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NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS**

**Title: MEETING: RELIABILITY AND
PROBABILISTIC RISK ASSESSMENT**

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

JULY 11, 2000

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This transcript had not been reviewed, corrected and edited and it may contain inaccuracies.

1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION
3 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

4 ***

5 MEETING: RELIABILITY AND PROBABILISTIC
6 RISK ASSESSMENT

7
8 USNRC

9 11545 Rockville Pike, Room T2-B3
10 Rockville, MD

11
12 Tuesday, July 11, 2000

13
14 The committee met, pursuant to notice, at 1:00
15 p.m.

16
17 MEMBERS PRESENT:

18 GEORGE APOSTOLAKIS, Chairman, ACRS

19 MARIO BONACA, Member, ACRS

20 THOMAS KRESS, Member, ACRS

21 DANA POWERS, Member, ACRS

22 WILLIAM SHACK, Member, ACRS

23 JACK SIEBER, Member, ACRS

24 ROBERT UHRIG, Member, ACRS

25 ROBERT SEALE, Member, ACRS

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1 PARTICIPANTS:

2 MICHAEL T. MARKLEY, ACRS Staff Engineer

3 ERIC HASKIN, RES

4 T. KING, RES

5 MARY DROUIN, RES

6 BOB CHRISTIE, Performance Technology, Inc.

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[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 Probabilistic 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 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 -- as it is usually stated in the Federal Register notice.

It is requested that speakers first identify

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

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

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

14 DR. APOSTOLAKIS: So noted.

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

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

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

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

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

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

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

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

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

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

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

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

3 MS. DROUIN: Sure.

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

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

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

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

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

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

19 MS. DROUIN: Okay.

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

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

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

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

21 MR. KING: Yeah, I think --

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

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

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

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

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

25 DR. APOSTOLAKIS: Yes.

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

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

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

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

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

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

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

14 MR. KING: We have done it.

15 DR. APOSTOLAKIS: I have no problem sharing.

16 MS. DROUIN: That would help us.

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

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

22 [Laughter.]

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

25 MS. DROUIN: I have a Greek dictionary.

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

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

5 DR. APOSTOLAKIS: I understand.

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

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

10 MS. DROUIN: That would be even --

11 MR. MARKLEY: We can do that.

12 DR. APOSTOLAKIS: Yeah.

13 MR. BONACA: Can I get --

14 DR. APOSTOLAKIS: Now, there is --

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

17 DR. APOSTOLAKIS: Yes.

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

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

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

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

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

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

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

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

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

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

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

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

9 DR. APOSTOLAKIS: No.

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

12 DR. APOSTOLAKIS: Right.

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

15 DR. APOSTOLAKIS: Yeah.

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

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

21 MS. DROUIN: Okay.

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

1 the overall framework months ago.

2 MS. DROUIN: Yes.

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

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

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

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

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

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

19 MS. DROUIN: Yes.

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

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

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

5 DR. APOSTOLAKIS: Okay.

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

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

18 THE COURT: Can I ask one more question?

19 DR. APOSTOLAKIS: Yes.

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

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

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

6 MS. DROUIN: Okay.

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

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

12 MR. KING: That kind of thing.

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

20 MR. KING: Like NEI.

21 DR. APOSTOLAKIS: Huh?

22 MR. KING: Like NEI.

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

1 beholder.

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

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

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

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

21 MR. KING: Yeah.

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

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

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

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

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

22 DR. APOSTOLAKIS: No, it doesn't.

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

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

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

3 MR. KING: Right.

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

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

11 MR. KING: Right.

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

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

17 MR. KRESS: Yeah.

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

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

23 DR. APOSTOLAKIS: I have no problem with that.

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

1 together.

