph on the right-hand column --oh, boy. This is not the new version, right?

MR. KRESS: I've got the old version. What page are you on?

DR. APOSTOLAKIS: The NRC has established safety goals.

MS. DROUIN: What page are you on?

MR. KING: Yeah, what page are you on?

DR. APOSTOLAKIS: Section 2.1.

MR. KING: Okay.

DR. APOSTOLAKIS: Yeah, the revision dated May, 2000. Actually, the paragraphs starts on the left-hand side.

MR. KING: We found it, yeah.

DR. APOSTOLAKIS: Although licensees are not required to demonstrate that they meet the quantitative goals, comparisons of PRA to IPE results to the goals are common. Okay, my problem is that okay, then it goes on and says it is proposed in this document that quantitative objectives be used to provide guidelines for risk informing existing regulations.

The first paragraph of this section talks about the Commission referring to this standard as either the adequate protection or the no undue risk standard. What are we talking about, goals or undue risk, and what should the numbers be, the ones that are being used in the framework? Should they be goals or numbers representing in some sense adequate protection?

MR. KING: They're not numbers representing adequate protection. They're guidelines for the staff to use when they take a look at the existing regulations and have to decide are there holes in the regulations? Are there things in the regulations that are overkill and really aren't contributing much to safety? There are sort of guidelines for what's the baseline of safety that we're

shooting for where we can quantify that. The fact that they're based upon the Commission's safety goals means that they're really written at the level of how safe is safe enough.

They're not intended to define adequate protection. They're not something that we expect licensees to come in and have to demonstrate compliance with either. That was an issue NEI raised. They looked at the framework and said my God, am I going to have to as a licensee do some analysis to show that I meet this framework? No, the framework is for the staff.

MR. KRESS: I think it's entirely appropriate that you write your regulations in a sense that you're trying to meet the safety goals and stay away from adequate protection.

MR. KING: Yeah, you don't have to deal with the adequate protection question.

MR. KRESS: You don't have to deal with it that way.

MR. KING: And besides --

MR. KRESS: I don't think we have to resolve anything. I think that's what safety goals were intended to be.

MS. DROUIN: Well, the other thing, by having a guideline, you certainly don't want to write a requirement

that's going to be more stringent than the safety goals.

MR. KRESS: Yeah, you certainly don't want to do that.

MS. DROUIN: And so, by having the quantitative guidelines, that kind of gives us the measure so that we know that we aren't going past the safety goals.

MR. KRESS: The problem I may have with it is that the current regulations have objectives that are more than just safety goals. They're objectives of limiting fission product releases, and most of your quantitative guidance has to do with core damage frequency and conditional containment failure probability, and you don't deal with fission products at all. I have a little bit of a problem handling that because I don't think you can get away from fission products altogether.

MR. KING: And there are things --

MS. DROUIN: I don't think we did.

MR. KRESS: Well, I didn't see anything that would, say, deal with something like 10 C.F.R. 100 because it's not a risk dominant concept. It's just a way to limit the releases of certain levels of fission products to certain frequencies, in my mind, that's what it is. But those aren't risk dominant, and they don't involve containment failure. They do involve some level of core damage frequency.

MR. KING: It's the same issue as anticipated operational occurrences. They're not risk dominant, but we don't want to throw away the concept. We still want plants to be able to ride through those without any damage. So, there are things like that that we have to deal with.

MR. KRESS: And I guess you still deal with those by maintaining the design basis accident concept somehow.

MR. KING: We can deal with those at the structuralist level. See, there are some things, and we'll get to a viewgraph on that. There are some things --

MR. BONACA: I mean, although you're not looking really at those goals numerically as criteria that you have to meet, you're still using this as a way of looking at possible gaps in the fabric of regulation.

MR. KING: Right.

MR. BONACA: Okay.

MR. KING: And particularly severe accident gaps.

MR. BONACA: Okay, so you're looking at it, yeah.

DR. APOSTOLAKIS: In the past, thought, when the staff wrote regulations, you had in mind adequate protection, didn't you?

MR. KING: No, number regulations were based upon safety enhancement, station black-out. You had to do cost benefit analysis.

DR. APOSTOLAKIS: Yeah.

MR. KING: That's not adequate protection.

DR. APOSTOLAKIS: Right, but you had to do a cost benefit analysis.

MR. KING: Yeah.

DR. APOSTOLAKIS: And now we're talking about the framework, the regulatory framework which will actually not be based on adequate protection, and there will be no cost benefit evaluations.

MR. KRESS: Voluntary.

MR. KING: Well --

DR. APOSTOLAKIS: It is voluntary.

DR. SHACK: Well, there is a question of how you apply cost benefits. Is it regulation by regulation, which is the way we do it now, or is there some overall kind of cost benefit? That seems to be the --

MR. KING: The whole issue f backfit cost benefit is a policy issue the Commission's going to have to deal with, and it could range anywhere from maybe since this whole thing is voluntary and we're just providing an alternative to an existing regulation, maybe we don't need to do any backfit analysis. Or, maybe we do need to do some backfit analysis, and if we do, is it piece by piece within a regulation, or do you bundle all the changes within a regulation together and do it?

MR. BONACA: Again, it's interesting, but still,

for example, say that you have a generic safety issue that you raise. Okay, you could bring it through this process, and then through that determine that we have adopted the regulation for the specific issue. Then you can use a criteria like ten to the minus six cut off point to determine whether or not you should do something about that.

MR. KING: Yes.

MR. BONACA: So, you're still not looking at the absolute, you know, CBF nerve, but you're possibly using criteria of that type to determine whether or not you should go ahead with that enhancement.

DR. APOSTOLAKIS: I think I'm a little uncomfortable with this, and I wonder if there can be -- I mean, is the industry aware of what you're doing, of the distinction between adequate protection and goals and they have agreed that what you're doing is okay? I've heard them complain that this is becoming too risk based, but that's not the same complaint. That's their usual whining. The question is do they fully understand that you are using numbers that were meant to be indicators of safe enough rather than adequate protection?

MR. KING: We met with the industry, discussed this issue specifically with them, among other issues, and they did not object. They seemed to understand.

MR. KRESS: As long as you're not trying to force

each individual plant to meet those numbers, I don't think they'd have any problem with it.

MR. KING: Again, we're making generic changes to the generic set of regulations. We're not asking each licensee to come in and demonstrate that he meets these numbers.

MR. KRESS: They shouldn't have any problem with it because I suspect they feel that the bulk of the plants already meet them anyway.

When you go to the Commission with these policy issues like funneling cost benefit and selective implementation, are you going to make your recommendations to them as to which way you'd like for them to go, or are you just going to leave it to them and say tell us what you want?

MR. KING: I think we ought to make a recommendation. That would be my view.

MR. KRESS: Do you want some input from us on those particular kind of issues then, or is that something for later?

MR. KING: These are going to be issues we're going to have to address in our August paper.

MR. KRESS: August paper.

MR. KING: Yeah, I would like the Committee's views, and we have a timing -- since you don't have an

August meeting, there's a timing issue about how we get that, but yes, I would like to get those views.

DR. APOSTOLAKIS: I think the Commission also should be presented with a clear statement that this is different from adequate protection. This is what we're basing it on for a certain reason. The center for strategic -- CSIS, asked that the Commission define adequate protection. My concerns is that if we start doing things like this, pretty soon before you know it, simply because these are the only numbers that are available, they will become measures of adequate protection.

MR. KRESS: And I would wave the flag and say good for them. They won't because nobody's going to define adequate protection, and nobody's going to put numbers into the regulations that each individual plant has to meet, not while I'm still on the Committee they probably won't.

MR. BONACA: These plants were not really licensed on the basis of this goal. They were licensed on the basis of meeting the regulation, whatever regulation was in place at the time. I don't think that there is an ambiguity there.

MR. KRESS: There's not much of an ambiguity because you can write the regulations, but they have to be read in such a way that they can be met in a variety of ways, so that some plants will exceed the goals and some

plants won't.

DR. APOSTOLAKIS: Let me put it in a different way. If Option 3 is based on these numbers, and by the way, there was a lot of discussion later of some other subsidiary numbers that are even more stringent for certain reasons. Are we de facto ratcheting up the regulation?

MR. KRESS: Well, we've always had this in the regulations. It's in the cost benefit rule and the regulatory analysis rule.

MR. KING: The reg analysis guidelines are in effect based upon the safety goal numbers.

MR. KRESS: And you have a safety goal policy statement that says policy is to write the regulations so that they try on average to achieve those kind of things, so it's been there. Actually, they show up in 1.174. It's the same numbers there, basically.

DR. APOSTOLAKIS: No one has the same concerns. It's not an objective. It's just a --

MR. KRESS: I've always been concerned that adequate protection has never had a quantified value to it because I think it's a little bit strange that we have such a concept and don't have a quantified number associated with it, but I think that's a different problem than this one. I think it's a different issue.

DR. APOSTOLAKIS: So the least we can do then is

in Section 2.1, maybe at the paragraph explain the number we are about to use are not protection numbers.

MR. KING: I think the document ought to be clear as to what these numbers represent in the relation to adequate protection.

DR. APOSTOLAKIS: Before we go on, I've been advised that it would be best at the end of this meeting you return the copy that we just gave you. Feel free to copy anything you want right now.

MS. DROUIN: We can't read it anyway.

DR. APOSTOLAKIS: I suspected that.

MS. DROUIN: I mean, the Xerox wasn't good enough.

DR. APOSTOLAKIS: But you can ask me to explain. That's during the meeting. Mario? I thought you had a question. Okay.

So, I think we beat this to death. Yes?

MR. POWERS: A question. When you focus your examination of the regulations on risk analyses, you usually have available to you things like core damage frequency and maybe even things like large early release frequency. I'm wondering what about late small release frequencies, which also has to be a part of public protection. How do you get measures on that to look at?

MR. KRESS: That was one of the things I had in mind when I said they didn't focus on some of the

objectives, and that was one of them. Late small releases would be something I would worry about.

MR. POWERS: I just made that up because it's --

DR. APOSTOLAKIS: Late small?

MR. KRESS: Yeah.

MR. POWERS: It's the opposite of large early release.

MR. KRESS: Yeah, and normally you can get it out of a PRA or some measure of it, but not very good. The regulations deal with those things, some of the ones that we have now. So, yeah, that was one of my concerns. How do you deal with those kinds of things?

DR. APOSTOLAKIS: I think they have something on that in the document somewhere. It specifically deals with latent cancers.

MR. POWERS: Containment failures.

DR. APOSTOLAKIS: A quantitative objective of less than .1 containment failure probabilities proposed, yeah, for a late large release in a core damage accident.

MR. KRESS: Yeah, but that's a late large. We're talking about a late small.

DR. APOSTOLAKIS: Late small?

MR. KRESS: And I would worry about early smalls also due to some of the bypass accidents.

MR. POWERS: I guess what I'm asking about is here

are some numbers that I don't see usually coming out of the PRA's. I don't know that it's not possible to get them, but for instance, PRA's usually, in the past at least, ones I'm familiar with usually said all accidents are over at 24 hours, whether they are or not.

When I look at the regulations and I see things that seem to suggest that you've got to maintain control room capability with outside intervention for seven days and 30 days and things like that, these are numbers that are not addressed by the PRA, and I'm wondering how you handle that kind of issue.

MS. DROUIN: When you go back and you look at the IPE's, there were certainly a select group. I don't recall how big the group was that terminated the accident at 24 hours, regardless of where they were. You did have analyses that went through the whole progression. We certainly have numbers from the IPE's on late releases.

What you don't see out of the IPE's in terms of numbers are numbers associated with small releases. We don't have those kinds of quantitative numbers from the PRA's. That's not to say we don't have them. We just don't have them. Data that we have all tend to center around your large releases both early and late. Then some of the late stuff, you know, is not consistent because of how they define late and how far they took the analysis.

So, on the late you kind of have a mixture.

MR. KING: Where we don't have risk information, seven days or something like that, we're going to have to make judgment using something else, or we leave that piece of the regulation alone.

MR. KRESS: A conditional containment failure probability could address if it's the full conditional over a whole time period. Do you limit the conditional containment failure probability to conditional early containment failure, or is it the whole conditional?

DR. APOSTOLAKIS: I think that's what I read, recover late, but also large.

MR. KING: It covers late, but what does late mean? Is late 24 hours? Is late -- I don't think late is seven days.

DR. APOSTOLAKIS: I think it's late, the opposite of early. Early is I think, the way I understand it, about three hours, is it not?

MR. KING: The neighborhood of four to six hours kind of thing.

MS. DROUIN: Yes.

DR. APOSTOLAKIS: Then late must be after that.

MR. KING: But there's a cut-off. I mean, you don't carry the analysis for 30 days.

DR. APOSTOLAKIS: No, no.

MR. HASKIN: By the same token, small is a complement of large. I mean, if you have the large and you have your PRA, you could extract the small release, but we haven't established it.

DR. APOSTOLAKIS: I'm going to be confused now by my colleagues because the two colleagues that have been speaking for the last ten minutes were the ones that objected to using frequent -- well, not so much the one to my right -- frequency consequence curves and the CDF and LERF point values were good enough.

MR. KRESS: I like frequency consequence curves. I just think --

THE COURT: But what happened? I mean --

MR. KRESS: Well, CDF and LERF happen to be a very convenient, in my mind, is a convenient representation of an FC curve, if you draw lines correctly between them.

DR. APOSTOLAKIS: Well, and the argument that --

MR. KRESS: And if you use the whole LC part of that and not just the end parts.

DR. APOSTOLAKIS: But in terms of early fatalities, I thought that was the argument that, you know, which is what really counts. CDF and LERF point values were good enough.

MR. KRESS: Yeah, and that was based on the concept that early fatalities generally dominated.

DR. APOSTOLAKIS: Right.

MR. KRESS: That if you covered those, you've covered the goals you would have for late, and there are no goals for that.

DR. APOSTOLAKIS: So, what are we talking about today?

MR. KRESS: Well, basically the same issue there, and that's what -- in my mind, when I talk about goals that involve small releases or late releases or late small releases, I'm talking about frequency consequence curves because that --

DR. APOSTOLAKIS: Well, Dave probably doesn't.

MR. KRESS: Well, that's what I had in mind when I talk about them. You have a frequency limit on fission product releases of any magnitude, and it deals with the whole range, the small, early. So, I'm certainly not opposed to FC curves. I think they're a good concept, and they can come out of the PRA if you do it correctly.

THE COURT: Well, and the other question is whether you need 84, as Dana was arguing, or you can pick one representative, like cesium.

MR. KRESS: Oh, yeah, I think that's an issue, but if I were going to pick one representative, I'd probably pick cesium.

DR. APOSTOLAKIS: You would or wouldn't?

MR. KRESS: I would, probably, yeah, because in my mind, I can generally correlate the iodine release with cesium.

MR. POWERS: You can if you persist in believing the releases are driven by the high temperature component. You can't if they're driven by the aquus chemistry component.

MR. KRESS: Yeah, then you have a problem.

MR. POWERS: In late, you're very likely to lose that correlation.

MR. KRESS: Yeah, you'd have to do something else with the late part, and if you had an error ingression problem, cesium may not be the -- you'd have to have a different cesium curve. You could still use cesium, probably.

MR. POWERS: And of course, you have at least one member of the committee that believes you always have an error ingression problem.

MR. KRESS: Yeah, or maybe two. Maybe two members in this Committee. Huh?

DR. APOSTOLAKIS: What advise are we giving this time?

MR. KRESS: Well, I don't know. I think the advice is that we think CDF, CCFP or LERF --

DR. APOSTOLAKIS: They like CCFP.

MR. KRESS: Yeah, are fairly good things to use because they're practical and they do incorporate things, but we believe they're limiting. There are other objectives in the regulations that they want us to think with and deal with, and we just don't want them to forget those when they do this.

DR. APOSTOLAKIS: I'm under the impression the Commission decided recently on the safety goal issue that plant contamination ought to be part of the revision?

MR. KING: That's right.

DR. APOSTOLAKIS: So, if that's the case, then why are we discussing this? Did they say anything about late releases and consequences? My impression was, as I recall, that they like things as they are now.

MR. KING: It's basically approved updating the policy to be current with the practices that are in place today.

DR. APOSTOLAKIS: So, there isn't an issue anymore. The policy issue has been resolve. I mean, we could choose to write a letter to the Commission, but I don't think they're staffing writing Option 3.

MR. KRESS: The staff is concerned in building a policy, I think.

DR. APOSTOLAKIS: But this is not the right forum. Before we leave 2.2, which is really an important section in

my view, from page 2.3, there is a discussion of the paragraph that starts in applying the strategies, good engineering practices will be maintained. The general design criteria of providing many concise statements of good engineering practice. For example, negative prompt feedback, emergency AC power. I never considered those as good engineering practice. This is not what I understand by good engineering practice. I mean, these are deliberate, rationalist measures that have been imposed on nuclear engineering. In the west and in the United States, you would not design a reactor with a positive feedback option. Not you will have emergency power. I mean, to call these good engineering practices seems to me you're stretching the meaning of the term.

MR. KRESS: It's not my usual determination of that term either.

DR. APOSTOLAKIS: Yeah. Then I read on in this paragraph, requirements that the fuel design limits not be exceeded in anticipated operation occurrences, and that the extent of fuel damage be limited in design basis, accidents will be maintained. Now, why do you want to make this, to commit yourself to the fact that design basis accidents will be maintained? What if later on we become wiser and we come up with something better?

MR. KING: No, this is not intended to say we're

going to stick with today's definition of design basis accidents. I mean, I think clearly one of the things we may do is come up with a new set of design basis accidents that reflect risk consideration. What we were trying to say here is we're not going to go in and make the acceptance criteria, core melt, for example.

DR. APOSTOLAKIS: I think you've made it very clear earlier that you're not going to put the numbers up there. In my view, this paragraph more hurts than helps. Would you lose anything if you just deleted it?

MR. KING: In reading it now, I think clearly it needs to be modified, but I would like to come back to this issue of good engineering practices because I don't agree with everything you've said.

DR. APOSTOLAKIS: Okay. Well, good engineering practice, we've heard those words a lot from South Texas in the context of quality assurance.

MR. KING: To me, there's an element of good engineering practices that fits under the structuralist label, and I would put prompt negative feedback coefficient as one of those. I mean, that's not something you're going to decide based upon risk information.

DR. APOSTOLAKIS: No, no.

MR. KING: I mean, that's something you want in the plant. I don't care what the PRA says. That's what you

want.

DR. APOSTOLAKIS: I wouldn't call it a good engineering practice either.

MR. KING: What would you call it?

DR. APOSTOLAKIS: I don't know.

MR. KRESS: A general design criteria.

DR. APOSTOLAKIS: Yeah, I mean, it's a design. Good engineering practice usually means, you know, I will pick a better quality pencil, given the option, and you know, that kind of low level stuff.

MR. KING: I think use of codes and standards to me would be a good engineering practice. You're not going to decide that based upon your PRA. You're going to say hey, I'm going to design stuff to the ASME code or whatever.

MR. BONACA: But I think it's more than good engineering practice in a certain way. I mean, for example, look at the word containment. I mean, containment. Maybe it's a good example to talk about. Containment, would we eliminate containment if we could demonstrate that you don't need it?

DR. APOSTOLAKIS: If you convince me that you don't need it, yes.

MR. KRESS: Yes, thank you.

DR. APOSTOLAKIS: I want to be on record that I would.

MR. KRESS: Thank you, George, thank you.

DR. APOSTOLAKIS: This seems to be a sacred cow, like this -- we don't want it to be risk based. It has to be risk informed. I mean, come on. Yes, if you can convince me, why should I have it.

MR. BONACA: Remember that the Titanic didn't have enough life boats because it was unsinkable.

MS. DROUIN: Maybe one way to look at these things is that they're the outcomes of your good engineering practice. If you want to go in and say maybe your good engineering practice is to have diversity redundancy, and how do you go about achieving that. Well, you have a containment, you have multiple barriers.

DR. APOSTOLAKIS: I know, but even you in here, you know, you say the general design criteria provide many concise statements of good engineering practice. For example, negative prompt feedback, emergency core cooling containment, are all called for in the GDC's and deemed essential to the defense and depth approach. So, you are going now from good engineering practice to defense in depth. I don't know, I think most people don't pay attention to these things, but I don't --

MR. KRESS: I would be tempted, George, just to call that a good defense in depth approach.

DR. APOSTOLAKIS: Right, that's what it is.

MR. KING: I'd say these defense and depth measures will be maintained no matter what.

DR. APOSTOLAKIS: But I wouldn't call them good engineering practice.

MR. POWERS: I agree with that.

DR. APOSTOLAKIS: It's the structuralist approach.

MR. KRESS: They're structural defense in depth.

DR. APOSTOLAKIS: It the structuralist defense and depth.

MR. BONACA: And I believe the uncertainty issues to the issue.

DR. APOSTOLAKIS: But the negative prompt feedback is not defense in depth, is it?

MR. KRESS: Not at --

DR. APOSTOLAKIS: I mean, it's a matter of controlling the thing.

MR. KRESS: Not traditionally, but --

MR. BONACA: No, but there's a preventative defence in depth concept.

MR. KING: I tell you, that's an important fundamental aspect you want your design to have.

DR. APOSTOLAKIS: But you want to control it.

MR. KING: It's because you don't want to rely on a control system to do it.

DR. APOSTOLAKIS: Yeah, inherently.

MR. KING: So, I mean, it's an inherent defense --

DR. APOSTOLAKIS: That's not what I'm saying, that I believe that if you delete this paragraph and maybe other few lines that make clear the stuff we just discussed, like yes, there are essential elements of defense and depth that will be maintained. Then I don't know what you want to say about the GDC's, but --

MR. KING: I agree. This paragraph needs some work, but I think basically what we're trying to say is reflected on our slide four in that there are some elements of defense and depth that are going to be implemented regardless of what the risk analysis says, and there's going to be others that are going to be dependent upon the risk analysis.

DR. APOSTOLAKIS: You don't have to put it that way. You don't have to put it that way. It will be maintained.

MR. KING: All right, and I think we ought to try and list those, or list examples of those.

DR. APOSTOLAKIS: And then there is this discussion here that goes into detail that the reader, you know, for example, it's been suggested that the number of regulatory requirements have led to the fuel design limits during normal operation could be eliminated, because the

intent of GDC 10 is being met for commercial reasons so the requirements are not risk significant. I mean, I probably have to read the whole report to understand what this means.

MR. KING: Well, it means we found some things that don't have any risk implications and you really don't need them as requirements to keep the fuel intact. So, those are candidates for removal.

DR. APOSTOLAKIS: Okay. If you put it that way, it's a general statement that I understand, but referring to GDC 10 and so on.

MR. KING: Like I said --

DR. APOSTOLAKIS: There are too many thoughts in this paragraph. I mean, it's really loaded with thoughts that somebody obviously is a veteran of regulatory wars.

Now -- oh, you're now in your tactics.

MR. KING: Well, we put that up because you brought up the issue of negative power coefficient.

MS. DROUIN: Our viewgraphs, George, do not necessarily follow the outline of the report.

DR. APOSTOLAKIS: Okay.

MS. DROUIN: I like the way we're going through the report.

DR. APOSTOLAKIS: Okay, great.

MS. DROUIN: I mean, to me, this is very helpful.

DR. APOSTOLAKIS: On 2.5, off the old and the new

one -- maybe that's what I can do, huh?

MS. DROUIN: So you like 2.4?

MR. KRESS: You can't assume that.

DR. APOSTOLAKIS: Silence means -- I think the strategy was all right.

MS. DROUIN: There's not a 2.5.

DR. APOSTOLAKIS: Page 2.5.

MS. DROUIN: Oh, page 2.5.

DR. APOSTOLAKIS: It!s still section 2.3. The four high level defense in depth strategies on the left, paragraph on the left.

MS. DROUIN: Yes.

DR. APOSTOLAKIS: The four high level defense in depth -- you don't have that figured. Do you have a transparency of the figure?

MR. KRESS: It's figure 2.1.

MS. DROUIN: Yes, we do.

DR. APOSTOLAKIS: Yeah, but I mean to show it up there.

MR. KING: It's not in your hand-out.

DR. APOSTOLAKIS: Right, right, right. So the four high level defense in depth strategies are intentionally more focused than the reactor safety cornerstones. Now, the reactor safety cornerstones are initiating events, right?

MR. KING: Yeah, the four that are up there.

DR. APOSTOLAKIS: Why are these more focused?

MR. HASKIN: Basically, we're not dealing with fuel handling, fuel storage, rad waste storage tank rupture, those types of requirements in this pass-through. We're concentrating on the core damage frequency. You don't get core damage from rad waste tank rupture, for example.

DR. APOSTOLAKIS: So these, don't worry about these things. You don't have those here, do you? These are just reactor?

MR. HASKIN: As we proceed to the quantitative goals, yes. I mean, it doesn't show on this viewgraph. If you read the cornerstones, they're concerned with accident prevention no matter what the accident is, whether it can lead to core damage or not.

DR. APOSTOLAKIS: But isn't the original statement from the Commission on QHO's referring to operations at the nuclear power plant? They don't really distinguish between reactor accidents and other kinds of releases.

MR. HASKIN: Right. I think this is an insight that we obtained from risk assessment, is those types of accidents really aren't the risk dominant ones. Hence, our focus on core damage.

DR. APOSTOLAKIS: But you could have public --

MR. HASKIN: Conceivably, there could be

regulations dealing with those types of accidents that could impose excess burden. If they did, we'd take a look at them. You know, our framework strategies and quantitative objectives, we didn't feel that that was the appropriate place to focus.

DR. APOSTOLAKIS: Okay. The paragraph in describing the cornerstones, the strategies to break this down? I suggest you delete everything up until containment failure for all conceivable accidents. Then you say, the use of all four strategies constitutes a high level defense in depth approach, which compensates for the limitations of the individual strategies, and assures that the risks to public health and safety will be low and consistent with the top level objectives. Everything else is not needed.

I'm a little bit uncomfortable the way this is going, though. I mean, do the other members of the subcommittee feel this is a good Subcommittee meeting?

MR. POWERS: I think you're belaboring individual comments.

DR. APOSTOLAKIS: Well, we are hitting big and small here, but we have had no other opportunity to discuss this report, which is one of the most important reports the staff is going to release, and I'm not allowed to give them my comments in private. So, I don't know how to do it.

MR. MARKLEY: George, what we could do is if you

have some higher level comments, we could provide them to them in like a memo or something of that nature, which we could also, you know, make available to the public. I think that would be the better way of doing it, the editorial type things, unless they have a real major impact.

DR. APOSTOLAKIS: The editorial I agree.

MR. MARKLEY: yeah.

DR. APOSTOLAKIS: At the high level, no. We should discuss them now.

MR. MARKLEY: Yes.

DR. APOSTOLAKIS: So, there is a table 2.1 on page 2-6. Tactics and examples of related regulatory documents. You say that the safety goals under PRA's IPE's is a tactic? I thought that was the top objectives that was driving everything. See safety goals under PRA's, IPE's?

MR. KING: Yeah, I see it.

MR. KRESS: I think it's out of place in this thing.

DR. APOSTOLAKIS: It's completely out of place, isn't it?

MR. KING: Yeah, I tend to agree. I'm not sure why that's there.

DR. APOSTOLAKIS: And then next to special treatment, there's a parenthesis, non-scope. I don't understand what that means, non-scope? You see special

treatment in the same column?

MR. KING: Uh-huh.

MS. DROUIN: I can't answer why the word non-scope is there. It doesn't make sense to me.

DR. APOSTOLAKIS: Fine. You will look at it later and take action.

Now there is something that's a little bit more of substance. At the beginning of 3.0, quantitative objectives for the framework, the second sentence of the first paragraph. The intent is to develop requirements which retain deterministic characteristics in such a way that compliance will provide reasonable assurance. Now, why do you want to insist that they will be deterministic? I mean, in the maintenance rule, not all requirements are deterministic, and it's already out in the street. The revised oversight process certainly uses frequencies for initiating events, unavailabilities for protective systems and other things. Not all requirements will necessarily be deterministic.

MS. DROUIN: I think all we're trying to say there, and it was probably a misuse of the word, is that a defense in depth characteristics.

DR. APOSTOLAKIS: Now, this comes back to my earlier comment that you're protesting too much various places. You know, we will never use probability numbers as

part of the regulation. I saw this as being consistent with that approach, which there is no reason. I mean, some numbers come naturally in some places, like the frequency of initiating events, or unavailabilities, the maintenance rule.

MR. KING: Well, we sort of went into this with the ground rule that we wouldn't put the risk numbers in the regulations themselves.

DR. APOSTOLAKIS: I think you mean higher level. You mean core damage frequencies.

MR. KING: Or damage frequencies.

DR. APOSTOLAKIS: Yeah, and I agree with that because the whole framework, as you say correctly here, will make sure that if you meet those lower level requirements, then you meet the top. I don't think you should be so absolute as to say that even at the lower levels, the probability risk numbers are out of the question. There's no reason for that. You already have regulations that use them. Maybe there should be a distinction of some sort.

MR. KING: I don't think we have regulations that use them. I think we have reg guides and SRP's that use them, and I think in our -- in this effort --

DR. APOSTOLAKIS: Well, maintenance rule is a regulation, is it not?

MR. KING: Well, reg guide is a one way, one

acceptable way to meet the regulation.

DR. APOSTOLAKIS: No, but the maintenance rules.

MR. KING: Oh, is a regulation.

DR. APOSTOLAKIS: Regulation.

MR. KING: Yes, that's a regulation.

DR. APOSTOLAKIS: It doesn't have numbers itself, but it asks the licensee to specify such a number.

MR. KING: Yeah, and that's reasonable.

DR. APOSTOLAKIS: And that's reasonable.

MR. KING: And in this effort, it might be reasonable to have a reg guide or something that has numbers in it.

DR. APOSTOLAKIS: That's right, but also in this effort, you should say that, you know, you will try to have deterministic requirements as much as you can, but in some instances, at low levels, you know, some unavailabilities or frequencies would be natural to use, e.g., see maintenance rule. So, people would not be shocked, that it's something that they have already done.

MS. DROUIN: No, it is very conceivable that in the implementing documents of a regulation, you could certainly see numbers, but we're just talking about the actual requirement in the regulation.

DR. APOSTOLAKIS: But I mean, the way I see it, Mary, is that you are taking an extreme position. You are

saying we will not produce anything that will be probablistic. They will all be deterministic characteristics, and that's not what you intend.

MS. DROUIN: No, that's not what we intend. That's not what we're saying.

DR. APOSTOLAKIS: Yeah. Now, in the next column, you go into the details of how the average individual risk is determined by dividing the number of fatalities to one mile, weighted by the frequency of accident and so on and so on. I didn't think that that was part of the regulation. This is just what happened.

MR. KRESS: That's a part of the definition in the safety goal policy.

DR. APOSTOLAKIS: Is it in the safety goal policy statement, that you should do it that way? I thought you were postulate an individual being there 24 hours.

MS. DROUIN: I'm sorry, George. What was your comment? I missed it.

DR. APOSTOLAKIS: The bullet on the right. It starts the individual risk.

MS. DROUIN: Correct.

DR. APOSTOLAKIS: Towards the end, it describes how the average individual risk is determined.

MR. KRESS: My understand is this is exactly how you do it.

MS. DROUIN: This is --

DR. APOSTOLAKIS: No, this is how you do it, but is it how it is stated in the QHO statement?

MR. KRESS: Yeah.

DR. APOSTOLAKIS: I'm not sure.

MR. KRESS: Somewhere it's stated that way. I'm not sure it's in the QHO.

DR. APOSTOLAKIS: I'm not sure it's in the QHO's.

MR. KRESS: But that's been my complaint for a long time. What this does is treat all sides the same. That means an accident that kills 100,000 on one site is treated the same as an accident that kills 10,000 people on another site.

DR. APOSTOLAKIS: Because you are exacting the societal aspect.

MR. KRESS: I'm saying they don't have a real societal vote.

DR. APOSTOLAKIS: They don't have societal, but I'm objecting to even describing how the average individual risk is calculated. It seems to me --

MR. KRESS: Well, I think this is my understanding of how it's done.

DR. APOSTOLAKIS: Does anyone know?

MR. KRESS: I'm sure this is how it's done.

DR. APOSTOLAKIS: Yeah.

MR. KRESS: I'm not sure where it tells them it's done.

DR. APOSTOLAKIS: That's where my question is.

MR. KRESS: And I thought it was in the safety goal policy statement.

MR. HASKIN: It's a direct quote, but I'm not sure it's --

DR. APOSTOLAKIS: I'm sorry?

MR. HASKIN: It's a direct quote.

DR. APOSTOLAKIS: From the goal?

MR. KRESS: I've read it somewhere.

MR. HASKIN: Because I tried to write it a different way.

DR. APOSTOLAKIS: From the safety goals --

MR. KRESS: I've read it somewhere, and I think it's in the safety goal policy statement.

MR. HASKIN: I don't confirm that.

DR. APOSTOLAKIS: That statement needs to be defined. Now again, here is a defensive thing. The right-hand column near the bottom, the QHO's and related subsidiary objective set forth in the section applied to mean risk measures. Unfortunately, the QHO's are difficult to apply. Simply replacing existing regulations with the QHO's would be an entirely risk based approach, heaven forbid, which you would not assure defense in depth. I

mean, gee whiz, we are grown people, guys. Come on. I mean, it's again, this fear of risk based and trying to soothe somebody because they're bound to explode.

I don't think you need statements like that. Take them out. This is what we're doing because it makes sense. It's a rational way to do things. To try to apologize -- and then on the next page you say that the subsidiary quantitative objectives are developed from the QHO's and are generally consistent with subsidiary goals. Well, we have a report from a former fellow that says that's not true for the CDF. A CDF of ten to the minus four, in fact, is not consistent with the QHO's. It's much more stringent.

MR. KRESS: That's why they put the word generally in.

MR. UHRIG: That's with a factor of ten? Well, but the subsidiary goals, the Commission gave us the ten to the minus four back in 1990.

DR. APOSTOLAKIS: But then --

MR. UHRIG: I mean, that's a subsidiary goal.

DR. APOSTOLAKIS: Do you have your figure 3.1 in a transparency? Can you put it up?

MS. DROUIN: Yeah.

DR. APOSTOLAKIS: Okay. So, one question that was raised earlier is under mitigate, condition of probability of early containment failure, right? Why don't we have

late. Is that a question that you guys raised?

MR. KRESS: That was one of them, yeah.

MR. POWERS: Another question Dr. Kress frequently raises and might be raised in connection with these figures, is suppose that I have done an analysis and persuaded myself that my plant has a core damage frequency of less than ten to the minus four per year. I think Dr. Kress might well ask gee, at what confidence level do you think that you have met that criteria on ten to the minus four per year? I wonder if you have a confidence level in mind for these things?

MR. KING: We have a mean value in mind. Maybe we ought to go to our viewgraph.

MR. KRESS: You can also have a confidence level associated with the mean. Even just saying the mean, to me, implies a 50 percent confidence level in the mean, but I'm not sure that's what you mean or not.

MR. KING: No.

DR. APOSTOLAKIS: They mean that mean value is calculated in a PRA.

MR. KING: Right.

DR. APOSTOLAKIS: So the curve that gives you the core damage frequency until you find the mean value.

MR. KRESS: Yeah, and if you put uncertainties --

DR. APOSTOLAKIS: On the curve?

MR. KRESS: On the curve, you get a confidence level in the mean.

DR. APOSTOLAKIS: Yeah, but nobody --

MR. KING: No, but no PRA does that.

MR. KRESS: You won't get it out of the PRA, but that's the way you do --

DR. APOSTOLAKIS: You don't get it out of anywhere.

MR. KING: The reason we selected the mean was simply because that's what the safety goal would -- that's what would be consistent with the safety goal. The safety goal is essentially based on the means.

DR. APOSTOLAKIS: Perhaps what you need here, Eric, is a similar statement like the one in 1.174, that if the mean values are close to these limits, there ought to be increased management potential as to the issue of uncertainty.

MS. DROUIN: But remember, we're not applying these numbers on a plant specific basis, and I think that's a very important --

MR. KRESS: There's no way of knowing whether the mean value approach is there or not.

MS. DROUIN: -- difference here that comes into play.

DR. APOSTOLAKIS: So, what are we applying them

to?

MR. KRESS: How they write the regulation.

MS. DROUIN: How we write the regulation generically. We're not writing a regulation to a specific plant.

DR. APOSTOLAKIS: That's true.

MR. KRESS: And in fact, I'm not sure how you translate these numbers into the regulation unless you do it like the intent, and that's looking at limits on the anticipated initiators and frequent initiators. Unless you get down with that level, you are actually -- you know, you actually have to write the regulation in such a way that you meet these frequencies. I don't know exactly how you do that, and that's kind of an interesting --

DR. APOSTOLAKIS: Generic business. I mean, let's say the 19 PWR's have a greater damage frequency, so none of these regulations would apply to them.

MS. DROUIN: I'm sorry?

DR. APOSTOLAKIS: We have right now, as you point out right now, as you point out in the report under ID's, 19 PWR units where CDF is greater than ten to the minus four. Some would say there are many more because they have not included a number of other contributors, but you look at numbers, I mean, the reports right now, it says 19.

MR. KING: Then we ought to look at what's causing

that.

MS. DROUIN: What's causing that.

MR. KING: Look at the 19 and say what's causing that. If there's some generic item that's causing that to happen, maybe we ought to think about a change to the regulations to take care of that generic item.

DR. APOSTOLAKIS: Say it's not generic. With the regulations you produce here, then it should not be available to these people because they're already above the limit.

MR. KRESS: This won't appear in your regulations. They'll have something else in the regulations. This very well could meet those regulations, even as they are now and not meet these numbers.

DR. APOSTOLAKIS: It's not clear to me what the use of these would mean.

MR. KRESS: It's not to me either. I'm not sure how you translate this into a regulation.

MR. BONACA: Well, the interesting thing about this table is that the column on the left, anticipating the issue, et cetera. That is exactly what you have in the core licensing basis. Even those frequencies in the aggregate are consistent with what is using the standards that goes into the current accident analysis.

MR. KRESS: The DBA. These are the DBA's.

MR. BONACA: Exactly, the frequency. Now, the only thing that didn't exist then was then the condition or core damage probability, et cetera. Now, what you're looking at then is specific requirements implemented that would address conditional core damage probability for an anticipated initiator and how in the aggregate they would contribute ten to the minus four. That's what you would be looking at, right? You would be looking at the effect of requirements imposed to deal with conditional core damage probability for a set of anticipated initiators.

MR. KRESS: Yeah, I was guessing they would use these numbers, just like they do now, in designing a set of design basis accidents, and in describing the characteristics, you have to go into the medium.

MR. BONACA: Before you can link it.

DR. APOSTOLAKIS: But would these design base accident apply to the current generation of reactors or the generation four?

MR. KRESS: It would apply to any reactor that volunteers to use the risk base.

DR. APOSTOLAKIS: I mean, my plant has already been designed against it.

MR. KRESS: So, that's the whole question of the backfits.

MR. BONACA: But no, taking the example of the

loca. You know, you go to the frequent initiator. Why don't we just talk about an example to make it clear to all of us. If I would put the loca inside the frequent initiators, right?

MR. HASKIN: Yes.

MR. BONACA: Less than ten to the minus two, the reactor in the aggregate of all infrequent initiators. Then I would look at the effectiveness of these is yes. I would have to demonstrate that the requirements should impose, you know, that the conditional core damage probability resulting would be less than ten to the minus two. That would be a criterion to impose the expectation on this is yes, performance.

MR. HASKIN: Right, but you can take that example a little further, and you can say well, there's a certain class of large locas, large pipe break locas, which may actually have frequencies of ten to the minus six per year. Then we ought to be looking at eliminating those as design events.

MR. BONACA: Exactly, so what you would be looking at is, you know, whatever you have in excess. Then there would be a way of trimming whatever you do not have in excess, so you're lacking. You may have new considerations.

MR. HASKIN: Right, and I think in retrospect in practice, we'll wind up applying this more to accident

classes than to the three classes as we've, you know, enumerated from here.

MR. KING: I think there's two aspects. There's the aggregate aspect. There's the overall core damage frequency LERF number. Are they being met, or is there some class of plants that isn't meeting it? Then there's the looking at individual accident classes. There we've chosen, you know, one-tenth of the numbers in this table as sort of a guideline to look at individual acts and classes. You don't want one accident class to chew up the whole --

DR. APOSTOLAKIS: Which brings me to another thing. I mean, this seems to be a very severe application of the concept of defense in depth. You start out with defense in depth. Because of defense in depth, you have prevention mitigation. Because of defense in depth, you have the four columns limiting the figures of initiators and so on. So, you have a multiple application of defense in depth there.

MR. KRESS: Even down to the ten percent.

DR. APOSTOLAKIS: And then in the footnote, you're throwing a bomb.

MR. KRESS: Yeah, that's a real one there.

DR. APOSTOLAKIS: That's really a big one. You're saying even for each one of these, no individual accident sequence should contribute more than ten percent of the

goal, which is -- the first time I saw that was in Sizewell B.

MR. KRESS: That's a very interesting concept.

DR. APOSTOLAKIS: The question is why. I don't think it's even discussed in the text. Even if it is discussed, I mean, the question is why did you feel that there was a need for such a multiple application of defense in depth?

MR. KRESS: And then my comment in the subcommittee meeting on that was why just ten percent on the contribution to the main? Why not a percentage applied to the -- related to the uncertainty also?

DR. APOSTOLAKIS: That would make it even worse, but you see the point, Tom?

MR. KING: I understand your point.

DR. APOSTOLAKIS: There's this little thing that says when applying the quantitative guidelines. In smaller font in the note, it really is a major constraint.

MR. KING: And I'm probably largely responsible for putting that in there.

DR. APOSTOLAKIS: Well --

MR. KING: I mean, it seems to me what this table is doing is trying to say what's the balance we'd like to see when we employ defense in depth? I mean, we always talk about prevention and mitigation, but this is an attempt to

quantify what's the balance between prevention and mitigation, and even cut it a little finer, looking across initiating events, prevent core damage and so forth. But it doesn't seem unreasonable to say okay, even if you achieve this balance, I don't want one accident to chew up the whole, you know, the whole segment of that balance I'm trying to achieve, and therefore, I took it a step further and said let's, you know, let's look and see if we do have one accident like that. Let's have some criteria in here that will force us to take a hard look and maybe make some judgment that even that's too much.

MR. KRESS: This is our whole argument we had in the joint subcommittee on risk allocation.

DR. APOSTOLAKIS: Yeah.

MR. KRESS: And I was advocating this risk allocation, but I was advocating that you also have to factor into it the uncertainties, contribution due to each of these sequences. You can't just use the ten percent.

DR. APOSTOLAKIS: In essence, that's what Tom is doing.

MR. KRESS: Yeah, but --

DR. APOSTOLAKIS: He says based on what I know about the uncertainties. I think a ten percent value is reasonable, I mean, without becoming explicit.

MR. KING: If you're concerned that this might be

too rigidly applied --

DR. APOSTOLAKIS: Let me give you what my concern is. First of all, as I say, the first time I saw this was in the context of the Sizewell B debate, and I was very impressed by it. At that time, I happened to be advised in the director of the new production reactor, DOE. Everybody thought it was great until we actually did some calculations, and the seismic risk was way up there.

MR. KRESS: And there wasn't anything you could do about it.

DR. APOSTOLAKIS: And there is nothing you can do about it. I mean, unless you are willing to double your budget to bring down the seismic stuff, there's nothing you can do about it. So, it's not always feasible. I think you can find -- that's one argument, and I think you can find different words that express the same thought without sticking the ten percent there. Maybe you want to say that it would be desirable to have a balanced design in the sense that no accident sequence unduly dominates something like that. So now, if you have this thing with the seismic where you can't do much about it, at least you can say well, it says unduly, it says this, you know, that kind of thing.

The second point here is that again, because you're using -- see, I come to my earlier comment. You are using goals, not adequate protection. I mean, how far down

are you going to go? You have defense in depth already twice. Now you are adding another defense in depth measure on a goal, which is good enough. I understand doing that on adequate protection numbers, but not on the goal. But that's more of a philosophical objection. I think the other one is more practical.

MR. KING: Yeah. I understand your first line. It's a good point. Maybe we ought to -- it comes across too rigid.

DR. APOSTOLAKIS: Yeah. That was, in fact, the compromise and then --

MR. KRESS: Yeah, we had to compromise.

DR. APOSTOLAKIS: -- the letter that Dr. Kress referred to, that we kept referring to a balanced design, balanced -- not allocation, balanced defense in depth concept.

MS. DROUIN: But I do think that you need to at least have a starting point. I agree that I don't think you should have -- you shouldn't apply it rigidly, and I think you're going to need to take it on a case by case.

Personally, I don't like words like unduly. I don't know what that means. Does that mean ten, 50, 60, 70? You know, you ask ten people, ten people will give you a different answer. I do think that you ought to have something that you start from. You don't apply it strictly.

You know, you go in there, but at least, you know, that's the ballpark of where you're at.

DR. APOSTOLAKIS: I think, Mary, you're going to have that problem with a lot of risk informed regulatory documents, that you have to be deliberately fuzzy, because the moment you put numbers down, you know, why 60 percent? Why not five percent or ten percent. I think it means you would like to see it sort of an equal distribution, but you're willing to accept something else, and you're willing to listen to arguments. That's what it means.

MR. KING: Yeah, I mean, this is a level of detail one step below what's in 1.174 in terms of having another layer.

DR. APOSTOLAKIS: Yeah, that's right. This is the first time we're using this.

MR. KING: Right.

DR. APOSTOLAKIS: And I also would recommend that you take it out of the note, or leave it there but also discuss it somewhere else, because it's really an important thing. In fact, raise Mary's concern in that we recognize that, you know, you can't have --

MS. DROUIN: We took the concepts from 1.174 that, using your words, are fuzzy, and tried to come up with some working definitions, recognizing they were just working definitions, that it was a place to start. They weren't

absolutes, but at least it was something that, you know, we could put our hands on. Then, as you look at it on an individual basis, does it make sense to use a two percent. Maybe for this particular case, a 50 percent is better, but absent anything else, what's your fallback position? I think, you know, you owe it to people to tell people what you mean.

DR. APOSTOLAKIS: You'll get into trouble with ten percent.

MS. DROUIN: That's my personal opinion.

DR. APOSTOLAKIS: I bet you. Go back and look at the IPE's. It's a routine. It's a routine that one or two initiators dominate everything else.

MR. SEIBER: Cold pump seal failures.

MR. KING: Yeah.

MS. DROUIN: Yeah.

MR. SEALE: I can just see you now going through and de-rating the quality of your design so that you've got some competition.

DR. APOSTOLAKIS: This was not the intent.