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

9 MR. KING: Yeah.

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

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

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

20 DR. APOSTOLAKIS: The NRC has established safety
21 goals.

22 MS. DROUIN: What page are you on?

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

24 DR. APOSTOLAKIS: Section 2.1.

25 MR. KING: Okay.

1 DR. APOSTOLAKIS: Yeah, the revision dated May,
2 2000. Actually, the paragraphs starts on the left-hand
3 side.

4 MR. KING: We found it, yeah.

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

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

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

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

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

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

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

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

20 MR. KING: And besides --

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

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

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

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

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

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

16 MR. KING: And there are things --

17 MS. DROVIN: I don't think we did.

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

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

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

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

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

15 MR. KING: Right.

16 MR. BONACA: Okay.

17 MR. KING: And particularly severe accident gaps.

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

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

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

25 DR. APOSTOLAKIS: Yeah.

1 MR. KING: That's not adequate protection.

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

4 MR. KING: Yeah.

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

9 MR. KRESS: Voluntary.

10 MR. KING: Well --

11 DR. APOSTOLAKIS: It is voluntary.

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

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

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

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

7 MR. KING: Yes.

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

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

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

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

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

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

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

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

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

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

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

23 MR. KRESS: August paper.

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

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

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

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

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

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

1 plants won't.

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

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

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

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

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

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

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

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

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

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

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

11 DR. APOSTOLAKIS: I suspected that.

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

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

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

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

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

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

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

4 DR. APOSTOLAKIS: Late small?

5 MR. KRESS: Yeah.

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

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

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

16 MR. POWERS: Containment failures.

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

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

22 DR. APOSTOLAKIS: Late small?

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

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

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

6 When I look at the regulations and I see things
7 that seem to suggest that you've got to maintain control
8 room capability with outside intervention for seven days and
9 30 days and things like that, these are numbers that are not
10 addressed by the PRA, and I'm wondering how you handle that
11 kind of issue.

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

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

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

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

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

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

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

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

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

21 MS. DROUIN: Yes.

22 DR. APOSTOLAKIS: Then late must be after that.

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

25 DR. APOSTOLAKIS: No, no.

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

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

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

13 THE COURT: But what happened? I mean --

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

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

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

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

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

1 DR. APOSTOLAKIS: Right.

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

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

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

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

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

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

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

25 DR. APOSTOLAKIS: You would or wouldn't?

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

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

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

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

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

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

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

21 DR. APOSTOLAKIS: What advice are we giving this
22 time?

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

25 DR. APOSTOLAKIS: They like CCFP.

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

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

10 MR. KING: That's right.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

23 DR. APOSTOLAKIS: No, no.

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

1 want.

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

4 MR. KING: What would you call it?

5 DR. APOSTOLAKIS: I don't know.

6 MR. KRESS: A general design criteria.

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

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

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

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

23 MR. KRESS: Yes, thank you.

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

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

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

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

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

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

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

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

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

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

5 MR. POWERS: I agree with that.

6 DR. APOSTOLAKIS: It's the structuralist approach.

7
8 MR. KRESS: They're structural defense in depth.

9 DR. APOSTOLAKIS: It the structuralist defense and
10 depth.

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

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

15 MR. KRESS: Not at --

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

18 MR. KRESS: Not traditionally, but --

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

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

23 DR. APOSTOLAKIS: But you want to control it.

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

1 DR. APOSTOLAKIS: Yeah, inherently.

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

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

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

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

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

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

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

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

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

11 MR. KING: Like I said --

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

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

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

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

20 DR. APOSTOLAKIS: Okay.

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

23 DR. APOSTOLAKIS: Okay, great.

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

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

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

2 MS. DROUIN: So you like 2.4?

3 MR. KRESS: You can't assume that.

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

6 MS. DROUIN: There's not a 2.5.

7 DR. APOSTOLAKIS: Page 2.5.

8 MS. DROUIN: Oh, page 2.5.

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

12 MS. DROUIN: Yes.

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

16 MR. KRESS: It's figure 2.1.

17 MS. DROUIN: Yes, we do.

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

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

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

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

2 DR. APOSTOLAKIS: Why are these more focused?

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

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

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

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

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

24 DR. APOSTOLAKIS: But you could have public --

25 MR. HASKIN: Conceivably, there could be

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

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

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

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

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

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

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

6 DR. APOSTOLAKIS: The editorial I agree.

7 MR. MARKLEY: yeah.

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

10 MR. MARKLEY: Yes.

11 DR. APOSTOLAKIS: So, there is a table 2.1 on page
12 2-6. Tactics and examples of related regulatory documents.
13 You say that the safety goals under PRA's IPE's is a tactic?
14 I thought that was the top objectives that was driving
15 everything. See safety goals under PRA's, IPE's?