MS. DROUIN: But I think that if you go to the point where you don't want something to unduly dominate, then you owe it to explain what you mean by that.

MR. POWERS: My understanding, Tom, of your idea behind your phrase there was it might really be that if I

have a ten to the minus seven plant, that it's nine times ten to the minus eight of that is one accident sequence, and that's fine. You don't have any troubles with that. That it's only if I have a ten to the minus -- I have a nine times ten to the minus fifth plant. If you don't want to see eight times ten to the minus fifth of that coming from one sequence. Is that my reading of it?

MR. KING: Yeah.

MR. POWERS: So, no, I don't think that you're going to run into a problem. I don't think this phraseology leads you to de-rating things to get competition because I think we do have plants in the IPE's where because of the way they did things and the way they've been things, there are dominant accident sequences that make up big fractions of the total, but it's a small total.

MR. KRESS: Yeah, but that concept doesn't come across here, I don't think, that you know, that was one of my argument I tried to make with those, that if the overall risk number of a plant is very small, I don't care if it's completely dominating the one accident if it's very small, and any uncertainties are dealt with, but if you're up there near the margins, then I worry about one accident dominating it, but that makes it a sliding scale, in essence. You know, a flat ten percent doesn't capture that sliding scale concept to me very well.

MR. POWERS: Well, okay, maybe there's some language in there, but I'm saying how I read it.

DR. APOSTOLAKIS: I think there is also an issue here of cost benefit because I think even if it is, you know, one accident that says, that has about 70 percent of the core damage frequency, and you are close to ten to the minus four, if that accident is, as I say, as was the case with NPR, and it would nearly double your budget, just to bring that down by a factor of three or four or five, would you do it, since you are already meeting the goal?

MR. KRESS: Yeah, that's the concept.

DR. APOSTOLAKIS: So, I think the phraseology should be vague enough to allow for flexibility but also send a message that really a balanced design would be highly desirable, balanced in the sense of nothing really dominates. The reality is that the one or two things will always dominate.

MR. POWERS: I would encourage the language to be specific enough to allow some flexibility rather than vague enough to be.

I wonder if I could come back to something Eric said. You said gee, we might find some LOCA's that have ten to the minus six probabilities and less that we should think about getting rid of from the regulations. My mind turns to the issue of reactivity control accidents. I don't think

they -- I'm not familiar with any PRA where reactivity control accidents dominate a risk. The reason they don't is the plants are designed by all these other regulations and by Appendix A largely, so that that doesn't happen.

MR. HASKIN: Yeah, as a matter of fact, I agree with that. Then our preliminary screening of DBA's that was an accident that appeared high on our list of things that would deserve risk informing. What we found from the industry feedback was not too many complaints in terms of excess burden of no overwhelming feedback from industry in support of that being one of our early regulations to look at risk informing, or DBA's to look at risk informing. There was much more concern about the Part 46, but I think we did a ranking of DBA's, and that was one of the top three to look at from a risk informed perspective, specifically the rod ejection accident.

MR. POWERS: I guess what I'm saying, the question I'm asking is you have a probablist analysis tool or an intuition on probablistics that's based on plans to comply with a bunch of regulations that are addressing systems, but you don't address those accident anymore because they so completely eliminate the concern.

If you use that tool to say should I complete have eliminated that concern or not, you come up with the answer no, I shouldn't have deleted it because it's so low in risk,

I should not be regulating this. You don't have a mechanism to say now, if I don't regulate it and they do start creating, doing things in the plant that cause reactivity control problems that yes, it will show up high on my risk analysis, it's not built into the tool. It's not built into your tuition right now.

MR. HASKIN: Right, and that was another reason for not pursuing that one from the outside because as you're aware I'm sure, as you go to high burn-up fuel, there's a set of questions in terms of fuel performance that comes up that I don't think anybody has fully analyzed yet. We just felt we were in a better position to start with 46 rather than -- and it was more important in the overall scheme of things.

MR. POWERS: Might have a little visibility on.

MR. HASKIN: Yeah.

MR. POWERS: Let me ask another question.

MR. KING: I don't totally agree with your premise on the previous question, by the way.

MR. POWERS: Oh, okay. Maybe you could tell me more about that.

MR. KING: If it turns out the design basis reactivity insertion actions is and the PWR's are rod ejection, you're right. On a risk assessment, it doesn't show up.

MR. POWERS: It barely shows up.

MR. KING: Barely shows up, but if for some reason that is causing operational pen at least and would make sense in terms of a burden reduction, would really remove some unnecessary burden. I mean, the question is one, what would you replace it with and two, what's your basis for saying that the probability is low enough that yeah, it falls below, you know, the things we worry about on this table of frequency.

MR. POWERS: If you replaced it, do you still fall below the place where you'd worry about it?

MR. KING: I mean, you'd replace it with something that would fit within this framework of frequencies here. I think the real question is how confident are you that the designs and the other regulations really insure that the one that's in there today is going to stay low. It's not going to pop up again if you change the regulation.

MR. POWERS: Yeah, that is the question.

MR. KING: That's the real question.

MR. POWERS: Uh-huh.

MR. KING: And I think, and even though Eric said yeah, this is not number one on the industry's list of things to change, we may eventually get to that one.

MR. POWERS: Well, the question is now, suppose you -- I don't know what you change, but suppose you change

something, and an all knowing PRA says that became a ten to the minus third event. How do you find that out?

MR. KING: You mean the rod ejection all of a sudden becomes ten to the minus three because you changed the regulations?

MR. POWERS: By hypothesis it does, and I'm asking the question how now -- you've come through and you've said gee, the regulations I've got now that keep the rod ejection accident down low are just an unnecessary overwhelming burden, that it's silly to do this. It's preventing people from using fuel to high burn-ups, and there are lots of society benefits I can find for using fuel to high burn-ups. Tangible benefits to the public, regardless of what the economics is to a plant. Now, what do you do? Do you have a mechanism that allows you to go back and say okay, I now incorporate this change into my PRA tool? I don't know what you're using. Maybe you're using some unpeer reviewed thing or maybe it's a wonderful thing. I have no idea, and see whether the probability came up?

MR. KING: I think what you do is you say I'm not going to keep the rod ejection as my design basis accident anymore. I think you'd make sure the regulation has enough teeth in it that the design permits rod ejection accidents, whether it's, you know, you put some design requirement on the control rod housing or you know, maybe you already have

something in place that does the job, but I think you'd have to look at the regulation and see, you know, the frequency of that is very low today. What in my requirements keeps it very low, and if it's already in there, fine. If it isn't, you might want to put something in that keeps it very low. I mean, that's my approach to that.

MR. POWERS: I guess I'm still puzzled by that, but I'd like to ask another question that puzzles me. One of the questions that's come up recent years has been gee, our steam generator tubes and PWR's are suffering a certain amount of degradation. Do we have the possibility that as accident progress, we fail those tubes, and that's a problem for us because it creates a bypass of the containment and risk numbers usually result.

People have done a variety of analyses and whatnot, and they come back and say gee, there's these wonderful natural convection phenomena that show up that cause the system to rupture someplace else first. So, we don't have any problem with that. When you ask them, how much of that phenomena that they're hypothesizing, were they able to see at TMI? They respond by saying well, no, there was no heating in the peripheral regions of the core at TMI. You're a little bit surprised, and you say gee, are we analyzing accidents in our PRA tools or the associated analyses that are stylized to the point that they're not

giving us good information on details of regulations.

So, I guess what I'm asking you is do we know that the analyses that we're using are, in fact, sufficiently detailed to address some of these questions of details of engineering?

MR. KING: That's a generic question that applies to more than steam generator?

MR. POWERS: Yeah, I just used that as an example to motivate my question.

MR. KING: I'm not sure there's a -- I'm not sure the framework addresses that, and I'm not sure that we can answer it at this meeting. I think one of the things I know Mary and I have talked about is in the PRA standards effort, what are they saying about making sure we have verified, validated analytical tools that we're using to calculate the phenomena. You may have the best vent trees, fault trees in the world, but if your, you know, thermohydraulic tools aren't any good, your PRA isn't any good. I'm not sure we have a complete answer to that question.

MR. HASKIN: I think as we get into risk informing the individual regulations, things like that are going to appear. In fact, we've already seen some of those in Part 46. We're just going to have to deal with them as we go. Whether that means that people are going to have to revise PRA's or we're going to have to do some internal work, we

haven't progressed far enough to determine, but there are biases both in the deterministic analyses and in risk assessments that overlook certain phenomenologically plausible scenarios. So, you just -- we simply have to be aware of those to the extent that we can as we're proceeding with the risk informing.

Now, certainly if it's a matter of, you know, group A says an accident's going to progress one way and group B says an accident's going to progress another way, that's an uncertainty that has to be dealt with. Maybe that precludes us from doing something in risk informed space because it's an uncertainty that's either unresolved or not resolvable within the time frame that we're looking at. I think the only way to address that is on a regulation by regulation basis as we go through these things.

MR. POWERS: I guess I would feel more comfortable if those kinds of issues were spelled out a little more clearly. Just say that that phenomenological activity needs to become part of the overall strategy here.

MR. KING: I agree. I think that's a good point. In fact, one of the things we've talked about doing, since most of the industry PRA's are based upon the map code, how well do we understand the map code, its strengths, its weaknesses, so we can ask these kinds of questions, and we've kicked around the idea of doing a review of the map

code so we could get some idea of the strengths and limitations. For a number of reasons, that hasn't started yet, but it's right to the heart of your question.

DR. APOSTOLAKIS: Can we take a break now until 2:50?

[Brief recess.]

DR. APOSTOLAKIS: Okay, we're back in session. Anything else that the Subcommittee members have on this figure 3-1, which would you please put back up? It's very important.

You know, a big question in my mind is how does one use a figure like this to actually write individual regulations, but I guess we're going to see examples at some point.

MR. KING: Yeah, I mean, we use this in 5044, which we went through with the Subcommittee a week or so ago.

DR. APOSTOLAKIS: Yeah.

MR. KING: And since it was really talking about containment performance, we really only use the numbers in the one column, but we basically took risk information for the cross section of plants that we had. We looked at how well the conditional containment performance was under hydrogen combustion type events. We found some cases where those numbers were met and some cases where they weren't,

and then the question is okay, for those that weren't, what would it take to eliminate the problem that's causing the performance issue, and that's where we talked about, for Mark III's and ice condensers during station black-out, maybe the igniters ought to have alternate power supply because that was really the thing that was driving that. So, I mean, that's the way it worked.

DR. APOSTOLAKIS: Okay, anyone has a comment on --

MR. KRESS: So, the regulation would say Mark III's and ice condensers need alternate power supplies to the igniters, something like that?

MR. KING: Something like that.

MS. DROUIN: No, no. The regulation would say that we want them to have a hydrogen control system that is capable of meeting their risk significant accidents. Now, they can come in and either show that station black-out as an accident is not contributing, or if station black-out is contributing, they can deal with it. So, we are not prescribing that they have to have D.C. power back-up, but we have analyses, you know, that show for some ice condensers and for some Mark III's that they're having relatively high conditional containment failure probabilities against our guideline, and we're saying okay, that's a concern.

MR. KRESS: That's not necessarily a risk

significant accident.

MR. KING: If station black-out is very low frequency, as Mary said, and somebody could come in and make that case, then that would be good enough.

MS. DROUIN: That would be good enough.

MR. KING: But if it isn't, if it's a fairly dominant contributor, then they're going to -- how do I deal with hydrogen combustion and hydrogen control under station black-out conditions? Mary's right. The way we're -- the alternative we're developing is allow some flexibility on a licensee to come in and say this is how I'm going to do it. It doesn't say well, you'll hook it up to, you know, the 1-E batteries or something like that. It's not that specific.

MR. BONACA: I have just one more question on the figure which we raised during the Subcommittee meeting when Mr. Christie made a presentation. He had some concepts, you know, similar. The issue is here you're looking at, for example, containment failure probability, and there you're really introducing a criteria that is used typically in probablistic risk assessment. I mean, you're looking at the ultimate capability of containment, which is not really what the units are committed to in core design. It would be to a different kind of volume.

So, you're really introducing an interesting mixing of criteria there, isn't it?

MR. KING: You're saying, for example, you're worried about aging concerns and maybe that containment is strength is not the same?

MR. BONACA: Now, clearly you're talking about LERF here, so LERF is a large early release, but I'm just wrestling with that a little bit because you're taking now, for example, 5044, and you're running it through the process of this type. In doing so, you're now -- 5044 included a number of criteria, okay, within 5044 that included, for example, a certain containment capability, which had to do purely with the design pressure of the containment, which was somewhat a very conservative estimate of the capability of the containment. It allowed for aging of the containment. It allowed for uncertainties of all kinds, and to credit only for one-third of the pressure capability.

Now, you're running the same regulation through, but you are using different criteria to make a judgment on the performance of the containment. Now, you may do the same without the criteria that pertained to the condition of the core damage probability, for example, best capability or piping rupture that you'll assume and so on and so forth.

MR. KING: You're right.

MR. BONACA: Maybe you're right. I just --

MR. KING: Using ultimate strength in containment, for example, not design pressure. You know, how much has

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that ultimate strength eroded by things like corrosion over time. That's not factored into the analysis.

MR. BONACA: Because I mean, again, in current evaluations, you are taking credit for what the utilities are committed to, which is a conservative assumption of that, and here you're now -- all right.

MR. KRESS: Let me ask another question. These regulations that you're redoing, if DOE or some representative of DOE comes in with the Gen IV reactor, would these regulations still apply, or were they flexible enough that they can fit that kind of a different concept into them? Let's assume that Gen IV turns out to be an HTGR, and they come in and say well, we don't really need a containment, so we don't need to meet this ten to the minus one because we don't have any such thing as a LERF anyway. This is so low that forget about it. Will they accommodate that, or will you just have to do a special view of it?

MR. KING: Well, my own view is the framework would accommodate that.

MR. KRESS: The framework?

MR. KING: The framework would accommodate that.

DR. APOSTOLAKIS: If you replace a conditional early containment failure probability by conditional early radioactivity release probability, then I don't need to go there.

MR. KRESS: That's right.

DR. APOSTOLAKIS: If they can demonstrate that it's less than this.

MR. KRESS: At a certain probability --

DR. APOSTOLAKIS: This assumes you have a containment, but you really --

MR. KING: Or confinement. I mean, it doesn't have to be the traditional containment building. It could be a confinement building like Fort St. Vrain had. They didn't have a containment building.

DR. APOSTOLAKIS: It's really the release you're interested in.

MR. KING: Yeah.

DR. APOSTOLAKIS: Not so much a structure.

MR. KING: Large early release.

DR. APOSTOLAKIS: Now, another point I want to raise here is the issue of external events. I remember that somewhere in the document we're saying that some initiators cannot really be handled in a neat way like, you know, frequency, condition or core damage and so on. Then you move up, right? Like an earthquake is shaking the whole plant, and it's not really very meaningful to talk about the condition of core damage probability separately from the containment failure probability.

In fact, I'm not even sure. You can talk about

prevention versus mitigation. You have to go even higher than that. The goals themselves perhaps, or the release.

MR. KING: I think you can still talk prevention.

DR. APOSTOLAKIS: As one package, the release of radioactivity. So, you have ten to the minus five or six, whatever you want, because the same event affects both prevention and mitigation, doesn't it?

MR. KING: But I think you can still talk the two separately for an earthquake because --

DR. APOSTOLAKIS: The question is whether you want to have a goal for separate, I mean, if you have such a major event. Now, you classify them as rare events a little later, as rare initiators.

MS. DROUIN: That we did.

DR. APOSTOLAKIS: Right?

MR. KING: Right.

MS. DROUIN: Yes.

MR. HASKIN: There were some things that are going to be low on frequency or not going to regulate. I mean, we're not going to require people to design for rare events, but as Tom mentioned earlier, if there's something that needs to be done to assure that a low frequency event stays a low frequency event, that may be within the purview of the regulatory arena.

MR. KING: Yeah, that's a good point.

DR. APOSTOLAKIS: What does it mean that you do not require them to design for rare events?

MR. KING: It depends on what you're talking about. If you're talking about, you know, vessel rupture, the reason we're confident the vessel is going to hold together is because of the design requirements.

MR. KRESS: Well, let me throw in my example for that one. I hate to bring it up now, but the spent fuel pool, the problem with the fire and the loss of cooling or the loss of inventory. It's a rare event. It falls in that category in terms of frequency. The problem I may have with your table is that you probably assume it's already conditional of early containment failure probability of one. You forget about the containment. So, the question is is this ten to the minus -- the value of the product of the conditional core damage and the initiator frequency, is it a sufficient criteria to guide a regulation on a spent fuel pool?

I would say it's not, and that's because this goes back to my original concept that you're not really dealing directly with fission products here. You're dealing with a source term related to the reactor. You get a different source term for the spent fuel pool. You might get a different LERF value for the prompt fatality goal. So, I wouldn't apply this table directly to the spent fuel pool,

because I would have a different set of criteria. I'm hoping that that doesn't happen just because this table exists.

MR. KING: Your point's a good point in that the LERF value we're using here, and we're using 1174, was derived from a reactor --

MR. KRESS: Arrived from a reactor, yeah.

MR. KING: -- accident, a single core. A spent fuel pool could have several core loads of fuel. The timing is different. You know, the air oxidation or whatever is different. LERF could be different for a spent fuel pool to meet the same safety goals.

MR. KRESS: Right.

MR. KING: But the concept of a table like this could be developed.

MR. KRESS: Could be developed specifically for the pool.

MR. KING: Yes. I mean, we didn't have the spent fuel pool in mind when this was put together.

MR. KRESS: But when you come to a regulation that involves the spent fuel pool, you would keep the concept of the actual quantitative goal in mind close to these numbers here.

MR. KING: You could develop quantitative goals, back them out consistent with the overall safety goal

objectives.

DR. APOSTOLAKIS: So if I were to do a seismic analysis -- of course, I can have a spectrum of earthquakes, so some of them would be infrequent initiators and some of them will be rare initiators, and I would have to look at the analysis and judge whether I met the various criteria there? Is that how it's going to work?

MR. KING: I think in principle that's how it would work. I don't think we've gotten into a seismic event yet. I don't know. Mary, have you thought anymore about it?

MS. DROUIN: Not beyond what we have here.

MR. KING: But in principle, that's the way it would work.

DR. APOSTOLAKIS: No, these things tend to dominate risk.

MR. HASKIN: Other than the fact that we are getting into that as we proceed with Part 46, we'll obviously have to consider that aspect of risk.

DR. APOSTOLAKIS: Anything else on this figure?

MR. BONACA: Just I would like to add one thing. I raised an issue before containment. Clearly what was making me somewhat uneasy was the fact of not linking it to the uncertainty section, to the section that later on talks about this, you know, regarding uncertainty. That should

take care of it. Simply, I'm still thinking about the fact that most PRA take credit for, you know, that capability of containment. This is an example of what to take credit for. I'm not sure that the uncertainty analysis recognizes, for example, aging the way we have seen it in license renewal, where the capability of the containment is significantly reduced. It seems to be, at least.

MR. KRESS: Well, once again, it's a sort of a success criteria.

MR. BONACA: Yeah.

MR. KRESS: And PRA's don't deal well with uncertainties and success criteria. I think that's something.

DR. APOSTOLAKIS: Well, there are model uncertainties, and I think you see more and more concern about model uncertainties.

MR. KRESS: Yeah, but they rarely show up in the success criteria, though, even the model.

DR. APOSTOLAKIS: Yeah, but we will start pushing for that.

MR. KRESS: Yeah, well we need to deal with it.

DR. APOSTOLAKIS: And one of the reasons why I don't like the word best estimate code. The thermohydraulic arena is that I think they should make a statement of the uncertainties due to modeling approximations to the extent

they can. It's about time we started doing that and forget about the best estimate.

MR. BONACA: Yeah. I guess we got to see some examples of how they run through this table.

DR. APOSTOLAKIS: This is not cast in stone.

MR. BONACA: Oh, no, no, no.

MR. KING: You raised a good point. Maybe the uncertainty chapter ought to touch on that.

MR. BONACA: No, and I think certainly that actually attaches on the issue in general. Maybe some specific discussion of how you resolve some of these issues will be helpful, if you know already how to get there.

MR. KING: At least pose the question. When you're going through this, you'd have to think about those kinds of things.

DR. APOSTOLAKIS: Okay, I have a few more comments after this figure. Anyone wants to continue debating the figure? Okay, page 3-3. There is a series of bullets on the left-hand column. The last one says no quantitative objective is proposed for conditional individual fatality probability because existing PRA's demonstrate that the QHO's can generally be met through the preceding three quantitative objectives. For individual -- conditional individual fatality probability.

MR. KRESS: That means they just didn't use the

QHO's directly.

DR. APOSTOLAKIS: QHO's don't talk about conditional probabilities. They talk about absolute, one tenth of one percent.

MR. HASKIN: What we're saying is we didn't establish a goal for column four. We were just using the --

DR. APOSTOLAKIS: Then it says however, off site protective actions are essential to protect the public.

MR. KRESS: This is conditional on the other three things happening, the conditional only. It's conditional on the other three things, yeah.

DR. APOSTOLAKIS: On the other three, yeah. But do you agree with the last sentence? Off site protective measures are essential to protect the public?

MR. KRESS: You can't meet the safety goals without it.

MR. KING: The risk calculations --

DR. APOSTOLAKIS: See, that's what bothers me about this business of individual risk. It's not individual risk, because if we're individual risk, whether we evacuate or not should be relevant. The way it's calculated, by calculating societal and dividing by the number, why that's not individual. That's a misnomer then.

MR. KRESS: It's a misnomer, but it's --

DR. APOSTOLAKIS: It's a misnomer.

MR. KRESS: It's too late to do anything about that.

DR. APOSTOLAKIS: Individual means you take an individual like in the Yucca Mountain thing, and you put them there, and you say 24 hours, they're there.

MR. KRESS: That's why it's always given the average individual.

DR. APOSTOLAKIS: So, it's a representative societal risk.

MR. KRESS: No, it's not that.

DR. APOSTOLAKIS: Societal normalized by the number of people.

MR. KRESS: No, it's societal risk at all.

DR. APOSTOLAKIS: It's normalized.

MR. KRESS: It's normalized. That's why it's not a societal risk.

DR. APOSTOLAKIS: But it's a measure because if you evacuate, you effect really the societal risk, not individual. Can we do something about it, though? Is there any place where we can -- this is not individual risk because individual risk should be independent of whether you evacuate or not. That's the whole point, that you assume the guy's there. Probability of death of an individual who's 24 hours right there. Unless, again, like the unavailability business, we are using terms that are not

used by the wider community.

MR. KRESS: I think we are.

DR. APOSTOLAKIS: I think we are.

MR. KING: Early versions of this framework table did have numbers in that fourth column, the emergency planning column. We decided that didn't make sense for a couple of reasons. You know, one is if we're talking regulations that deal with design and operation, the emergency planning column doesn't deal with that.

MR. POWERS: Why doesn't emergency deal with operations?

MR. KING: Operating the plant?

MR. POWERS: Yeah, plant, the plant operations. Activities of the operator. The operator sees conditions in the plant. He's called upon to make judgments that activate various aspects of the emergency procedures, or the emergency planning activities.

MR. KING: Yeah, but I think in effect what you're saying is independent of the design, we want that emergency planning capability. You want the ability to have off site evacuation. That's independent of the design.