16 MR. KING: Yeah, I see it.

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

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

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

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

1 treatment in the same column?

2 MR. KING: Uh-huh.

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

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

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

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

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

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

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

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

11 MR. KING: Or damage frequencies.

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

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

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

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

1 acceptable way to meet the regulation.

2 DR. APOSTOLAKIS: No, but the maintenance rules.

3 MR. KING: Oh, is a regulation.

4 DR. APOSTOLAKIS: Regulation.

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

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

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

9 DR. APOSTOLAKIS: And that's reasonable.

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

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

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

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

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

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

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

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

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

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

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

21 MS. DROUIN: Correct.

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

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

1 MS. DROUIN: This is --

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

4 MR. KRESS: Yeah.

5 DR. APOSTOLAKIS: I'm not sure.

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

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

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

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

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

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

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

23 DR. APOSTOLAKIS: Does anyone know?

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

25 DR. APOSTOLAKIS: Yeah.

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

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

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

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

8 DR. APOSTOLAKIS: I'm sorry?

9 MR. HASKIN: It's a direct quote.

10 DR. APOSTOLAKIS: From the goal?

11 MR. KRESS: I've read it somewhere.

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

14 DR. APOSTOLAKIS: From the safety goals --

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

17 MR. HASKIN: I don't confirm that.

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

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

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

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

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

18 DR. APOSTOLAKIS: But then --

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

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

22 MS. DROUIN: Yeah.

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

1 late. Is that a question that you guys raised?

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

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

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

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

18 MR. KING: No.

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

21 MR. KING: Right.

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

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

25 DR. APOSTOLAKIS: On the curve?

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

3 DR. APOSTOLAKIS: Yeah, but nobody --

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

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

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

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

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

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

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

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

25 DR. APOSTOLAKIS: So, what are we applying them

1 to?

2 MR. KRESS: How they write the regulation.

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

6 DR. APOSTOLAKIS: That's true.

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

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

18 MS. DROUIN: I'm sorry?

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

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

1 that.

2 MS. DROUIN: What's causing that.

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

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

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

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

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

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

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

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

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

15 MR. BONACA: Before you can link it.

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

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

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

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

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

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

5 MR. HASKIN: Yes.

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

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

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

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

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

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

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

19 MR. KRESS: Even down to the ten percent.

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

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

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

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

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

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

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

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

15 MR. KING: I understand your point.

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

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

21 DR. APOSTOLAKIS: Well --

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

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

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

14 DR. APOSTOLAKIS: Yeah.

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

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

21 MR. KRESS: Yeah, but --

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

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

1 too rigidly applied --

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

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

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

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

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

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

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

12 MR. KRESS: Yeah, we had to compromise.

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

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

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

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

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

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

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

16 MR. KING: Right.

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

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

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

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

10 MS. DROUIN: That's my personal opinion.

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

14 MR. SEIBER: Cold pump seal failures.

15 MR. KING: Yeah.

16 MS. DROUIN: Yeah.

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

20 DR. APOSTOLAKIS: This was not the intent.

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

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

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

8 MR. KING: Yeah.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

15 MR. POWERS: Might have a little visibility on.

16 MR. HASKIN: Yeah.

17 MR. POWERS: Let me ask another question.

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

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

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

1 MR. POWERS: It barely shows up.

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

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

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

18 MR. POWERS: Yeah, that is the question.

19 MR. KING: That's the real question.

20 MR. POWERS: Uh-huh.

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

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

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

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

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

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

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

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

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

1 giving us good information on details of regulations.