MR. KING: ...minus fifth CDF doesn't matter

MR. APOSTOLAKIS: That's a defense-in-depth measure

MR. KING: Defense-in-depth measure --

structuralist defense-in-measure.

MR. APOSTOLAKIS: But this is different from saying that it essential to protect the public.

MR. KRESS: It is.

MR. APOSTOLAKIS: It may happen in some cases to be but I would be much more comfortable saying it is a defense-in-depth measure than saying it is essential.

MR. KING: Except remember the LERF value that we backed out,
the 10(-5th) LERF value that was backed out of safety goal calculations. Those safety goal calculations made assumptions on evacuation. So that LERF does have a built-in assumption that evacuation takes place.

MR. KRESS: Absolutely.

MR. KING: And if you didn't make that assumption you would have a different LERF value. So in that respect it is --

MR. KRESS: Now you have a (inaudible) on the book associating the siding -- (inaudible) siding.

MR. KING: Yes.

MR. KRESS: And those, some aspects deal with population distributions around the plant or --

MR. KING: Population centers.

MR. KRESS: Population centers, basically. And I presume, those sort of regulations would be considered

defense-in-depth and you won't try to touch those with risk informing them. I mean, I can see how you could do some risk informing of that but --

MR. KING: Part 100 is not high on our list of regulations to look at in risk informing. I won't say it will never be looked at, but it is not in the top ten.

MR. KRESS: What is your point? But you know what it does it limits -- limits the number of sides (inaudible)

MR. KING: (inaudible) top 10.

MR. APOSTOLAKIS: Would you say that for a plant that is relatively modern, like South Texas Project, has a very low core damage frequency. That that side protected action are essential to protect the public?

MR. KRESS: No.

MR. APOSTOLAKIS: So I suggest you change the words.

MR. KRESS: It is very plant specific.

MR. APOSTOLAKIS: It is very plant specific and the word "essential" -- I think essential --

MR. KRESS: Well, if you are talking about on the average for the whole population of plants, generically it is.

MR. KING: But I think what is fair to say is that our LERF value is based upon calculations that make

assumptions on evacuations. Therefore, --

MR. APOSTOLAKIS: Then on the right-hand side column, we have again the same political statement that would not be prudent to simple replace existing regulations with a quantitative objectives. Compliance with, you know, it is the same like in page 21, so.

Then on the next page, unless somebody has a question, 3-4: "Anticipated initiators are either expected to occur or may well occur." Seems to me that is a (inaudible). Something that is expected, turning out I'm an English expert. Something that is expected to occur --

MR. SEALE: May well occur.

MR. APOSTOLAKIS: May well occur, right.

MR. KRESS: Where are you reading at?

DR. SHACK: Second column, second paragraph.

MR. APOSTOLAKIS: Anticipated initiators is way down bottom, that's right. I mean, it is not essential, it just struck me.

MR. KRESS: Yeah, it is a little strange.

MR. APOSTOLAKIS: It is the same thing.

DR. SHACK: Give it to your tech editor.

MR. APOSTOLAKIS: Now, in the text, of course, the initiators are placed in -- according to their frequency in equalities in the table, you just have the upper bond it is understood, I suppose. The lower bond is the upper bond of

the next category.

"Even when common cause failures and human errors are accounted for most plants can meet the proposed plant state of objections."

I guess he means no power, huh? There is a sentence I don't understand on page 3-5. So, "The defense-in-depth approach does not ignore rare events," okay. Righr-hand side column.

"Tactics such as research, and so on, are applied to validate the low frequency of rare initiators. Generally, however, a risk informed regulation will not require plant structure systems and components be specifically designed to cope with rare initiators."

I don't know. I mean, do you really know that?

MR. KRESS:.Unless it changes the initiators (inaudible) frequency itself. I mean, by (inaudible)

MR. APOSTOLAKIS: Sometimes it is rare because of the design, right?

MR. KRESS: Maybe.

MR. KING: Well, I mean, we don't design for meteorites. We don't design for huge earthquakes.

MR. APOSTOLAKIS: Meteorites, we don't. But LOCAs we have a lot to do with, even big earthquakes.

MR. KING: Well, this initiator there are the ones

you just do not worry about like meteorites because they are so right. But then there are the others that Eric was talking about the reason they are rare is because the design is so rare.

MR. APOSTOLAKIS: The classic example in California is that an earthquake of a certain magnitude occurring in Los Angeles, and occurring in Guatemala has very different consequences. So our designs must have something to do with the rare initiator and its consequences, right?

MR. KING: But if you are building a plant in Florida you are not going to design for the big earthquake in California. You would design for whatever you think makes sense for Florida.

MR. APOSTOLAKIS: Right. And that is what you are saying here?

MR. KING: Yes.

MR. APOSTOLAKIS: That components be specifically designed to cope with a rare initiator?

MR. BONOCA: Because you conceive that the earthquake in California to be (inaudible) in Florida?

MR. KING: Yeah. There are some things that are sight specific: earthquakes, hurricanes.

MR. APOSTOLAKIS: But that is not the fear. I mean, that is something that comes naturally for risk inform the regulation the regulation. A risk informed regulation will

not require plant (inaudible) to be specifically designed to cope with rare initiators.

MR. BONOCA: It is general (inaudible)

MR. APOSTOLAKIS: I think a risk informed approach would look at all spectrum of all possible accidents and take measures.

Now if what --

MR. SHACK: If all he is saying is that the initiator has a low enough frequency you don't design for asteroids, because the --

DR. POWERS: But that question has come up before. I am trying to have things that are risk significant, but if I only compute frequencies, how do I know what is significant? I mean, clearly to my mind there must surely be some frequency below which I am not concerned. I am not concerned about the meteorite.

MR. KING: Yes.

DR. POWERS: I mean, I refuse to let myself be concerned about that --

MR. KRESS: Yeah, because then (inaudible) the whole inventory in the core and then -- as a release and still meet the goals, yeah. So small.

DR. POWERS: Is that the reason that some how I know that if I smack this thing with an asteroid and I explode out of it the entire core inventory plus the spin

fuel, that even then multiplied times the probability that the asteroid -- I know that is some intuitional --

MR. KRESS: I would guess so. That would be the only logical way, yes.

DR. POWER: I would guess that that is the only way I would do it. Now I ask myself what is that number that allows me to quit calculating frequencies?

MR. KRESS: It ought to be calculable.

DR. POWERS: It ought to be estimatible. They ought to be able to put that down on a piece of paper --

MR. KRESS: I never seen it actually.

DR. POWERS: -- and look at it. I don't know what that is.

MR. KING: Wouldn't that be the safety goal numbers. The early fatality numbers?

MR. KRESS: Oh, yeah. But he just wants to know what the frequency is.

DR. POWERS: Yeah, I want to know -- I got a safety going risk but it is a big chore to go from frequencies to that risk number, because Dr. Kress would get all over my case because I used the wrong force term, or something like that. And Dr. Powers would climb on because I used the wrong dispersion code. And there are a lot of funny people in on this committee, they are very difficult to get along with. And so, it would be a lot easier if you

can tell me if your frequency is below this thou shalt forget about it.

MR. HASKINS: The number we are currently using is 10(-6th). That is the number that has been used for aircraft impact, for example.

DR. POWERS: So you actually have a number that you would like to use as 10(-6th)?

MR. KING: Yes.

MR. HASKINS: That is the number we are currently using, and that number appears in the standard review plans. Yes.

MR. KRESS: Now the question you have is, why? What is the basis of it?

DR. POWERS: I don't believe that number.

MR. KRESS: It seems a little high, doesn't it?

DR. POWERS: Yes

MR. HASKINS: The number is based on ten percent of 10(-5th). The ten percent came from the earlier discussion and the 10(-5th) comes from the figure.

MR. APOSTOLAKIS: But not in the standard review plan, because there were not thinking that way.

MR. HASKINS: No, but also it was consistent (inaudible)

MR. KRESS: See that number has to be different for aircraft impacting the thing versus my asteroid impacting

that.

MR. APOSTOLAKIS: My question here is, isn't this an issue handled naturally by the existence of safety goals. Why do I have to worry about it? I mean, that is the residual risk.

MR. KRESS: Well, from the point --

MR. APOSTOLAKIS: And later on in fact it says, "To focus on reducing risks associated with rare initiators would draw attention away from, and potentially increase risk associated with more likely initiators."

Why do you have to worry about it? I mean, you have their goals; you met them. There are always initiators that are much less frequent, you know.

MR. KRESS: That's because the goals are not revealed into the -- aren't explicit in the regulation. They are only implicit.

MR. APOSTOLAKIS: But not with this document. They would be very implicityly, right.

MR. KRESS: They will be implicit; they won't be explicit. That is the problem. In they are implicit which means you don't have to really meet them. You might meet -- the probability of meeting is very good.

MR. APOSTOLAKIS: There must be a better way of handling it though. Because, I mean, that is the whole idea of a goal. I am recognizing explicitly -- acknowledging

explicitly that there is such a thing as a residual risk.

MR. KRESS: But the only way to deal with that is to have the numbers actually built in explicitly in your regulations.

MR. APOSTOLAKIS: That is worst.

MR. KRESS: Which is a no-no, right now.

MR. APOSTOLAKIS: But then it is risk based. We will all go to hell.

MR. KRESS: Oh, yes. Then it's a no-no.

MR. APOSTOLAKIS: Oh, no, no, no. No risk base here.

MR. KING: No risk base.

MR. APOSTOLAKIS: So you guys agree that this crazy ideology makes sense?

MR. KING: We can look at it again, but the idea is there are some things that are below concern and frequency is one way to look at them.

MR. APOSTOLAKIS: All right, anything else here from anyone else. Next page; Additional Thoughts on Quantitative Objectives." Again, I don't believe that some of your subsidiaries want (inaudible) objectives.

I mean it says, that there are no risk arguments for setting subsidiary quantitative objective most stringent. Second paragraph from the left. And I think we made it clear that CDF is more stringent, 10(-4th), is it

not. The CDF 10 (-4th) goal is more stringent then one would derive from the QHOs. independently of what the commission said.

MR. KING: Actually, that word is --

MR. APOSTOLAKIS: And that is (inaudible)

MR. KRESS: Yeah, that is definitely true.

MR. APOSTOLAKIS: But in several places this document says, "That the subsidiary goal should not be more stringent the QHOs." And I think that language should be softened because some things are more stringent.

DR. SHACK: How about more stringent than the commissiion safety goals?

MR. KING: Then is should be the subsidiary objective.

MR. APOSTOLAKIS: The 10(-4th) is still there?

MR. KING: The subsidiary objective 10(-4th) was endorsed by the commission.

MR. KRESS: It is still there.

MR. APOSTOLAKIS: Later, though. Not in the original statement, as I recall.

MR. KING: Not in the original statement. In the 1990 SRM.

MR. APOSTOLAKIS: Oh, well. Okay. So we have elevated it, then.

MR. KRESS: Well, in the defactor.

MR. APOSTOLAKIS: Now there is another statement in the next paragraph why there is no basis for being more stringent than the QHO's both defense-in-depth and uncertainties, which tend to grow as postulated accidents proceeding time, influence, blah, blah, blah. "The uncertain extent to grow as postulated accidents proceed in time."

Is this something you all agree on. Okay. Since we do, it is just that it is a new thought that is thrown in there as a secondary clause that says --

MR. HASKINS: You can look at 1150 in that

MR. APOSTOLAKIS: Yeah, yeah, yeah.

DR. POWERS: I mean, it is the whole basis for being reluctant to go beyond Level 1 kinds of PRAs, because we can't get technical consensus on the Level 2. I think if we could get it on Level 2's it would not be hard to get it on Level 3. Level 2 is a challenge for us right now.

MR. HASKINS: You will still have a problem

MR. KING: Level 3 is a challenge.

MR. APOSTOLAKIS: Page 3-7 guidelines for each strategy

suggested to leave the table, it's motherhood and apple pie. It really doesn't say anything. How do limit the frequency of accident initiators. Provide assurance of the combine frequency less than one per year; provide assurance that the combine frequency, I mean, sure. It is almost a

(inaudible). I think the table does not provide any (inaudible)size should be limited. Limit the probability of core damage. How do you do that? By providing assurance of the probability of core damage is less than 10(-4th). Is that the same thing?

MR. KRESS: Well, it just expands on

MR APOSTOLAKIS: It is assuming.

MR. KRESS: So it is an expansion of -- what do you mean by that. It is an expansion of what you mean by the word imit.

MR. APOSTOLAKIS: It restates the figure. It really does not add anything.

MR. KRESS: Yes, it does.

MR. APOSTOLAKIS: It does.

MR. KRESS: I mean it restates the figure, yes.

MR. APOSTOLAKIS: Does the staff members feel otherwise, strongly, to keep it? You think about it. Take it into advisement and you make a decision in the proper time.

MR. KRESS: In the statement under strategy four does add some stuff.

MR. APOSTOLAKIS: I'm sorry, four?

MR. KRESS: Yes. It talks about this (inaudible).

MR. APOSTOLAKIS: It is probably the only one that goes a little beyond.

MR. KRESS: Yes. It goes a little beyond what you are talking about.

MR. APOSTOLAKIS: But if you look at the first -- at the top of the page on the right, Table 3-1 provides a list of guidelines. That is not what that is.

MR. KRESS: It is not guidelines.

MR. APOSTOLAKIS: It is not guidelines.

MR. KING: We will look at it.

MS. DROVIN: All Table 3-1 was meant to do was to take the information and summarize it from the text. So if you wanted to go to a Table and see it all without having to go through the text, that is all it was meant to do. Just and aide to the reader.

MR. KRESS: I did have a question on page 3.6, George. 3-6, in right-hand column, second paragraph and this is the old version.

MR. APOSTOLAKIS: Yes.

MR. KRESS: And the underline to specifically deal with latent cancers a quantitative object of Point 1 is proposed for the probability of a late large release in a core damage accident.

Now the Point 1, and I am not sure where it comes from, and I am not sure why the latent cancers is relegated strictly to late large releases of -- I guess you, the rationale is that your guideline is already on large

early release. Deal with that part of it. Now you are talking about the residual, the late part, and if you set conditional containment probability on that, covered the whole spectrum, I am not sure where the Point 1, how it had just derive from thinking along those lines and then going to the quantitative help objective on latent cancers.

MR. KING: Well, the Point 1 is just a parallel to the Point 1 for large early -- or conditional containment failure probability for large early releases. We call it large early release which derived from --

MR. KRESS: I just -- what my question was more specifically, because I am not sure if I started from the latent death quantitative health objective and worked backwards to get these conditional containment (inaudible). That I would actually get this number. You know, I have not seen that exercise done as of now.

DR. POWERS: I don't think we went through that exercise.

MR. KRESS: So my question is, is the Point 1 the right value to use?

DR. POWERS: It is a good question. It is one we pulled out to be parallel to the early --

MR. KRESS: And I am not sure that parallel is as applies here.

DR. POWERS: I don't know, Mary or Eric may want to

say more about that.

MR. KRESS: Yes.

MS. DROVIN: You have a different recommendation.

MR. KRESS: No, I haven't done the exercise either. But I was starting from the latent death quantitative health objective, and do something like you did to get a LERF and show that the --

MR. HASKINS: Let me just say one thing. There are source terms that can be, and have been, postulated and purees, for late containment failures where you have core concrete interactions going on in the absence and overlying pool that can be some very bad source terms that could actually result in fatalities beyond the ten miles zone. Certainly, we would want to have a consistent goal for those types of things. Now if the driving force turns out to be lightened cancers then there may be a more appropriate numerical goal. We simply put that down as a strawman at this stage.

MR. KING: I think it is a fair question. We ought to think about it some more.

MR. KRESS: If it is a strawman, it is all right. But I would want to see a technical basis for it based on the thinking if you went to it alert.

MR. KING: Okay.

MR. APOSTOLAKIS: I think on page 3-8, you are

given some thoughts on the core damage of containment failure that do not make sense there, but they make sense after I read page 4-1, where you make a distinction between the risk assessment perspective and the design bases perspective.

For example, on 3-8, there is a risk -- the second paragraph on the left, "A risk significant level of core damage found that is specified in the ACC as acceptance criteria. ACC has accepted criteria to permit only 1 percent."

I am sitting here, you know, everything I have read so far has something to do with risk. Now you are throwing in these new ideas. But then when I read later on the Safety Margins definition, and so on, that makes more sense. So, editorially, I think some how you should make it clear. Maybe shift this discussion to the next chapter, statement of uncertainties because I think we are mixing the two.

And my second question is, isn't it inconceivable that at some point that the whole frame work that you have presented can naturally can be used to define safety modules that was to move now from risk to design bases? Seems to me that would make sense that you may need additional guidelines for better ability and so on. I mean, this thing of a one percent of a (inaudible) being allowed

to be oxidized, I don't know if that could change but that is just an example.

And working backwards, one should be able to do that; shouldn't one.

MR. KING: Like working backwards to what?

MR. APOSTOLAKIS: Backwards from the top ladders that you have. Is that written down.

MR. KING: You mean to the actual QHOs themselves and the --

MR. APOSTOLAKIS: The QHOs I go down to prevention mitigation; go down to (inaudible) initiators; condition of core damage probability.

MR. KING: And then see what kind of QHO you get and compare that to the safety goal QHOs; is that what you are talking about?

MR. APOSTOLAKIS: No, no, no. What I mean, as I move down now, and I am going to the conditional containment failure probability, and I can derive a number, given that have core damage frequency of a initiator, cannot I say from there, "Gee, the safety margin that I want in terms of probabilities from my containment, is this." Rather than come from the outside and give the safety margin and do just an assessment.

I mean safety margins defined on the next pages are probability that the designer process will

perform an intended function. Can I do that?

MR. KRESS: I don't think so. Because you are dealing with means already and that is --

MR. APOSTOLAKIS: I can make contributions of distributions. I mean civil engineers do that all the time, don't they? I can play with the distribution of the strength, distribution of the strengths. Some nice mathematics and say, "This is the number." They are too strong right now, aren't they?

MR. KRESS: Maybe. I have a different question on that same page short. Similar to yours.

MR. APOSTOLAKIS: Which page, 3-8?

MR. KRESS: 3-8. Into my view the (inaudible) for 50.46, dealing with the ECCS acceptance criteria is the only risk component I see to that is that the acceptance criteria gives you a level of assurance and when you turn on the ECCS, and when I say terminate the accident, and not lead to an uncoolable geometry later on. So you have these safety margins in there to deal with the fact of how well the ECCS has to work. It is a statement of how good the ECCS has to be in order to assure a coolable geometry that doesn't get you in trouble later on. That to me is -- I don't see how you risk inform that because you have to ask yourself, well, what probability am I willing to live with that this doesn't actually terminate the accident like I thought it was going

to. It doesn't lead to bowing and the swelling of the clad and uncoolable geometries later on. It leads me back into the accident.

And I don't know how you deal with that in a risk informed regulations, because what you have to have there is some probability that you would live -- or frequency or willing to live with on this thing and I don't think we have defined any criteria like that in here.

MR. APOSTOLAKIS: You are absolutely right. I mean it is always some conflict conceived.

MR. KRESS: So, it is a defense-in-depth concept to me that I don't see how you can go in to say Appendix K and K 50.46 and change anything, because you don't have a risk informed way to change that.

MR. SIEBER: Well, I think you have to go beyond that. 50.46, to my memory can avow as a settlement of a lawsuit and it concerns scientist. The final acceptance criteria came out and so, being that there is an element of the legal basis in there, it is not clear that you now can lateral say that I am going to risk inform 50.46, because then the basis of the law suit settlement --

MR. KING: Jim, I am not sure about the legal aspects --

MR. KRESS: I think the voluntary aspect, you have to get around the legal, but --

MR. BONOCA: It is very significant for them to (inaudible) standard. Let me give you an example what is significant. We have seen a number of power plants, PWRs, recently, where they have found that the MPHS under certain conditions was inadequate. The condition was literally and open containment. Apathetic conditions, which means in the limiting design conditions in which you design a containment, you may have entrainment and you may have essentially a problem with PSH. But for all other ranges, I will see that coming through and risk inform regulation that particular condition may be almost eliminated because how did it get there.

MR. KING: You get there with failing containers.

MR. BONACA: So if you design for a more realistic range of conditions, you will find that all containments had in fact recirculation capability. See that is a fundamental change and maybe is the right change, but I think without implication, that absolutely, because now we have perform PRAs or power plants which were designed with (inaudible) material to meet certain limiting conditions that may not be realistic. In the future, we will be using PRAs to evaluate PRA designed plants, which therefore, have different success criteria, maybe. Maybe that is what is going to be reflected and what (inauible)but isn't this an important issue.

MR. KING: Let me get back to your question on 50.46. I mean, it seems to me you can risk inform. You can risk inform it in two ways. One is the large break LOCA still makes sense and all the assumptions that go with it, given probability and risk arguments. You can take a look at it from that respect. You can also look at -- I mean, I think clearly you want to maintain coolable geometry that is the ultimate goal. If you have a LOCA you don't want to loose coolable geometry. But is the 2200 degrees and the 17 percent oxidation are they the right numbers to do that. Maybe they are very conservative.

Have you new information that says, no, there are better numbers that will help you achieve that. You know, maybe they'll be more restrictive, less restrictive. To me that is also risk informing in the sense that you are trying to take the best available. Maybe do some best estimate calculations and then you got to figure out what margin you want to account for uncertainties, but to me that is part of misinforming the regulation. So I think you can get into all aspects of 50.46. Either from probability risk or, you know, best technology.

MR. KRESS: Yeah, I would have to agree with you. I think those are risk informed concepts.

MR. KING: It won't be easy. Eric has been heavily involved and working with Westinghouse.

MR. KRESS: You know, I kind of view the concept of the large break LOCA as also adding margin, and I don't know how you deal with that versus the margin you have in the temperature, the peak clad temperature thing. Because I view just requiring this thing to deal with the large break LOCA as it sits there a margin concept.

MR. KING: It adds margin for LOCA but what does it do for PTS?

MR. KRESS: Not very much.

MR. KING: It may make it worst. You have high capacity pumps that shove a lot of cold water in, particularly under a small break LOCA when you are still pressurized, you know?

MR. KRESS: Yeah.

MR. KING: Maybe that is not a good idea.

MR. SIEBER: Small break LOCA --

DR. POWERS: I think this discussion on the oxidation and the 17 percent raises a question, I am not sure how you deal with it. And I am not sure how general the situation is but the specifics of the 17 percent oxidation and the use of baker adjust kenitics for calculating that oxidation

And you say, gee, I want to do a more realistic analysis here. Baker Just, I know how he got his numbers, he threw balls in the water and things like that to get

those numbers, they are not applicable. I have got better things, Cathcart, Paul, and a couple of guys at the PNL did some better work. A couple of guys from Germany have done better work on those kinetics. And I can go apply those and if I do, I will get much lower oxidation levels.

But that presumes that the temperature history of a LOCA is this very benign history which is a rampup to a specified temperature and a hold for a certain period of time.

If, in fact, the temperatures, as they probably do, go through a rampup to a peak, they drop back down and then rise up to a hold point, then you put thermal stress, create thermal stresses in that oxide so it spalls, you get breakaway oxidation and it goes much, much faster than Cathcart, Paul or Hobson, or any of those other people, because they were looking at planchettes that were flat. They didn't have the curvature problems of clads and things like that.

All of these things that people understood when they set up, when they were looking at 50.46 in setting it up, and they said, gee, we will try to bound all those effects by using Baker Just. And so, if you try to do something more realistic there, then you have to take these more realistic scenarios on the temperatures, and it gets into a complicated nightmare that is very troublesome.

When you look for sections to risk-inform, do you go back into that history far enough to know what kind of cans of worms that you are opening up in looking at these things?

MR. HASKIN: There has already been some work done on those sorts of replacements in the Appendix K calculations, and the answer is, yeah, you have kind of got to go back. Norm Lauben is the one that is doing that work, and he has got enough historical perspective that he has an appreciation for most of those things.

But you are right, the point is as you start trying to make Appendix K calculations less conservative in some respects, you have got to look at what the original intent was, because you can't have your Appendix K calculations becoming less conservative than what you would get with the best estimate in 95 percent, for example. And you can easily get yourself into that situation if you just start relaxing Appendix K assumptions right and left.

So, he has got a procedure that he is going through to make sure that that doesn't happen.

MS. DROUIN: If you take 50.44, for example, and we had just said, let's just look at the rule and bring risk insights, it would have been a much easier process to deal with. But I don't think, in all fairness, you can do it that way. I think you have to go back and look at the

technical basis. Why did it come around the way it did? You know, what were all the assumptions and everything? And that was the difficulty. I mean, so that when you finally do get to here is your alternative for risk-informing this, you know, you haven't dropped something, for example, because of other reasons that were in there, that you just had no idea about.

So, on all of these, be it 50.44, 50.46, part of our process is going back and understanding the technical basis.

DR. KRESS: But is that spelled out in the framework document somehow, that that would be part of the framework?

MR. KING: It is spelled out in the plan we sent to the Commission before we even wrote the framework document, that we have to go back in and look at the technical basis. That was back in November last year.

MS. DROUIN: It was in the plan.

DR. KRESS: Now, I remember, you had to actually add those words.

MS. DROUIN: And I don't know in the version you have how well that was explained. In the May version of Chapter 5 that is talked to very explicitly, that you have to go back and look at that. You have to see how these are tied to the other regulations. And maybe you did something

in this regulation, you know, you backed off on it because it is covered elsewhere.

So that is very explicitly in the newer version of the framework. I don't remember, in the version you have, how well that was explained.

MR. KING: It is not an easy task. I mean in 50.44, it took so long precisely because of going back and looking at all the places that hydrogen issues show up, and looking at things like, well, was the analysis just for in-vessel hydrogen generation or did it consider ex-vessel hydrogen generation? And, you know, how long did the generation take place, and all that, and it took a long time.

I mean I expected 50.44 to proceed much faster than it did, but then Mary clued me in on what was going on. And, you know, it is not an easy task.

DR. POWERS: You always bring back news.

MR. KING: Yeah.

[Laughter.]

DR. KRESS: Yeah, I see in Section 5, you actually have a whole section on assessing the technical basis of the regulations in relationship to other regulations. I guess that is where it is dealt with.

CHAIRMAN APOSTOLAKIS: Okay. First of all, let me understand how this works. Mr. Christie is supposed to

present his views at 4:00. Now, this is not going to be done by 4:00. Should we interrupt, tell Mr. Christie make a presentation and then we will come back to the document? Or we --

DR. KRESS: If they can accommodate that arrangement, I think that would be the way to do it.

CHAIRMAN APOSTOLAKIS: Because a schedule is a schedule, right.

DR. KRESS: Yes.

CHAIRMAN APOSTOLAKIS: Can you accommodate that?

MS. DROUIN: I have to leave.

CHAIRMAN APOSTOLAKIS: What time? What time do you have to leave, Mary?

MS. DROUIN: I have to leave by quarter of 5:00 today.

CHAIRMAN APOSTOLAKIS: Okay. And Eric?

SPEAKER: I have got an 8:00 flight.

CHAIRMAN APOSTOLAKIS: Oh, 8:00 is fine.

SPEAKER: I am taking Metro.

CHAIRMAN APOSTOLAKIS: Do you think you guys can handle it without Mary?

MR. KING: It will be tough. We will try.

MS. DROUIN: They can handle it. I am scared what they are going to agree to without me that I am going to have to live with.

[Laughter]

DR. SEALE: Well, you can handle it.

MS. DROUIN: I can handle it.

DR. KRESS: This is our chance.

DR. POWERS: Now is your chance, Tom.

CHAIRMAN APOSTOLAKIS: Yeah, I don't expect it will be much longer.

Mr. Christie, are you going to stick to your time schedule, 15 minutes, or you will need more? It depends on the question.

DR. KRESS: It depends on what we ask.

CHAIRMAN APOSTOLAKIS: Anyway, we will try to be reasonable. Okay. We will try to be reasonable, but I think we should start at 4:00 with Mr. Christie, because that is the scheduled time.

So maybe we can go on for another five minutes and then break for five, and then come back with Mr. Christie.

Anything on 4-1? Yeah, I do. The first paragraph on the left says NUREG-1489 provides a more tutorial discussion in terms of methods in uncertainty analysis. This reference is from 1994. I would rather have you cite Regulatory Guide 1.174, which reflects the more recent thinking. There is a lot of discussion on uncertainties there and how to handle them in the context of that Regulatory Guide.

Then on the next page, 4-2, it says, for example, compliance with the ECCS acceptance criteria of 10 CFR 50.46 can be demonstrated using best estimate codes provided that uncertainty is accounted for. I don't think a best estimate code means anything. How do you account for uncertainties in a best estimate code? It seems to me you have to have a quantitative statement of how accurate the model is.

DR. KRESS: I don't know if we have a good definition of what a best estimate code is.

CHAIRMAN APOSTOLAKIS: There is no definition. Yeah, I think the whole thing has to be revisited. Now, I can see how, by having a distribution of the output of the code, one defines acceptance criteria in such a way that in the future, all you have to do is run the code with point estimates, because you don't want to do uncertainties all the time. Right? And then you compare with the acceptance criteria which have now in them, built into them, the uncertainties in the code.

MR. KING: But I think you are right, a best estimate code, for it to work, you have got to have an idea of what the uncertainty band about the estimate is.

CHAIRMAN APOSTOLAKIS: So, would you please rephrase this to make sure that it is not offensive.

DR. BONACA: I have a question on this, however. Doesn't the NRC right now allow for what they call a best

estimate?

MR. KING: Yes. Yes.

CHAIRMAN APOSTOLAKIS: Yeah.

DR. BONACA: So there is a definition of it.

MR. KING: But you have to know the uncertainty band.

MR. HASKIN: There is a Reg. Guide that governs how you do that.

CHAIRMAN APOSTOLAKIS: That does what?

MR. HASKIN: This is an option under Part 46.

DR. BONACA: There is a definition right now in place for a best estimate LOCA now. Yes, there is.

MR. HASKIN: Yeah, there is a Reg. Guide that governs what it is.

CHAIRMAN APOSTOLAKIS: What does it say? What does it say? It says use best estimate codes.

MR. KING: But you have to quantify the uncertainty.

DR. BONACA: You have to quantify the uncertainty, compare it to the Appendix K. You have -- it is a very elaborate process. Now, how best estimate it is, I cannot tell you, but --

MR. HASKIN: And including looking at the biases in the code modeling. So, I mean there is a whole Reg. Guide that deals with this.

CHAIRMAN APOSTOLAKIS: Okay.

DR. KRESS: On that same page, George, they have this intriguing paragraph at the end of the second column, "As in considering a change to the existing regulatory requirements, it is important to estimate the overall impact on the actual plant changes that would ensue."

I think that is not only important, I think it is mandatory to do a good risk-informing job. But I don't know how you are going to do that. And my question is, how do you implement that requirement? Is this an iterative process where you will make a rule and then go to the plants and say, now what will you change based on this rule? Or will you guys try to guesstimate what they will change?

MR. KING: We would have to make some estimate of what the changes would be. I mean we have to have something in mind.

DR. KRESS: And then estimate what the effect is on --

MR. KING: Estimate what the effect is on risk.

DR. KRESS: But isn't that plant-specific? Wouldn't you have to do it for each plant and see if, on the aggregate, you still meet your goals? Yeah, it is just the implementation of this, I am not sure how you are going to go about doing it.

MR. KING: I mean it is no different than when we

modify a regulation today. We have to basically do the same thing. Pick an estimate of what the change is risk is.

DR. KRESS: When you make a regulatory analysis.

MR. KING: Yeah, regulatory analysis based on what we think the licensees are going to do to comply with that regulation.

DR. KRESS: So this would be similar to a normal regulatory analysis.

MR. KING: Similar to a regulatory analysis. We don't look at 103 plants, we pick a few representative plants.

DR. KRESS: Pick out, you will out enough of them that you have got it covered.

CHAIRMAN APOSTOLAKIS: The righthand side, top of the page, there is a sentence that I think is great. "To the extent possible, revised and new deterministic parameters will be based on probabilistic considerations." This is really a very good statement. I think it should have been stated much earlier as well.

And I think the statements that I have been complaining about, you know, about not using probabilities and risk measures in the thing, can be combined with this to give a nice little paragraph that explains where you are coming from, because this really is the essence of it.

MR. KING: Yeah, this is the main them of this

whole document.

CHAIRMAN APOSTOLAKIS: Yeah, this is the essence.

But, again, revised or new deterministic parameters, that does not exclude the possibility of having some of these requirements use probabilistic language, like unavailabilities, the maintenance rule and so on.

MR. KING: So if we are not risk-based, George?

CHAIRMAN APOSTOLAKIS: Huh?

MR. KING: As long as we are not risk-based.

[Laughter.]

CHAIRMAN APOSTOLAKIS: This is awful. Can you believe that?

MS. DROUIN: We now know what button to push.

CHAIRMAN APOSTOLAKIS: To be vigilant not to become risk-based, because then -- I suggest that we stop now for a few minutes. I don't think there are too many comments after that, but I think we should take a short break and then allow Mr. Christie to present his views.

I take it you don't have anything. It says here, status of proposed revision to 10 CFR 50.44. You can do that?

MR. KING: We covered that at last subcommittee meeting. We will cover it at the full committee tomorrow.

MS. DROUIN: Tomorrow.

MR. KING: Tomorrow.

CHAIRMAN APOSTOLAKIS: We will cover in the full committee, yes, that is true.

Okay. So we are recess for seven minutes.

[Recess.]

CHAIRMAN APOSTOLAKIS: We are back in session.

Mr. Robert Christie has the floor.

DR. KRESS: Would you introduce yourself so we know who we are --

CHAIRMAN APOSTOLAKIS: I think Mr. Christie is well known to the committee, and it is late in the day.

MR. CHRISTIE: My name is Bob Christie. I am the owner of a firm, Knoxville, Tennessee consulting firm called Performance Technology. I have been in the commercial electric power business, nuclear and some other things, risk and reliability related, for about 26 years. And I think that today what I would like to start out with is a couple of corrections administrative in nature.

One is, George, I am not talking about hydrogen 50.44 today, that is tomorrow.

CHAIRMAN APOSTOLAKIS: Okay.

MR. CHRISTIE: Okay. The second is there is, again, brought up in the discussion today, this statement that I am supposedly to have made that when we proposed something in 50.44, we were talking about ultimate containment capability. And I just want to go back again on

the record, during the meeting last week on the 29th, you know, I will just read what I said.

I don't see anywhere in that proposed rulemaking that says we are using the ultimate capability. We are just saying that the large drives are going to check their containment capability. We don't use ultimate capacity. We just say for high probability events, check your containment capability. Whether you use design, whether you use ultimate, whatever you do, that is for the people at the plant to decide how to do that, and they have done that in their previous works.

The last thing I would like to check, the staff has stated today that no one has objected to the framework document, and that is definitely untrue. In the February meeting that we had to talk about the framework document, which isn't exactly the same as what we have had today, and we had probably one of the most, as I stated in our March 1st meeting, the most contentious meetings I have ever been to with respect to the interactions of the industry and the NRC.

So, there were violent objections to the framework document in that meeting. We came to you and we went on the record on the March 1st. We provided you documentation that, you know, put down our objections to what the framework document is. And then last, I guess, last week,

you know, you called me up and asked me, did you hear what they said to me, and do you agree to that, you know, et cetera? I said, no, I don't agree to that framework document.

So, it is not true that the industry has not objected to the framework document. That is not true at all.

Okay. What I would like to talk to -- those are just to clarify some other things. I would like to talk to you today. I would like to, you know, just quick, five subjects, adequate protection, the policy statement on safety goals, the June 15th, 1990 staff requirements, goal allocation and summary. And I don't think we have to spend a lot of time on it. This is, again, the primary basis -- I mean primary responsibility-wise with the people running it, and the Nuclear Regulatory Commission is the adequate protection, public health and safety.

The definition that is generally used, and we will talk about that, if a nuclear power plant is in compliance with the regulations, it is presumed that nuclear unit provides adequate protection of public health and safety. I think that is pretty well straightforward.

DR. KRESS: Except what do you mean by presumed?

MR. CHRISTIE: I have no idea. I am just quoting from what the NRC puts in their paperwork.

DR. KRESS: Okay.

MR. CHRISTIE: I am just saying that is the definition.

DR. KRESS: Okay.

MR. CHRISTIE: Okay. We have the 1986 Nuclear Regulatory Commission policy statement on safety goals for the operation of nuclear power plants. It consists of two parts. Basically, the qualitative part having to do with individual members of the public, and then the societal risk to life and so. We have seen those before.

From the qualitative goals, we go down to what is known as the quantitative health effects objectives. And here we see the .1 percent rules. .1 percent rule means .1 percent of the background. For accident fatalities, that is called the top fatality goal, and then we have got the latent cancer fatalities, which, again, is .1 percent.

Where do the numbers come from after that? It is pointed out in the staff presentation, you figure out the numbers and so you get approximately 100,000 accidental deaths per year in, you know, 200 million. So it comes to one in 2,000. For latent cancers, it is 400,000 per 200 million, and it is one in 500. Okay.

I think, you know, that is pretty straightforward.

I want to talk to you now about this document that has been referred to a couple of times, and I don't know

whether you have read it or not. I have read it millions of times. But this is the -- you know, the document defines how safe is safe enough in adequate protection. And the first statement that is in here is that the Commission agrees that it must not depart from or be seen as obscuring the arguments made in court defending the backfit rule. Okay. These arguments clearly establish that there is a level of safety that is referred to as adequate protection. This is a level that must be assured without regard to cost and, thus, without invoking the procedures required by the backfit rule.

Beyond adequate protection, if the NRC decides to consider enhancements to safety, costs must be considered and a cost benefit analysis required by the backfit rule must be performed.

The safety goals, on the other hand, are silent on the issue of cost, but do provide a definition of how safe is safe enough that should be seen as guidance on how far to go when proposing safety enhancements, including those considered under the backfit rule.

And on your point, Tom, where did we get the bit about -- read the footnote on a related point. The presumption is that compliance with our regulations provides adequate protection. I don't know what presumption means. I don't like the definition, but that is something else.

Okay. What the Commissioners, to me, clearly said in that, that there is a level of adequate protection somewhere, and there is also a thing called -- how safe is safe enough? And the quantitative health objective is to find, how safe is safe enough?

So, let's take the individual, which, you know, everybody generally agrees is the most restrictive. And you look at it and you take the background as one in 2,000, and you go to .1 percent, and it comes out to be one in 2 million. And below that point, the NRC is not to impose requirements even if cost beneficial. That is pretty clear to me in the safety goal policy statement.

Okay. Now, they said somewhere above that line lines something called adequate protection. Okay. And this is my curve from my Delphi Process, where I asked everybody that I knew, including the members of the ACRS, to contribute to the Delphi Process to see if we could get this curve defined with adequate protection. And as I told you before, we didn't get a heck of a lot of response. No one from the NRC, including no member of the ACRS, responded. We got a limited from the industry, and it turns out that most of the people are coming in between 1 and 10 percent, with kind of a mean, you know, somewhere 3 to 5, as I have told you before.

So, now, if that were true, this would be the

curve that would be used to define adequate protection. Above that line, the NRC imposes requirements without regard to cost, between the adequate protection line and this "how safe is safe enough?" that we would be using the 10 CFR 50.109. Why do I have 10 CFR 10.109 on there? Sorry about that. I just caught that.

And in there, we would be using the 200 person-rem conversion factor based on the $3 million value for health detriment.

DR. KRESS: So your Delphi Process would say currently, today, adequate protection is like a factor of 10 above the safety goals?

MR. CHRISTIE: I would say 30 to 50, but a factor of 10 for sure.

DR. KRESS: Just go out to the --

MR. CHRISTIE: Three to 5 percent versus .1. Adequate protection over here is about 3 to 5 percent.

CHAIRMAN APOSTOLAKIS: Of what?

MR. CHRISTIE: Of background. Which is an order of 30 to 50 more than .1 percent.

DR. KRESS: But this was just a Delphi Process.

MR. CHRISTIE: Right.

DR. KRESS: So it is --

MR. CHRISTIE: You know, again, I have had a conversation with Dr. Joe Murphy about this, and Joe says

people don't think in terms of 3 to 5 percent, they think --

DR. KRESS: In terms of 10.

MR. CHRISTIE: Ten.

DR. KRESS: Ten.

MR. CHRISTIE: So, you know, what he recommends is we go -- well, he doesn't recommend, but he said it would be more logical if they used just 1 percent.

DR. KRESS: Yeah.

CHAIRMAN APOSTOLAKIS: For adequate protection.

MR. CHRISTIE: For adequate protection.

DR. KRESS: That would be the factor of 10.

CHAIRMAN APOSTOLAKIS: Of what, 1 percent of the background?

MR. CHRISTIE: 1 percent of background.

DR. KRESS: It is a factor of 10.

MR. CHRISTIE: Everything is --

CHAIRMAN APOSTOLAKIS: 10 to the minus 6 then.

DR. KRESS: Yeah.

CHAIRMAN APOSTOLAKIS: No.

MR. CHRISTIE: It would be if you used 1 percent. For me, it would be 5 times to the minus per year.

CHAIRMAN APOSTOLAKIS: Right. So, an order of magnitude above the safe enough.

MR. CHRISTIE: Right.

CHAIRMAN APOSTOLAKIS: Yeah.

MR. CHRISTIE: And in that region between 1 percent and .1 percent, we would be using the backfit rule.

CHAIRMAN APOSTOLAKIS: Well, this is a three region approach we have asked for several times, right?

DR. KRESS: That is exactly what it is.

CHAIRMAN APOSTOLAKIS: And the staff and the industry are against it.

MR. CHRISTIE: The staff and what industry? I am for it. I know that the next head of the ANS is for it.

CHAIRMAN APOSTOLAKIS: NEI was against it.

MR. CHRISTIE: Well, I am just telling you that there are -- you know, industry is not represented entirely by NEI.

DR. KRESS: The staff actually uses this approach.

CHAIRMAN APOSTOLAKIS: This is like risk-based.

MR. KING: This is, in effect, what the staff uses. We are not against it.

DR. KRESS: This is, in effect, what the staff uses.

CHAIRMAN APOSTOLAKIS: I'm sorry?

MR. KING: This is, in effect, what the staff uses, a three region approach.

DR. KRESS: I mean whether it is spelled out or not, that is what they use.

MR. KING: I mean we just haven't --

CHAIRMAN APOSTOLAKIS: That is what we said in our letter, Tom, that, in effect, people are using it.

MR. KING: Exactly. We just haven't put a number on adequate protection.

DR. KRESS: Right.

CHAIRMAN APOSTOLAKIS: And, of course, we did it in the context of CDF and you might object to doing that for the CDF. I know you --

MR. CHRISTIE: Depending on which CDF is chosen.

CHAIRMAN APOSTOLAKIS: You like the risk?

MR. CHRISTIE: We will get to that point in a minute, George.

CHAIRMAN APOSTOLAKIS: Oh, I never doubted that, Bob.

MR. CHRISTIE: Okay. And you have heard me before. The best requirements are those that define a criteria to be met, do not specify how to meet. The criteria should lead to a comprehensive approach to the whole plant, defining the overall criteria is better than defining a set of lower criteria.

All right. And then, again, we get to the problem. The public health risk is different for each unit, and it changes with time. All right.

DR. KRESS: What happens if you cure all the cancers?

MR. CHRISTIE: We have been through that last -- two years ago, Tom. If you cure all the cancers, the latent doesn't even appear anymore and we are down to the immediates.

DR. KRESS: No, no, the latent then becomes dominant.

MR. CHRISTIE: No, the latents is zero. You can't have a latent cancer fatality anymore.

DR. KRESS: Yeah, but you have got --

MR. CHRISTIE: Zero is zero, Tom.

DR. KRESS: -- .1 percent of zero that you meet that.

MR. CHRISTIE: No, Tom, zero is zero. 1 percent of zero is zero. 100 percent of zero is zero.

DR. KRESS: It is hard to meet zero is what I am saying.

MR. CHRISTIE: But if they cured cancer, then we wouldn't have latents.

Okay. Now, the staff is in here.

CHAIRMAN APOSTOLAKIS: Yes.

MR. CHRISTIE: And this is what we, you know, again, we object to this pretty vehemently. I mean it is such a complicated affair. Just think about writing your PRA three times now. You are going to run your PRA for -- what do they call them? -- anticipated initiation. You are

group all the ones that are, you know, somewhere between 10 to the minus 2 and 1, and you are going to run it again between all the ones that 10 to the minus 5. You can do all you can all your conditions, containment capabilities.

DR. POWERS: I guess I am lost. Why do you have to run them multiple times?

MR. CHRISTIE: How are you going to separate out the transients that are between 10 to the minus 2 and 1? If you just run it once, all of them are lumped together and all your event trees, et cetera, et cetera.

DR. POWERS: No, they are not. No, not my PRAs, they aren't. All spit out nice and separately.

DR. KRESS: And when you say --

MR. CHRISTIE: No.

DR. KRESS: When you say you are going to have to do this, do you think this is going to be the licensees having to do this?

MR. CHRISTIE: Absolutely.

DR. KRESS: Oh, I thought NRC was going to do that.

MR. CHRISTIE: Well, what code is it is going to do, code is the NRC going to use to do this for a plant-specific PRA that varies individually from plant to plant?

DR. KRESS: The same ones that they use now for

regulatory analyses is what I was told.

MR. CHRISTIE: Right. Right. And do you think they are going to get accurate results?

DR. KRESS: I don't know. Accurate enough for making regulations maybe.

MR. CHRISTIE: Anyway, this is a very --

CHAIRMAN APOSTOLAKIS: Your argument, Bob, is that what really matters is the bottom box, quantitative health objectives, is that your argument?

MR. CHRISTIE: No. What matters to me is adequate protection of public health and safety. That is my limit.

CHAIRMAN APOSTOLAKIS: I thought you are objecting then -- this is a clarification. You are objecting to two things that the staff is doing. First, they are going deeper than just the quantitative health objectives. You have always argued that that is the only thing that matters.

MR. CHRISTIE: No. I have never argued it is the only thing that matters. I have always argued --

CHAIRMAN APOSTOLAKIS: You have argued this for years.

MR. CHRISTIE: I have always argued that adequate protection of public health and safety is the standard to which plants are licensed and the thing that counted. And if you want to go below that, then you can go down to the backfit rule.

At the time I was saying it might be easier if all we did was demonstrate we are below the quantitative health objectives, because then we wouldn't even worry about the backfit rule. But the standard that I am held to today, at every license in the in the United States, is adequate protection of public health and safety.

CHAIRMAN APOSTOLAKIS: So you are -- I mean that is why I raised the issue three hours ago. Would the fact that we are using the goals create any problems?

DR. SHACK: You have to meet the regulations. Now, the regulations give you adequate protection, but nobody pretends that they are based solely on adequate protection. They clearly include safety enhancements that go beyond adequate protection.

MR. CHRISTIE: If you use the backfit rule.

DR. SHACK: Yeah.

MR. CHRISTIE: Right. That is the scheme that all of us are licensed to, and the scheme that is embedded in the law. And if you want to change that scheme, you have got to go back and change the law and go through the Congress and go through the courts.

CHAIRMAN APOSTOLAKIS: I'm confused.

MR. CHRISTIE: That's the way life is, George, in licensing a nuclear power plant.

CHAIRMAN APOSTOLAKIS: I understand that. I am

trying to understand your objection to what the Staff is doing.

MR. CHRISTIE: I am objecting that the standard that they are now setting to us is how safe is safe enough, which to me is -- not only they are not setting it as how safe is safe enough, they are even setting it below.

They are not even going to write rules for adequate protection in a risk-informed rule.

CHAIRMAN APOSTOLAKIS: So they are -- you are objecting --

MR. CHRISTIE: They are changing the Atomic Energy Act.

CHAIRMAN APOSTOLAKIS: You are objecting to their use of the goals to write regulations without looking at the backfit rule?

MR. CHRISTIE: Right. Absolutely.

CHAIRMAN APOSTOLAKIS: Which is something we discussed earlier.

The second one, which you surprise me today, I thought you have always argued that what really matters is ultimate public health and safety -- fine, and not CDF and conditional core damage and conditional --

MR. CHRISTIE: Absolutely.

CHAIRMAN APOSTOLAKIS: So you are also objecting in terms of that figure to all the boxes they have above

the -- that talk about prevention versus mitigation?

MR. CHRISTIE: Absolutely.

CHAIRMAN APOSTOLAKIS: Well, now I understand.

MR. CHRISTIE: You have got your letter from Dr. Seale to Chairman Jackson, you know -- we all know that. If you choose a core damage frequency of 10 to the minus 4, you are more conservative than the quantitative health objectives.

CHAIRMAN APOSTOLAKIS: But the Staff told us today that the Commission has blessed this.

MR. CHRISTIE: Well, I will talk about that in a minute. As a matter of fact, here's the next slide.

The Staff says in the June 15th memorandum from the Commissioners to Staff that they gave them permission to use the 10 to the minus 4, and let's start looking at what they say in that memorandum.

It says implementation and safety goals may require development and use of, quote, "partition objectives. In general the additional objectives should not introduce additional conservatism. The Staff should bring its recommendation on use of each subset of the area objectives to the Commission in the context of the specific issue for which it will be useful and appropriate and explain its compatibility with the safety goals."

Then they go on to say, "For the purposes of

implementation the Staff may establish subsidiary quantitative core damage frequency and containment performance objectives through partitioning of a large release guideline. These subsidiary objectives should anchor or provide guidance on minimum acceptance criteria for prevention and mitigation and thus assure an appropriate multibarrier defense-in-depth balance in design. Such subsidiary objectives should be consistent with the large release guideline and not introduce additional conservatisms so as to create de facto new large release guideline."

And as we know, in the safety goals they couldn't even come up with the large release guideline.

They said a core damage probability of less than one in 10,000 per year reactor appears to be a very useful subsidiary benchmark in making judgment about that portion of the regulations which are directed toward accident prevention.

Okay? Now how are you going to get that and still be, quote, "not introduce some additional conservatisms" is the dilemma that I have with a problem with.

CHAIRMAN APOSTOLAKIS: Would you say these SRMS is not self-consistent?

MR. CHRISTIE: I would say that statement is not self-consistent.

DR. KRESS: Do you know what core damage frequency

the current regulations were designed on an average to achieve?

MR. CHRISTIE: I have no idea -- it would depend on each individual plant would have its own specific core damage frequency that would meet the regulation.

DR. KRESS: Well, and that could vary. On the average, this might be the number they were shooting for with the current regulations and still use it --

MR. CHRISTIE: Could be.

DR. KRESS: -- and might not add any more conservatisms.

MR. CHRISTIE: Could be, but if I again look at the fact that I am working off the QHOs and a 10 to the minus 4 QHO -- I mean 10 to the minus 4 core damage frequency drives me down below the quantitative health objectives, then obviously this is inadequate protection because adequate protection according to this document is above the quantitative health objective.

DR. KRESS: If it drives every plant down below, then maybe on the average.

MR. CHRISTIE: So in the average it is all right to have half of the plants get more restrictive, to pick the 10 to the minus 4 as the core damage frequency --

DR. KRESS: Yes, that's what you mean by that.

MR. CHRISTIE: It's great that half of the plants

don't meet that -- couldn't meet the QHOs, don't meet the CDF?

DR. KRESS: Right. I think that's what you mean by it.

MR. CHRISTIE: I'm sorry. I'm not going to have half of the plants in the United States not meeting a subsidiary objective --

DR. KRESS: So you would rather have a fixed number that they all have to meet?

MR. CHRISTIE: I would like for them to meet adequate protection, which I hope some day to be able to define in terms of background. I would like for them, below that, to go with the backfit rule, and I would like for them not to have to meet any NRC regulations --

CHAIRMAN APOSTOLAKIS: What you are asking, Bob, is really for the Commission to define adequate protection in terms of some frequency number, some risk number.

MR. CHRISTIE: It would solve a lot of problems. But, you know, again, that's their -- now go look at the next statement however. The Commission has no objection to the use of a 0.1 containment conditional failure probability for the evolutionary design -- for the evolutionary design.

Now there's some thought that when they put this in the same paragraph and partitioning that they also meant the core damage probability of less than one in 10,000 per

year to be for the evolutionary designs also, because the Commissioners in 19 --

CHAIRMAN APOSTOLAKIS: 1990 --

MR. CHRISTIE: -90, when they were writing this knew that the existing plants didn't meet the 10 to the minus 4.

CHAIRMAN APOSTOLAKIS: And they were not aware of Rick Sherry's work I don't think at the time.

DR. SEALE: But they were aware of the criteria that were in the utility requirements document for the evolutionary designs that talked about 10 to the minus 5th.

CHAIRMAN APOSTOLAKIS: That's correct.

MR. CHRISTIE: Again, I am just going off what is stated here in the document.

CHAIRMAN APOSTOLAKIS: So what is your point from all this?

MR. CHRISTIE: I just want one more slide on the large early release frequency because I want to --

CHAIRMAN APOSTOLAKIS: By the way, just as a clarification, Tom, when you told us earlier that an SRM would confirm the 10 to the minus 4, you are referring to this one?

MR. KING: Yes.

CHAIRMAN APOSTOLAKIS: Okay, thank you.

MR. CHRISTIE: Okay -- and Tom Kress and I will go

over it again.

On the large early release frequency of 10 to the minus 5, you got the statement in the SECY that says, hey, we took the 1150 plants, we raised them all up to a certain level, we added a whole bunch of stuff up, and we picked the 10 to the minus 5 on the basis of those that are closest to the QHOs, okay? -- and Tom said, no, that's not exactly what we did is we drew a line, a kind of median, and so basically half of the plants if we choose 10 to the minus 5, choosing 10 to the minus 5 is more restrictive for half of the plants and maybe not that restrictive for the other half to meet the QHOs.

DR. KRESS: I don't think either of those is what has actually happened.

MR. CHRISTIE: Do you believe that there are plants in the United States who have a large early release frequency in your definition let's say of a 10 to the minus 4 and still meet the QHOs?

DR. KRESS: 10 to the minus 4 and still meet the QHOs? There may be some limited sites --

MR. CHRISTIE: So some plants in the United States could have a large early release in 10 to the minus 4 and still meet the quantitative health objectives?

DR. KRESS: It's possible, depending on the sites.

MR. CHRISTIE: Okay, so again picking a 10 to the

minus 5 means that there's some plants in the United States that's more restrictive than the quantitative health objectives?

DR. KRESS: Probably yes.

MR. CHRISTIE: Okay. That's what I think too --

CHAIRMAN APOSTOLAKIS: Let's look at summaries. Let's look at the summaries.

MR. CHRISTIE: All right, summary. And here's -- so we know where we are at.

Staff is proposing requirements for risk-informed regulations for the existing nuclear units far beyond the standard of adequate protection, okay? They're saying this is voluntary, so if we stick in the existing deterministic rule the standard is adequate protection. If we go over into the probabilistic world, the standard is how safe is safe enough. Oh, boy.

Number two, the Staff is ignoring the requirement of the backfit rule when the Staff wishes to go beyond adequate protection. The Staff is ignoring the express wish of the NRC Commissioners in the thing where they said not only said use it, but don't give any appearance of not using it.

Three -- the Staff is proposing subsidiary quantitative objectives for existing plants that the NRC Commissioners said were applicable to the evolutionary

plants -- to .1 for containment conditional probability is for evolutionary plants, new plants.

The framework they are using today uses .1.

CHAIRMAN APOSTOLAKIS: But not the 10 to the minus 4, as Dr. Seale pointed out. They were aware of the 10 to the minus 5 --

MR. CHRISTIE: I don't know what that 10 to the minus 4 meant.

CHAIRMAN APOSTOLAKIS: I think it was an allowance for the existing plants.

MR. CHRISTIE: But at least to .1 is for the evolutionary plants and now the Staff is applying it to existing plants.

CHAIRMAN APOSTOLAKIS: I must say that I am really troubled by the first bullet -- I mean the first comment there, as I stated earlier today.

I think we are using quantitative health objectives that were meant to indicate safe enough without using them in option three, which is intended to be for adequate protection.

I think Bob is right.

DR. KRESS: I don't think so, George. I think we're mixing up the concept of requiring individual plants to meet their goal versus writing the regulations so that on the average they can meet the goal.

CHAIRMAN APOSTOLAKIS: But the individual regulations will be imposed upon the individual plants --

DR. KRESS: As they are now, and I think they had the same goals in mind when they wrote the --

CHAIRMAN APOSTOLAKIS: Well, that's where we don't know. We don't what the goal was --

DR. KRESS: Now we don't know.

CHAIRMAN APOSTOLAKIS: -- when they were writing something in 1973.

DR. KRESS: I know we don't know that.

DR. SHACK: Any new regulation will have to meet the backfit rule.

DR. KRESS: That's right.

CHAIRMAN APOSTOLAKIS: I don't understand that. If you use option three, it won't.

DR. KRESS: They will probably do the backfit anyway, even if it's volunteer.

CHAIRMAN APOSTOLAKIS: Wait a minute, wait a minute. If I use option three, and it is finished, okay? -- and the NRC writes a regulation --

DR. KRESS: Right.

CHAIRMAN APOSTOLAKIS: -- then they will have to use the backfit rule to justify it?

DR. KRESS: They won't have to, but they will because it's sort of standard procedure nowadays.

CHAIRMAN APOSTOLAKIS: What do you mean, they don't have to but they will?

MR. KING: That is one of the issues that we are going to raise to the Commission.

There is a line of thought that when we propose an alternative, a risk-informed alternative, if that risk-informed alternative adds additional requirements there ought to be a backfit analysis to show that those would pass the backfit test.

MR. CHRISTIE: But you don't have to ask for the policy statement. The policy statement already exists -- June 15, 1999 the Commissioners told you that in the implementation of the safety goals you use the backfit rule. Don't even be perceived as not using the backfit rule.

CHAIRMAN APOSTOLAKIS: I am afraid we are ratcheting up the regulations if we use the goals.

DR. KRESS: I don't think we know that.

DR. BONACA: I don't think we do.

CHAIRMAN APOSTOLAKIS: You don't think we do what?

DR. KRESS: Look at the plants now. Where do they fall as a spectrum of plants on a safety goal plot? I don't know where they fall, but I'll bet you most of them meet the safety goals and that is because --

CHAIRMAN APOSTOLAKIS: Not according to the gentleman to my left.

DR. KRESS: Well, you know, we can debate this issue, but I would say --

CHAIRMAN APOSTOLAKIS: Well, let's take the subsidiary goals. You know they don't.

DR. KRESS: Most of them probably do.

CHAIRMAN APOSTOLAKIS: Most of them do but --

DR. KRESS: That is why you write the regulations so that the average meets them and if most of them meet it, well, the average meets it.

CHAIRMAN APOSTOLAKIS: I am very uncomfortable with that concept, that on the average if I look at the population they meet it, because all they need is one accident.

DR. KRESS: I've always had --

CHAIRMAN APOSTOLAKIS: An accident on the average --

DR. KRESS: I have always had a problem with that.

CHAIRMAN APOSTOLAKIS: That bothers me.

DR. KRESS: I have always had a problem with that too, George.

CHAIRMAN APOSTOLAKIS: Yes.

DR. KRESS: But that is the way the system is said to be designed. I have had a problem --

CHAIRMAN APOSTOLAKIS: We're supposed to fix the system.

DR. KRESS: Okay, but that is a different issue.

CHAIRMAN APOSTOLAKIS: I don't understand that. When we issue a particular rule --

DR. KRESS: To fix that issue you have to go to saying each plant has to be required to meet a particular CDF or a particular LERF, and the Commission has just over and over said they are not going to do that, so, you know, I would like to change that, and I have fought to change that, but we are not getting very far with it.

CHAIRMAN APOSTOLAKIS: But that doesn't mean that I can develop a new approach to Part 50 that has some fundamental if not flaws, fundamental questions embedded in it.

DR. KRESS: I think there are questions but I think we disagree on whether or not this is actually a ratchet or not.

CHAIRMAN APOSTOLAKIS: I am willing to be convinced otherwise, guys, but right now I think we are ratcheting up.

DR. KRESS: Well, the question of the ratchet is what does the current set of plants meet in terms of the safety goals.

How many of them meet it? How many of them don't?

I think you would say then with the new regulations are we requiring more of them to meet it or are

you still going to get the same distribution?

I don't know the answer to these questions but I have no --

DR. BONACA: I agree with Tom, but the other thing, adequate protection right now means that you meet the regulation, the regulation that we have in the books.

CHAIRMAN APOSTOLAKIS: That is not what it means. The Commissioner makes it very clear.

If you meet the regulations, there is a presumption of adequate protection. If there is adequate protection, that does not necessarily mean you meet all the regulations, and it is not necessary and sufficient. It is necessary, not sufficient -- which leaves open a huge hole for us to justify, you know, a lot of things.

MR. CHRISTIE: No, I do not believe it leaves a huge hole to justify other things except by use of the backfit rule. It is not a huge hole. It is a very well-defined hole.

DR. BONACA: I agree with that. I agree.

MR. CHRISTIE: So all we have to do from now on is everything that we want to add to the thing say it meets the backfit rule, go through the 51.09 analysis and make sure it meets the backfit rule.

DR. BONACA: The question I have is if we did not use the goals but we used some definition of adequate

protection, how would we go about risk-informing Part 50? I mean has anybody got any idea how to do that?

DR. KRESS: You would have to explicitly spell those out.

DR. BONACA: Exactly.

DR. KRESS: So since we can't, we have to use something different, because we can't explicitly spell those out.

CHAIRMAN APOSTOLAKIS: But you see --

DR. BONACA: We wrote a letter, right?

CHAIRMAN APOSTOLAKIS: But is it inconceivable that as an agency we'll want to have it both ways?

We don't want to define adequate protection quantitatively and yet we want to risk-inform the regulations.

DR. BONACA: But the point though that I would like to make is that, first of all, we had a regulation in place before there was any definition or goals, historically.

Then we began to talk about goals and, you know, these goals these members here, they were the AIF, American International Forum put them forth in the early '80s, late '70s, and now there has been always an intent of filling the gap with regulation, with the use of PRA.

How have we done that? By looking at CDF and LERF

and in cases we found there was a gap in the regulation, that there was no adequate protection on some plants, there were some changes made in the research of vulnerabilities. There was a process that ended up with the IPEs and so on and so forth.

So I don't think this concept here presented by NRC is inconsistent with all these developments.

CHAIRMAN APOSTOLAKIS: It is inconsistent.

MR. CHRISTIE: George, let me --

CHAIRMAN APOSTOLAKIS: 1.174 -- it refers to individual plants and says if you're changing CDF from what you have now, which presumably satisfies adequate protection criteria, is this and that, we approve or we don't approve.

This is a very different approach. This starts with the QHOs.

DR. KRESS: It ought to be. It ought to be --

CHAIRMAN APOSTOLAKIS: It doesn't start with the existing CDF at this plant.

DR. KRESS: George, it ought to be a different approach -- 1.174 can be viewed as a formal way to do exemptions.

CHAIRMAN APOSTOLAKIS: Changes.

DR. BONACA: It has to be plant-specific.

DR. KRESS: And this is not exemptions. This is rewriting the rules and they should not be -- the two of

them shouldn't be thought of except in general principles, you know, the principles are applicable in both cases but they are not the same thing.

CHAIRMAN APOSTOLAKIS: My point is that in 1.174 precisely because you are talking about changes the issue did not arise, because you are not relying fundamentally on the QHOs. You are saying we are allowing this guy to operate, therefore there is a presumption of adequate protection. Now he wants to change it a little bit and here are some rules.

Here we are taking a very different approach.

MR. KING: No.

CHAIRMAN APOSTOLAKIS: We are not looking at what the guy is doing. We are starting with the QHOs.

MR. KING: 1.174 started with the QHOs and backed out.

CHAIRMAN APOSTOLAKIS: No.

DR. KRESS: They did.

MR. KING: LERF, 10 to the minus 5th LERF number shows up in 1.174 as well as the 10 to the minus 4 CDF as cutoffs as to where --

CHAIRMAN APOSTOLAKIS: No, but there you are allowing to go higher. Come on.

MR. KING: But the changes have to be, you know, so small that they are almost negligible but there is a

cut-off in there and it is based upon the safety goals. It is not based upon adequate protection.

CHAIRMAN APOSTOLAKIS: You look at the figures you have. They go to the right and then there is a zig-zag line that says, you know, we really don't know where this is, but that is exactly the adequate protection, that you are approaching now regions where even a small delta is not tolerable.

DR. KRESS: That is because you are dealing with individual plants, not the body of regulations.

DR. BONACA: Exactly. That is the point -- 1.174 applies to the individual plants.

DR. KRESS: If you are going to risk-inform the regulations, in my opinion you are going to have to have in mind some risk objectives that you are trying to achieve. That is the only way you can risk-inform it.

Now if I were going to use as my risk objectives this factor of 10 above the safety goals that we saw on Bob Christie's plants, I would be in real trouble, I think. I think that would be real mistake to try to risk-inform the regulations.

DR. SHACK: And who would be -- the meaning of the safety goal at that point?

DR. KRESS: Nobody.

CHAIRMAN APOSTOLAKIS: No, the goal I think was

stated very well. It is if you are below the goal, we leave you alone. We don't even raise the issue of backfit.

DR. KRESS: That is when you deal with specific plants.

MR. CHRISTIE: Agreed.

CHAIRMAN APOSTOLAKIS: That is exactly what it was always supposed to be.

DR. KRESS: But that's when you deal with specific plants.

MR. CHRISTIE: And that was the intent of the Commissioners.

CHAIRMAN APOSTOLAKIS: I don't think anybody is disputing that.

MR. CHRISTIE: Okay. Let me explain. We do not need this framework to risk-inform the regulations.

CHAIRMAN APOSTOLAKIS: Why not?

MR. CHRISTIE: Well, because we have another framework which we will talk about again tomorrow, which I have already explained to you on the hydrogen, where the framework is. You go through the existing regulations. You retain what is effective and efficient in addressing public health risk. You add what is necessary that comes out of your risk assessments and you delete what is not effective and efficient.

CHAIRMAN APOSTOLAKIS: Well, then the Staff might

tell you that we are developing all this to help us decide what is necessary.

MR. CHRISTIE: Well, they can have a framework where half the plants in the United States don't meet the regulations, which to me is just a debacle of the nth order. It's almost ludicrous when you think about it.

Do I want to be an in the half of the plants that don't meet it and go out there and say, hey, I don't meet the regulations but it's all right?

DR. KRESS: Well, there's going to be two sets of regulations and you'll have to meet one or the other.

I think that is a problem we have had but I don't see any way around that.

MR. CHRISTIE: Okay. We are going to have a set of regulations where the plants that can meet all the quantitative health objectives and treat quantitative health objectives and even below the quantitative health objectives as adequate protection and meet all those are going to be over here in one set of rules and then we are going to have another set which can't meet all the quantitative health objectives as adequate protection and the subsidiaries, et cetera, and they are going to be up at another level?

DR. KRESS: Probably. That is probably what is going to happen.

CHAIRMAN APOSTOLAKIS: That is another thing that

makes me very uncomfortable, Tom.

DR. KRESS: I know, but --

CHAIRMAN APOSTOLAKIS: And you know very well -- I think all of us know that a lot of licensees will start to pick and choose.

DR. KRESS: Of course they will.

CHAIRMAN APOSTOLAKIS: Then what happens?

DR. KRESS: That is the issue of selective implementation, that we have got a policy to deal with, and we even wrote a letter once that we think you are going to end up with a dual set of regulations and don't see any way around it.

MR. CHRISTIE: Well, I see a lot of ways around it.

There's no doubt in my mind I see a lot of ways around it. I can risk-inform the regulations for everyone using just exactly the framework that we just explained.

I don't think it is the most optimum but it certainly can be done.

DR. KRESS: Well, you would make a new set of regulations that would be mandatory for everybody --

MR. CHRISTIE: Absolutely.

DR. KRESS: -- a different framework.

MR. CHRISTIE: The proposed petition for 50.44 is a mandatory application for petition for everyone. It

doesn't set -- and that is another problem we will talk about tomorrow. It's got nothing to do with Option 3.

DR. KRESS: That is certainly another option. We debated among ourselves some about that option.

CHAIRMAN APOSTOLAKIS: Let me understand something in the context of the framework that was presented.

Let's say that in one of the entries for infrequent initiators one of the facilities happens to be higher than the numbers we have here and we say it's a goal, it doesn't matter.

Then Quad Cities happens. Right or wrong, somebody comes up with a sequence that is really violating the goals, the numbers that the Staff has shown.

Where does the Staff start flying people over there to find out what is happening and in fact order a shutdown or the licensee itself shuts down the plant because they feel they have entered the region now where we are talking about adequate protection and all this remains with this framework obscure.

DR. KRESS: I think they make a judgment call, just like they do now.

CHAIRMAN APOSTOLAKIS: That's right, so this is not helping that way.

DR. KRESS: It is not helping their part. They will have to make a judgment call just like they do now.

CHAIRMAN APOSTOLAKIS: I think what makes it worse is that you are allowing a plant to be higher than some of these numbers but we don't know how high they are allowed to be before we reach adequate protection.

DR. KRESS: Well, you and I know.

CHAIRMAN APOSTOLAKIS: I know.

DR. KRESS: I think the Staff knows.

CHAIRMAN APOSTOLAKIS: I think everybody agrees that if you are in the 10 to the minus 3 for the reactor core damage frequency, I mean the licensee itself proved that they believe that's too high. They shut down.

I don't know why we have this great reluctance to --

MR. CHRISTIE: Are they shutting down because of public health risk --

CHAIRMAN APOSTOLAKIS: No.

MR. CHRISTIE: -- that they can't survive it, or are they shutting down because the investment risk is too high to lose $4 billion?

CHAIRMAN APOSTOLAKIS: I think it is really a combination, and you can add to that one probably the reaction from the NRC and so on, but the truth of the matter is that it seems to be consensus that a 10 to the minus 3 or higher core damage frequency is something that we have to act immediately upon.

DR. KRESS: Yes.

CHAIRMAN APOSTOLAKIS: I don't think you can dispute that. Now you can argue about the reasons but this is the truth.

DR. KRESS: So why don't we codify --

CHAIRMAN APOSTOLAKIS: Why don't we recognize that?

DR. KRESS: Why don't we codify that --

CHAIRMAN APOSTOLAKIS: And yet the Commission says, the Commission disapproved the proposed change to elevate the qualitative statement of the prevention -- qualitative even -- of severe core damage accidents to a qualitative safety goal. The Commission just flat out disapproved it and now we can't do anything about it.

Anyway --

MR. CHRISTIE: I don't think -- you are just focusing on the core damage frequency, which again is not the reason for the Nuclear Regulatory Commission's existence.

The reason for the Nuclear Regulatory Commission's existence is the public health effects. The radiation that is contained in the fission products in the core have a significant impact during accidents, if we have accidents, on the public health risk, and it is the role of the Nuclear Regulatory Commission.

CHAIRMAN APOSTOLAKIS: I wonder, Bob, if there was a core damage incident tomorrow and the New York Times and Washington Post were after the Commission whether you would stand up and say, hey, nobody was killed. Why are you putting them on the hot seat?

MR. CHRISTIE: Absolutely. I would stand up there without even blinking.

CHAIRMAN APOSTOLAKIS: I don't think the reporters would listen to you.

MR. CHRISTIE: Again, you are predicating everything on the front page of the New York Times and the Washington Post and I know that the Staff does it also, because I sat in on the meetings and they told me so, and that is not an appropriate measure for the regulations of the Nuclear Regulatory Commission nor the behavior of the Staff.

CHAIRMAN APOSTOLAKIS: What is appropriate it seems to me is what the American people say is their role.

Anyway, I think we are running out of time here. Thank you very much.

I don't know, now do you want to continue with --

MR. KING: It's up to you. Mary mentioned to me that Section 5 has changed quite a bit, so if you have comments on the old Section 5 it's probably not worth taking time to go through them.

MS. DROUIN: I mean we have --

CHAIRMAN APOSTOLAKIS: I have comments on Section 4 and then I would be very happy to skip 5.

MS. DROUIN: I mean we substantially reworked 5. The new version doesn't look anything like the old version.

CHAIRMAN APOSTOLAKIS: Will we have another chance to look at 5, or the new 5?

MS. DROUIN: I mean you have it.

DR. KRESS: We have it here.

MS. DROUIN: I mean a chance to talk to you about it. Tomorrow or the next day?

MR. KING: It won't be tomorrow. We are not -- the subject isn't on the agenda for tomorrow but certainly we would ultimately like a letter on the framework in support of our August paper. Now the timing of how to get that we have got to talk about.

DR. KRESS: That's probably, that's something we ought to talk about now, I guess.

MR. MARKLEY: The next meeting is August 30 through September 1st.

CHAIRMAN APOSTOLAKIS: Maybe we should postpone then the discussion until then. I have a few comments but they are --

DR. SHACK: Let me just ask what is intended in Table 5-1 where you have this regulatory coverage of some

accidents important to risk.

I mean is the implication here that you need a regulation addressing each of the accidents important to risk, or can you take the argument that if you have achieved a sufficiently low level of risk by some other means you don't need to explicitly cover them?

DR. KRESS: Which Figure 5-1 are you looking at?

DR. SHACK: Table 5-1.

CHAIRMAN APOSTOLAKIS: Table 5-1.

MS. DROUIN: It's been awhile since I have looked at this.

The only thing we were trying to say, and you know, this is an early version, I can't tell you what the new version looks like, is that we wanted to step back and look at Part 50 and look at what are the risk insights coming out of your PRAs -- what are your dominant accident sequences, what are the contributors, and just kind of match them up to the regulations to see at a quick, high level, back-of-the envelope approach is there some glaring hole in the regulations?

Is there some dominant accident class or some contributor, some large contributor that is not being addressed by a regulation.

This was just showing how -- you know, we went through the accident types that are important to core damage

and to LERF and tried to map up where these are being covered by the regulations, not to read any more into that table than that.

DR. SHACK: You did seem to be determined to preserve the concept of a design basis accident, and that would somehow seem to be inconsistent with this notion that all these accident classes -- or these would become new design basis accidents?

MS. DROUIN: Not that these should become new. This is just looking at here are the accidents coming out of the PRAs, that PRAs have told us are important.

And we actually have regulations that are matching up. And if there is something that is not a match, then we would then therefore want to go look at to say this is a hole in the regulation.

DR. SHACK: Okay, so we want to think about this?

MS. DROUIN: Yes, it's just a high level screening tool for us.

CHAIRMAN APOSTOLAKIS: Have you really thought hard about this position that the concept of design basis accident should be preserved?

MS. DROUIN: Thought hard about it? I'm not sure what you mean by hard. We've thought about it.

CHAIRMAN APOSTOLAKIS: You just took it for granted that this is a good idea? We are doing a lot of

things that really go away beyond the design basis accidents.

DR. SEALE: Like steam generator tubes.

CHAIRMAN APOSTOLAKIS: Yes. This is a beautiful paragraph here, right below that table. Some risk-significant accident types and related events do not find any mention in the current regulations.

So I don't know that the DBAs are something worth deserving.

MS. DROUIN: It may not be those DBAs, but I do think the concept of having accidents against which you want to design, personally I think that's a good concept.

CHAIRMAN APOSTOLAKIS: It is, but it could take a different form than the current form of design basis accidents.

MS. DROUIN: That's all we're saying. We want to keep the concept.

CHAIRMAN APOSTOLAKIS: Yes.

MS. DROUIN: We aren't saying it's necessarily the DBAs that are the books now will still be the same ones and in the same form.

DR. POWERS: Your affection for the concept is because of its design facility that it provides?

MS. DROUIN: I'm sorry, I didn't hear you.

DR. POWERS: The reason you have an affection for

this concept is because of the facility it provides to design?

MS. DROUIN: Yes.

MR. KING: That's part of it, and part of it is unless you go risk-based, I think you're pretty much forced to come into some sort of design basis accident concept. So as long as those design basis accidents really reflect the risk considerations, and --

CHAIRMAN APOSTOLAKIS: But there is always a residual risk.

MR. KING: Sure. There's a residual risk, even if you want risk-based.

DR. BONACA: And under a probabilistic regime, I mean, you would have to postulate some event to determine the sizing of your pumps or the way you're injecting.

DR. POWERS: Well, what I'm asking -- you might well do that, but the question I'm asking is, if it's just the design and not this question of risk-based, and just a question of design, why does the NRC want to get involved? Why ought not that be up to the designer hypothesizing anything you want to do?

Now, this other issue that Tom brings up, which is that, in essence, we don't want to become risk-based because we don't think our risk analysis tools are yet comprehensive enough and robust enough that we can rely strictly on risk,

then gets into this question of there are certain kinds of features of plants that we want to proscribe.

We want to proscribe plants that have an end-stable reactivity profile. Just don't even bring them to me, they're forbidden.

I think I'm putting words in your mouth, but that's --

DR. KRESS: No, that's an accurate statement of what I propose.

DR. POWERS: Once again, we come to the possibility that because we can't set up a completely self-consistent regime here, we have to legislate against certain kinds of alternatives.

DR. KRESS: That makes sense to me.

DR. POWERS: So, we can't get rid of the concept of design basis accidents.

DR. KRESS: Yes. I think even in the extreme of a risk-based system, your design basis accident becomes the whole spectrum of PRA.

DR. POWERS: Well, it does, but it might be different for each plant.

DR. KRESS: It would be different for each plant.

DR. POWERS: Yes, or certainly each plant type.

DR. KRESS: It certainly would be plant-specific design basis accident.

DR. POWERS: We discussed that before, because of different locations, the risk profile must necessarily be different.

DR. KRESS: Yes, and because of the different reactor concepts.

DR. POWERS: All you've succeeded in doing is persuading them, boy, I'm glad I'm not doing your job.

DR. KRESS: We don't think this is an easy job.

CHAIRMAN APOSTOLAKIS: I think the most fundamental issue here is the adequate protection versus the use of goals.

DR. KRESS: Yes. I think we have a fundamental difference of opinion among some of the members on that issue.

DR. POWERS: I think that's been adequately reflected in the e-mail traffic.

DR. BONACA: To which we did not contribute intently.

CHAIRMAN APOSTOLAKIS: Say again?

DR. BONACA: For which -- I follow that traffic very, very carefully. I was going to help in a couple of times, and I said, well, it's already said.

CHAIRMAN APOSTOLAKIS: I would say it's reflected in today's discussion as well.

DR. KRESS: We probably should have added Tom and

Mary to this, and put our e-mail address on that. It might have been interesting.

DR. BONACA: I would like to say at some point --

CHAIRMAN APOSTOLAKIS: How are we going to solve this?

DR. BONACA: Wait. If we --

DR. SHACK: We're going to out-vote you, George.

[Discussion off the record.]

DR. BONACA: If we decided to go with adequate protection, then we would have to quantify it in terms of some risk measure. And I don't see why the one that we propose would not be appropriate on an average basis.

CHAIRMAN APOSTOLAKIS: That's what bothers me, that because it's the only risk measure that we have, we resort to using that without thinking that its intent was very different.

DR. SHACK: I still come back to my argument that if you have goals, that your regulatory system ought to be out to achieve those goals.

DR. KRESS: That's exactly what the Commission said they were intended for.

MR. KING: I remind you that this issue is going to go to the Commission in our August paper. I mean, we're not going to decide this unilaterally. We're going to lay this out for the Commission that we're using their safety

goals, subsidiary objectives for this purpose, and, in effect what it means is, we're risk-informing the regulations to achieve the level of safety that they -- that was stated as their expectation in this Agency in the safety goal policy.

DR. KRESS: I think that's --

CHAIRMAN APOSTOLAKIS: So now someone meets all the regulations under Option 3, and then you promise to leave them alone and you will never impose additional regulations on them because they are safe enough?

MR. KING: Yes, unless some new information comes up.

DR. KRESS: If you could write perfect regulations.

CHAIRMAN APOSTOLAKIS: And the staff should incorporate in the reactor safety goal policy statement that it is the Commission policy that safety goals are goals and not limits.

Now, what difference would that make? That some plant may violate them and when you issue the rule or whatever rule --

DR. KRESS: That's what it means; that's exactly what it means.

CHAIRMAN APOSTOLAKIS: I don't understand that.

DR. KRESS: That's why they're goals.

CHAIRMAN APOSTOLAKIS: They issue a rule that flows from this framework, what does that mean?

DR. KRESS: That means some plants will --

CHAIRMAN APOSTOLAKIS: Will not follow the rule?

DR. KRESS: No. They will follow the rules. It says that the rules cannot be written so perfectly that every plant in how it operates and how it designs and how it runs its things, will not meet those numbers. It will meet the rules, but it will not meet those specific numbers.

And that's the way the rules are written now, and that's the situation we have now.

MR. SIEBER: Some plants may choose not to risk-inform that rule.

DR. SHACK: Even if you assume --

DR. KRESS: Even if you choose all of them --

DR. SHACK: -- choose to do it, that's going to be a fact of life, that when they do it, because they've done it on a generic basis, some will make and some won't.

DR. KRESS: More than likely, the ones that choose to do it will be the ones that know they can make it easily anyway.

But that's not something we ought to debate.

CHAIRMAN APOSTOLAKIS: I don't think you're right with your argument that if I have goals, I should strive to achieve them, and otherwise, why do I have them? No.

The goals were specifically interpreted as meaning that if you are below those, there's no reason to even consider additional safety measures.

That doesn't mean that I will establish -- it's safe enough; that's what it says.

DR. KRESS: I don't think that's what they said.

DR. SHACK: I think there was an expectation that they would do that on the average.

DR. KRESS: On the average. I think that's explicitly stated in there.

CHAIRMAN APOSTOLAKIS: But it's a safe-enough statement.

DR. POWERS: There was an expectation that --

DR. KRESS: They made it on the average.

CHAIRMAN APOSTOLAKIS: That's different from the expectation. The protection of the goal is that it's safe enough in the sense that I will not ask you to do anything else.

DR. KRESS: That's an additional interpretation.

CHAIRMAN APOSTOLAKIS: This is a --

DR. KRESS: Related to the backfit rule.

DR. POWERS: My perception, based on what I have read about the history of things was they were interested in the question of, is the body of regulation such that things are safe enough now, or is there some tremendous omission

that we've made out there in this body of regulation?

And one needs only think about the history prior to Appendix R and 50.48. Here's a tremendous omission.

I think they were really interested in, is there evidence of some tremendous omission? And we derive that evidence by looking at a lot of individuals, and seeing if, on the average, things are well away from where our goals are.

DR. KRESS: That's a good way to look at it.

DR. POWERS: But it doesn't obviate our problem. If we want to regulate, if we want to go approve a particular installation, what it wants to do, you need some number to compare against, and they're just not giving it to us.

DR. KRESS: Yes. They're not giving us that number at all.

DR. POWERS: And I don't know why. I mean --

DR. KRESS: I don't know why they're reluctant to do that.

DR. POWERS: They kind of have, in that they said go ahead and use 1.174, okay, for changes. And I should say, for the formal -- what method of granting exemptions, go ahead and use this number, which seems to me a lot more tenuous of a thing than saying prove the operation of this plant.

I seems to me that granting exemptions, I'd be more cautious with than just a general running of the plant.

It's curious.

DR. KRESS: It's curious.

DR. POWERS: Makes me glad that I don't have their job either.

DR. KRESS: We've argued that they ought to do that.

CHAIRMAN APOSTOLAKIS: Are there any other important comments?

MR. HASKIN: I just want to make one comment.

CHAIRMAN APOSTOLAKIS: Yes.

MR. HASKIN: While I was at Sandia, one of the jobs I had was to supervise the group that developed the methods to do the uncertainty analysis in 1150. If you guys recall, the uncertainty distributions on core damage frequency from 1150, typically from the fifth to the 95th percentile is two orders of magnitude.

If I establish a goal for core damage frequency at adequate protection at 10 to the minus three, and I base that on a mean, that means that there is a five percent chance that my actual core damage frequency could be as high as 10 to the minus two.

One of the things you haven't considered in this discussion of safety goals versus adequate protection is

that if you want to set an objective based on adequate protection for things like core damage frequency, you want to base that on a mean, or do you want to put some confidence level?

DR. KRESS: That's right.

DR. POWERS: It may have been neglected in this discussion, but it has been neglected before, and I will hasten to point out that the suggestion has been the 95 percentile for that particular goal.

DR. KRESS: Puts you right back to the safety goals again. That's what I was kind of arguing all along.

CHAIRMAN APOSTOLAKIS: Well, this will come after we decide what the limit -- what the goal is. And in 1.174, we just -- because, you know, it was too soon for these things, so we said there will be increased management attention, which means a qualitative treatment.

But you're right, that this uncertainty has to be taken into account. But that does not eliminate the fundamental concern of goal versus adequate protection.

DR. POWERS: If you're striving for the safety goal, I feel relatively comfortable making comparisons based on mean.

CHAIRMAN APOSTOLAKIS: So now you're saying that on the basis of defense-in-depth, I will use goals for adequate protection?

MR. HASKIN: No, it's just something that has to be considered in the deliberation.

DR. POWERS: What do we know about the history of the nuclear inspection -- anyone in their goal limit -- structure?

CHAIRMAN APOSTOLAKIS: We have this in -- see, the thing about documents that come out of Europe, as far as I can tell, is that this concern about uncertainty that we have here is not there.

So they tell you, individual risk, if it's less than 10 to the minus six, it's broadly acceptable by society, what we would call safe enough.

If it's 10 to the minus four or higher, it is unacceptable, what we would call adequate protection is violated.

In between, it's tolerable, in other words, cost/benefit --

DR. POWERS: I'm aware of the words.

CHAIRMAN APOSTOLAKIS: But the fact that 10 to the minus six may have two orders of magnitude uncertainty up and down does not appear, at least explicitly, does not appear.

DR. POWERS: So they must be prescribing methods of analysis?

CHAIRMAN APOSTOLAKIS: Not that I have seen. The

documents that I have seen do not.

DR. POWERS: Well, maybe they're not prescribing a particular method, but they're prescribing that the method be acceptable to the regulator.

CHAIRMAN APOSTOLAKIS: Oh, I'm sure it has to be.

DR. KRESS: They can deal with it in that prescription.

DR. POWERS: It's much more collegial and a less confrontational system. So if regulatory and regulatee agree on a method of analysis, yes, you can omit the question of uncertainties.

DR. KRESS: Because it's implicit in that.

DR. POWERS: It's been implicit in the way you've developed it, yes.

CHAIRMAN APOSTOLAKIS: Yes.

DR. POWERS: If you guys would just get along with your licensees, instead of being so damn confrontational.

[Laughter.]

CHAIRMAN APOSTOLAKIS: Any other comments from the members on issues that have not been addressed?

MR. KING: Do you want to talk timing of the next Committee's action?

CHAIRMAN APOSTOLAKIS: This is a good idea. You are supposed to send something to the Commission in August?

MR. KING: End of August, we owe a paper to the Commission that will have the framework, the policy issue in 50.54.

DR. POWERS: Why don't you come present that package to us at our September meeting?

DR. KRESS: And our letter would follow.

CHAIRMAN APOSTOLAKIS: Is that too late? That's what my question was; when is the Commission expected to do something about it, so that September will not be late?

MR. KING: I think if we could meet at your September meeting, it would probably work out okay.

CHAIRMAN APOSTOLAKIS: Can we write the letter at the September meeting?

DR. KRESS: Yes, I think we could do that. George, that would be a nice letter for you to write.

DR. SHACK: I can work on my added comments.

[Laughter.]

DR. KRESS: You and I can get together and work on our added comments.

MR. KING: Which means you probably want another Subcommittee so that we can delve more into the policy issues?

CHAIRMAN APOSTOLAKIS: I don't think another Subcommittee will help, but I think we can have a three-hour --

DR. POWERS: I think we would have great difficulty trying to schedule another Subcommittee meeting, but on the other hand, I think this is -- we've examined and debated this enough that if you could just appear before us and say here are the things that we call your attention to that have been changed dramatically from what we've talked to you about before --

I mean, just do that in a very terse fashion, because, quite frankly, as has been apparent, we've been going over this thing literally line-by-line.

CHAIRMAN APOSTOLAKIS: The other thing is, you know, it depends on what they say in the letter to the -- the report they send to the Commission.

If they pose an issue and they say, look, we can interpret it this way or that way, tell us what to do, then I don't think there is a question of added comments, right?

DR. KRESS: Probably.

CHAIRMAN APOSTOLAKIS: If the staff comes back and is de facto using certain things in a certain way, then some members may disagree, so it depends very much on what you guys write in the final.

MR. KING: You'd be interested in how we frame the issue and what our recommendation is.

DR. KRESS: Yes, definitely that.

CHAIRMAN APOSTOLAKIS: If you offer options to the

Commission, arguing, you know, both sides of the coin, I don't see why we would disagree.

DR. KRESS: They may have a preferred option.

DR. POWERS: I would presume the Commission would like to get our thoughts on which option to take.

DR. KRESS: Or if there is another option.

DR. POWERS: This sage and insightful one that Tom comes up with or the thing that we come up with.

CHAIRMAN APOSTOLAKIS: So we will have then a presentation during the September meeting with the expectation that we will write a letter at the time.

MR. KING: Okay, sounds good.

CHAIRMAN APOSTOLAKIS: Okay. Anything else?

DR. KRESS: That's a two-hour session.

CHAIRMAN APOSTOLAKIS: Members of the public?

[No response.]

DR. POWERS: I would try to make it short, the presentation short.

CHAIRMAN APOSTOLAKIS: No, I think we should have enough time for discussion. The presentation itself can be short.

DR. POWERS: I think I'm very familiar with the agenda for September, and I know there's no room to make it a lengthy period, and I'm going to talk to you guys. I think September is going to be a four-day meeting.

CHAIRMAN APOSTOLAKIS: The fourth day is Labor Day.

DR. KRESS: I don't care; I'm retired.

DR. POWERS: Second of all, I don't think that's the issue that we're confronting.

They will have a fait de complis; they will have a list of options that are so well explained that there's no clarification. All they need to do is call our attention to it.

DR. KRESS: All we need is to have the documents ahead of time.

DR. POWERS: Dr. Shack will be able to formulate his clear and insightful points of view that will undoubtedly be endorsed by the rest of the Committee at the expense of others.

[Laughter.]

CHAIRMAN APOSTOLAKIS: I am not that these comments deserve to be in the transcript. Does anyone have anything of substance to say?

[No response.]

CHAIRMAN APOSTOLAKIS: Thank you very much, both the staff, and Mr. Christie. This was a very informative meeting today. I hope the debate will not be repeated in September.

DR. SHACK: We tried to head it off with the

e-mails, George, but --

DR. KRESS: It didn't work.

CHAIRMAN APOSTOLAKIS: So we are adjourned. Thank you.

[Whereupon, at 5:07 p.m., the meeting was adjourned.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

NAME OF PROCEEDING: MEETING: RELIABILITY AND PROBABILISTIC RISK ASSESSMENT

CASE NO:

PLACE OF PROCEEDING: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Jon Hundley

Official Reporter

Ann Riley & Associates, Ltd.

7/7/00

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MEETING OF THE SUBCOMMITTEE ON PROBABILISTIC RISK ASSESSMENT
ROOM T-2B3, 11545 ROCKVILLE PIKE, ROCKVILLE, MD
Tues., JULY 11, 2000

ACRS Contact: Michael T. Markley (301) 415-6885

- PROPOSED SCHEDULE -

	TOPIC	PRESENTER	TIME
1)	**Introduction**		1:00-1:05 pm
•	Review goals and objectives for this meeting	G. Apostolakis, ACRS	
•	Review issues from June 29, 2000 Subcommittee meeting, including framework (SECY-00-0086) for risk-informing 10 CFR Part 50 (Option 3) and related issues		
2)	**NRC Staff Presentation**	ERIC HASKIN	1:05-2:45 pm
•	Discussion of SECY-00-0086	T. King, RES ~~M. Cunningham, RES~~ M. Drouin, RES	
	Related Issues:		
	– Status of proposed revision to 10 CFR 50.44 concerning combustible gas control systems		
	– Perspective on NEI letters dated January 19, and April 18, 2000		
	– Schedule for future meetings related to Option 3		
	** BREAK **		2:45-3:00 pm
3)	**NRC Staff Presentation - continued**		3:00-4:00 pm
•	Discussion of SECY-00-0086 and related issues - noted above	T. King, RES ~~M. Cunningham, RES~~ M. Drouin, RES ERIC HASKIN	

4)	**Industry Presentation**		4:00-4:15 pm
•	Comments on SECY-00-0086 and 10 CFR 50.44	B. Christie, Performance Technology, Inc.	
5)	**General Discussion and Adjournment**		4:15-5:00 pm
•	General discussion and comments by Members of the Subcommittee; items for July 12-14, 2000 ACRS meeting	G. Apostolakis, ACRS	

Note: Presentation time should not exceed 50% of the total time allocated for a specific item. Number of copies of presentation materials to be provided to the ACRS - 35.

INTRODUCTORY STATEMENT BY THE CHAIRMAN OF THE
SUBCOMMITTEE ON RELIABILITY AND PRA
11545 ROCKVILLE PIKE, ROOM T-2B3
ROCKVILLE, MARYLAND
JULY 11, 2000

The meeting will now come to order. This is a meeting of the ACRS Subcommittee on Reliability and Probabilistic Risk Assessment. I am George Apostolakis Chairman of the Subcommittee.

ACRS Members in attendance are: Mario Bonaca, Thomas Kress, Dana Powers, William Shack, Jack Sieber and Robert Uhrig.

The purpose of this meeting is to discuss the NRC framework for risk-informing 10 CFR Part 50 described in SECY-00-0086, and related matters. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee. Michael T. Markley is the Cognizant ACRS Staff Engineer for this meeting.

The Notice of this meeting was not published in the *Federal Register* in sufficient time to inform the public properly. Therefore, we will keep the transcript record open for ten additional days subsequent to the availability of this transcript to the public to enable persons desiring to have written comments and oral statements entered into the official record to do so.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It is requested that speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We have received no written comments from members of the public regarding today's meeting. However, Mr. Bob Christie of Performance Technology, Inc. has requested time to make a presentation concerning the staff's proposed framework for risk-informing 10 CFR Part 50 (Option 3) and the proposed revision to 10 CFR 50.44.

(Chairman's Comments-if any)

We will now proceed with the meeting and I call upon Mr. Thomas King of RES to begin.

Advisory Committee on Reactor Safeguards
Subcommittee on Probabilistic Risk Assessment

SECY-98-300
Option 3 Framework

July 11, 2000
Two White Flint, Rockville, MD

Bob Christie

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Agenda

A. Adequate Protection

B. 1986 Policy Statement on Safety Goals

C. June 15, 1990 Staff Requirements Memorandum

D. Goal Allocation

E. Summary

2/17

BASIS

- The primary responsibility for the "public health and safety" of a nuclear unit lies with the people at the site who are running the nuclear unit.
- The regulatory process that oversees the nuclear unit must ensure "adequate protection of public health and safety."

ADEQUATE PROTECTION

If a nuclear electric power unit is in compliance with the regulations, it is presumed that the nuclear unit provides adequate protection of public health and safety.

NRC SAFETY GOALS

Qualitative

Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.

Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

5/17

NRC SAFETY GOALS

Quantitative Objectives

The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1%) of the sum of prompt fatality risks resulting from other accidents to which members of the United States population are generally exposed.

The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of one percent (0.1%) of the sum of cancer fatality risks resulting from all other causes.

6/17

Prompt Fatality Accidents in USA.

Approximately 100,000 accidental deaths per year in a population of approximately 200, 000, 000 people. This equates to approximately 1 in 2000 per year.

Latent Cancer Fatalities in USA.

Approximately 400,000 cancer deaths per year in a population of approximately 200,000,000 people. This equates to approximately 1 per 500 per year.

Staff Requirements Memorandum
June 15,1990 - Implementation of the Safety Goals

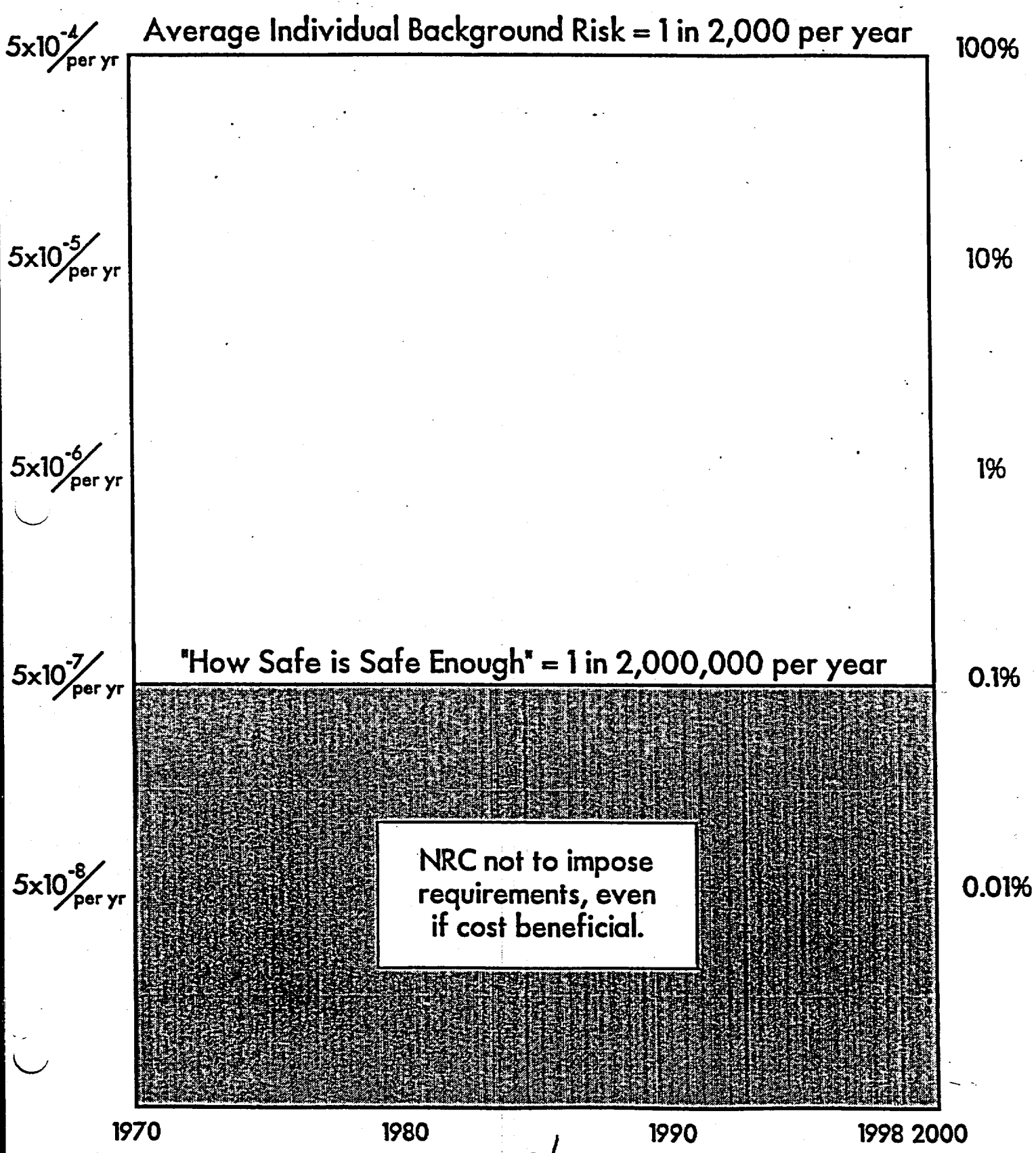
11) The Commission agrees that it must not depart from or be seen as obscuring the arguments made in court defending the Backfit Rule.

These arguments clearly established that there is a level of safety that is referred to as "adequate protection." This is the level that must be assured without regard to cost and, thus, without invoking the procedures required by the Backfit Rule. 1/ Beyond adequate protection, if the NRC decides to consider enhancements to safety, costs must be considered, and the cost-benefit analysis required by the Backfit Rule must be performed. The Safety Goals, on the other hand, are silent on the issue of cost but do provide a definition of "how safe is safe enough" that should be seen as guidance on how far to go when proposing safety enhancements, including those to be considered under the Backfit Rule.

1/ On a related point, the presumption is that compliance with our regulations provides adequate protection. The converse, however, is not true, i.e. adequate protection does not necessarily require compliance with the body of our regulations. The Commission can and does grant exemptions to specific requirements in our regulations as long as we assure adequate protection is achieved by other means. Moreover, we also have regulations which go beyond adequate protection and have been issued to enhance safety e.g. the Station Blackout Rule. Thus, if an "enhancement" passes the tests of the Backfit Rule, there is nothing to prohibit its imposition other than the guidance provided by the Safety Goals Policy.

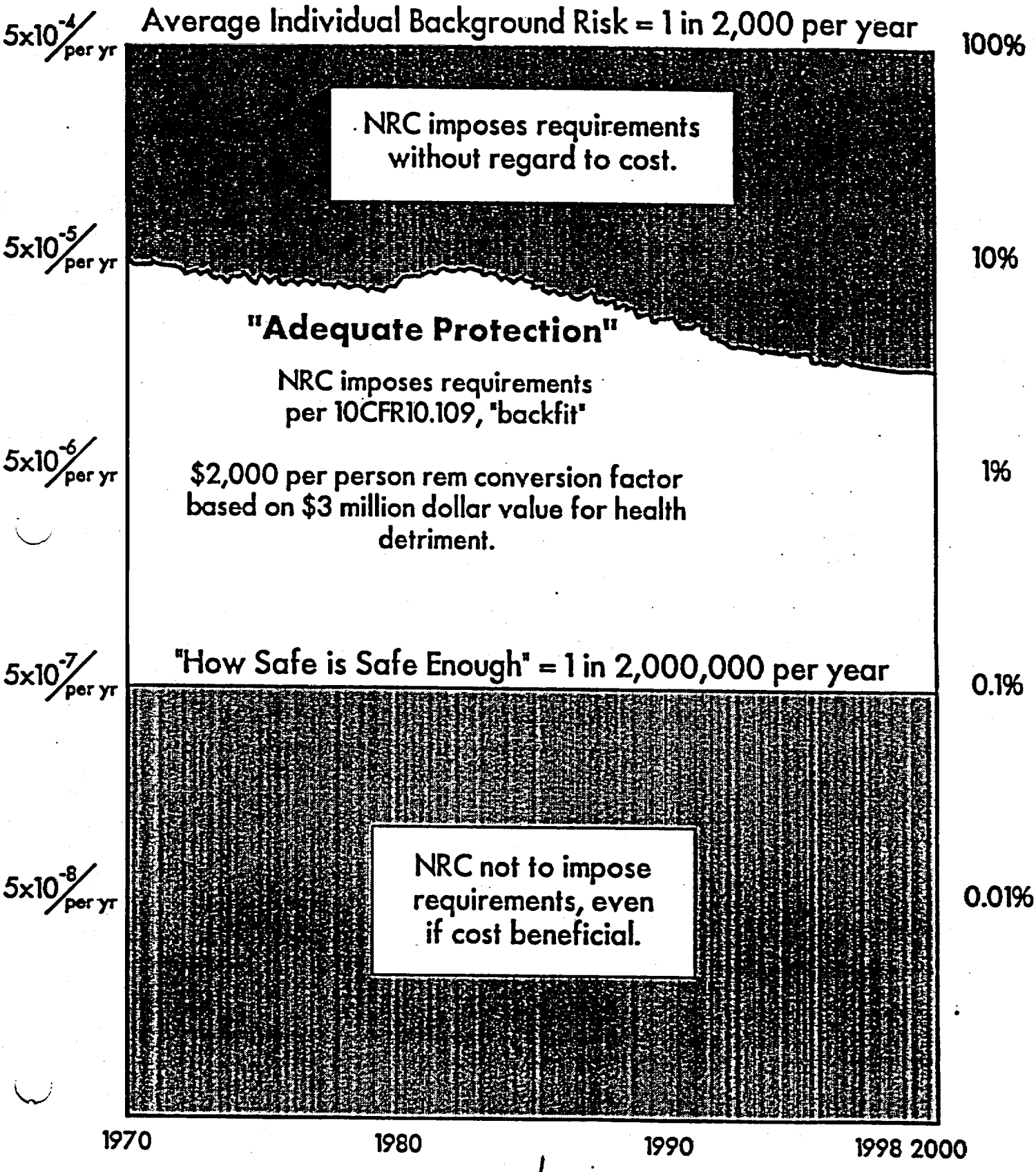
8/17

Individual Risk (Prompt Fatality Risk)



9/17

Individual Risk (Prompt Fatality Risk)



10/17

CRITERIA

- The best requirements are those that define the criteria to be met but do not specify "how" to meet the criteria.
- The criteria should lead to a comprehensive approach to the whole nuclear unit. Defining the overall criteria is better than defining a set of lower level criteria.

PUBLIC HEALTH RISK

1. Is different for each nuclear unit.

2. Changes with time.

12/17

Accordingly, subsidiary quantitative objectives based on risk measures related to the four high-level defense-in-depth strategies are developed in the following subsections. The subsidiary quantitative objectives are developed from the QHOs, and are generally consistent with subsidiary goals in current use (e.g., (Ref. 7), (Ref. 8)). A context for the development and a summary of the quantitative objectives is provided below and in Figure 3-1, which illustrates two methods of quantitatively assessing the level of protection against accidents at a given nuclear power plant.

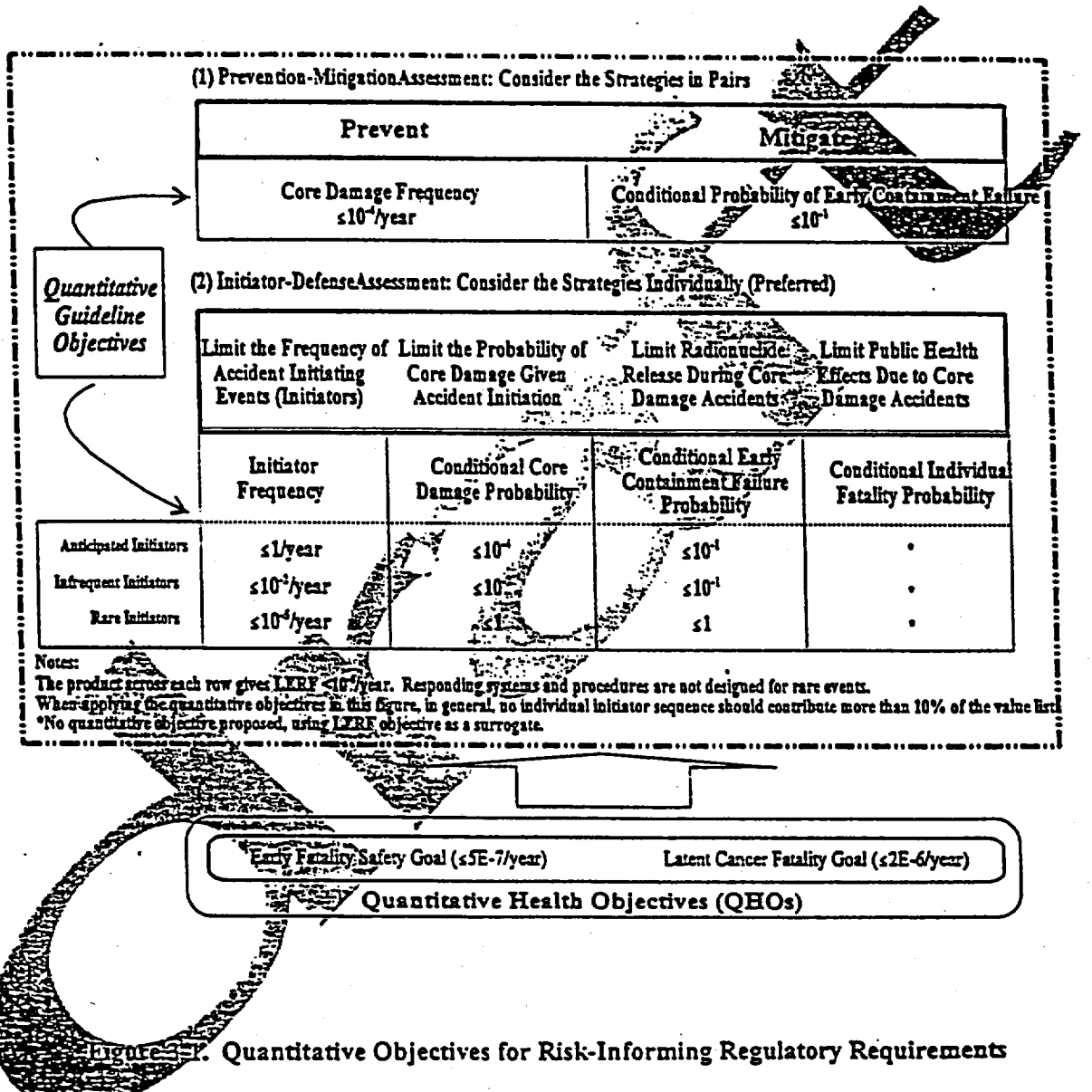


Figure 3-1. Quantitative Objectives for Risk-Informing Regulatory Requirements

(1) The prevention-mitigation method assesses the impact of the two preventive strategies and that of the two mitigative strategies. The quantitative objectives are:

- the core damage frequency should be less than 10^{-4}/year, and
- the probability of early containment failure (breach or bypass) given a core damage accident should be less than 0.1.

13/17

CORE DAMAGE FREQUENCY

Letter: R. L. Seale to Shirley Ann Jackson, May 11, 1998, "Elevation of CDF to a Fundamental Safety Goal, and Possible Revision of the Commission's Safety Goal Policy Statement."

"...Observation 2. Results of analyses indicate that a CDF of 10^{-4} per reactor year, if applied to all plants with their current level of containment performance, in many cases would be more conservative than the QHOs. This would, therefore, be a new *de facto* fundamental safety goal."

Staff Requirements Memorandum
June 15,1990 - Implementation of the Safety Goals

4) Implementation of the safety goal may require development and use of "partitioned" objectives. In general, the additional objectives should not introduce additional conservatism. The staff should bring its recommendations on the use of each such subsidiary objective to the Commission in the context of the specific issue for which it would be useful and appropriate, and explain its compatibility with the safety goals....

...Accordingly, for the purpose of implementation, the staff may establish subsidiary quantitative core damage frequency and containment performance objectives through partitioning of the Large Release Guideline. These subsidiary objectives should anchor, or provide guidance on "minimum" acceptance criteria for prevention (e.g. core damage frequency) and mitigation (e.g. containment or confinement performance) and thus assure an appropriate multi-barrier defense-in-depth balance in design. Such subsidiary objectives should be consistent with the large release guideline, and not introduce additional conservatism so as to create <u>de facto</u> new Large Release Guideline.

A core damage probability of less than 1 in 10,000 per year of reactor operation appears to be a very useful subsidiary benchmark in making judgments about that portion of our regulations which are directed toward accident prevention....

...The Commission has no objection to the use of a 0.1 Containment Conditional Failure Probability for the evolutionary design, as applied in the manner described above....

<u>...These partitioned objectives are not to be imposed as requirements themselves but may be useful as a basis for regulatory guidance.</u>

LARGE EARLY RELEASE FREQUENCY

SECY-98-015, January 30, 1998, Attachment 1, page 8.

"...The guideline value of 10^{-5} /RY for Large Early Release Frequency contained in RG 1.174 is based upon risk analysis results presented in NUREG-1150, which calculated offsite health risks for five nuclear power plants and compared them to the Safety Goal Quantitative Health Effects Objectives (QHOs). Analysis for all five plants calculated health risks well below the QHOs. However, if the results of this analyses were adjusted so that the offsite health risks just met the early fatality QHO (the most limiting QHO), with allowance for the unanalyzed modes of operation (shutdown) and, in some cases external events, a corresponding Large Early Release Frequency value of 10^{-5}/RY is the result for those plants whose calculated offsite health risks are closest to the QHOs.

Site to site variations in Large Early Release Frequency were judged to not be a large factor (this was also confirmed in a study reported by the Advisory Committee for Reactor Safeguards in a September 19, 1997 letter to Chairman Jackson) and thus a single value for all plants is used."

SUMMARY

In the Framework document for Option 3

1. The staff is proposing requirements for "risk-informed" regulations for the existing nuclear units far beyond the standard of "adequate protection." The nuclear units are to be penalized for "volunteering" for Option 3.

2 The staff is ignoring the requirement of the Backfit Rule when the staff wishes to go beyond adequate protection. The staff is ignoring the expressed wish of the NRC Commissioners in the June 15, 1990, Staff Requirements Memorandum to use the Backfit Rule in the application of the Safety Goals.

3. The staff is proposing "subsidiary" quantitative objectives for existing plants that the NRC Commissioners said were applicable to the evolutionary plants.

4. The staff is proposing "subsidiary" quantitative objectives that go beyond the Quantitative Health Effects Objectives in the 1986 Policy Statement on Safety Goals. Thus, the staff is not only ignoring adequate protection and the Backfit Rule, but they propose requirements that go beyond "how safe is safe enough."

United States
Nuclear Regulatory Commission

Risk-Informed Part 50 Framework

Presented to

ACRS Subcommittee

July 11, 2000

FRAMEWORK

- Framework applied to regulations, regulatory guides, DBAs, to screen and formulate technical requirements
- Framework is a risk-informed Defense-in-depth approach
- Framework based upon prevention and mitigation strategies to protect public (derived from Reactor Safety Cornerstones)
- Framework includes various tactics to implement prevention and mitigation
- Framework requires consideration of both design basis and severe accidents

DEFENSE-IN-DEPTH STRATEGIES

- Prevent core damage
  - Limit frequency of accident initiating events
  - Limit the probability of core damage given event

- Mitigate core damage
  - Limit radionuclide releases given core damage (containment)
  - Limit public health effects given release (emergency planning)

DEFENSE-IN-DEPTH TACTICS

- Tactics not dependent on risk insights:
  - use of good engineering practices (e.g., codes and standards, negative power coefficient, etc.)
  - maintain same level of protection against AOOs
  - three barriers to radionuclide release
  - emergency planning

- Tactics dependent on risk insights:
  - balance between prevention and mitigation
  - level of redundancy/diversity/independence necessary to achieve balance
  - guidelines for consideration of passive component failures
  - temporary conditions

QUANTITATIVE GUIDELINES

- Quantitative guidelines used to help establish, screen and formulate regulation and technical requirements

- Guidelines for staff use, ***will not appear in regulation*** (although may appear in regulatory guide)

- Guidelines derived from Commission Safety Goals (Quantitative Health Objectives)
  - Safety goals define "how safe is safe enough"
  - Risk-informing regulations should not impose requirements that force risk from plants to go beyond these guidelines

- No quantitative definition of "adequate protection"

QUANTITATIVE GUIDELINES

- Based on full-scope PRAs
- Guidelines:
  - Core damage frequency < 1E-4/yr
  - Conditional early containment failure probability < 0.1
  - Large early release frequency (LERF) < 1E-5/yr (surrogate for early health effect guideline)
  - Conditional probability of large late release < 0.1
- CDF and LERF guidelines consistent with RG 1.174
- Initiator and accident class considerations
  - More frequent initiators require better core damage prevention
  - No individual accident class contributes more than 10% to frequency guidelines
  - Accident class defined as *"group of accidents that require the same plant response to prevent core damage or containment failure"*
  - Should not have to design for rare initiators (e.g., not have to design mitigative features for vessel ruptures)
  - Some initiators render a defense-in-depth element ineffective and need to be compensated by making other defense-in-depth elements stronger (e.g., ISLOCAs bypass containment)

LARGE RELEASE FREQUENCY GUIDELINES

- LERF guideline emphasizes early containment failure
- Early containment failure most critical for ensuring public health and safety
- Late large release frequence (LLRF) guideline for late containment failures
  - Health effects
  - Worker protection/Severe Accident Management Guideline implementation
  - Environmental contamination

CONSIDERATION OF UNCERTAINTIES

- Quantitative guidelines apply to mean values, but need to consider the causes in the spread of the distribution
- Three categories of uncertainties: parameter, modeling, completeness
- Parameter uncertainties can be addressed by redundancy, diversity, independence single failure criterion
- Modeling uncertainties can be accounted for with safety margin and acceptance criteria
- Completeness uncertainty can be accounted for with defense-in-depth and safety margin

ISSUES

- ***Should selective implementation within a regulation of the technical requirements be allowed?***
- ***Should safety enhancements be required to pass backfit rule?***
- ***Should there be a reverse backfit test for burden reduction?***