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

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

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

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

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

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

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

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

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

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

4 DR. APOSTOLAKIS: Can we take a break now until
5 2:50?

6 [Brief recess.]

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

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

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

18 DR. APOSTOLAKIS: Yeah.

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

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

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

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

12 MR. KING: Something like that.

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

25 MR. KRESS: That's not necessarily a risk

1 significant accident.

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

5 MS. DROUIN: That would be good enough.

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

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

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

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

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

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

22 MR. KING: You're right.

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

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

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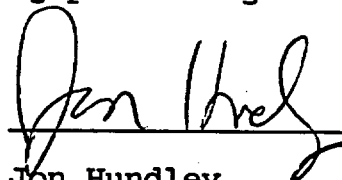
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1 that ultimate strength eroded by things like corrosion over
2 time. That's not factored into the analysis.

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

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

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

20 MR. KRESS: The framework?

21 MR. KING: The framework would accommodate that.

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

1 MR. KRESS: That's right.

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

4 MR. KRESS: At a certain probability --

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

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

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

13 MR. KING: Yeah.

14 DR. APOSTOLAKIS: Not so much a structure.

15 MR. KING: Large early release.

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

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

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

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

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

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

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

14 MS. DROUIN: That we did.

15 DR. APOSTOLAKIS: Right?

16 MR. KING: Right.

17 MS. DROUIN: Yes.

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

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

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

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

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

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

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

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

7 MR. KRESS: Arrived from a reactor, yeah.

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

13 MR. KRESS: Right.

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

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

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

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

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

1 objectives.

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

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

12 MS. DROUIN: Not beyond what we have here.

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

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

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

20 DR. APOSTOLAKIS: Anything else on this figure?

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

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

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

10 MR. BONACA: Yeah.

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

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

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

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

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

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

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

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

5 DR. APOSTOLAKIS: This is not cast in stone.

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

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

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

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

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

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

1 QHO's directly.

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

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

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

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

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

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

17 MR. KING: The risk calculations --

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

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

25 DR. APOSTOLAKIS: It's a misnomer.

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

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

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

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

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

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

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

14 DR. APOSTOLAKIS: It's normalized.

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

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

1 used by the wider community.

2 MR. KRESS: I think we are.

3 DR. APOSTOLAKIS: I think we are.

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

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

12 MR. KING: Operating the plant?

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

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

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

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

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

1 structuralist defense-in-measure.

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

4 MR. KRESS: It is.

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

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

14 MR. KRESS: Absolutely.

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

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

20 MR. KING: Yes.

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

23 MR. KING: Population centers.

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

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

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

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

10 MR. KING: (inaudible) top 10.

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

15 MR. KRESS: No.

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

18 MR. KRESS: It is very plant specific.

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

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

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

1 assumptions on evacuations. Therefore, --

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

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

12 MR. SEALE: May well occur.

13 MR. APOSTOLAKIS: May well occur, right.

14 MR. KRESS: Where are you reading at?

15 DR. SHACK: Second column, second paragraph.

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

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

20 MR. APOSTOLAKIS: It is the same thing.

21 DR. SHACK: Give it to your tech editor.

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

1 the next category.

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

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

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

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

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

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

20 MR. KRESS: Maybe.

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

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

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

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

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

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

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

16 MR. KING: Yes.

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

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

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

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

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

3 MR. BONOCA: It is general (inaudible)

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

7 Now if what --

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

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

17 MR. KING: Yes.

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

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

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

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

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

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

8 MR. KRESS: It ought to be calculable.

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

11 MR. KRESS: I never seen it actually.

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

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

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

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

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

3 MR. HASKINS: The number we are currently using is
4 10(-6th). That is the number that has been used for
5 aircraft impact, for example.

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

8 MR. KING: Yes.

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

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

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

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

16 DR. POWERS: Yes

17 MR. HASKINS: The number is based on ten percent of
18 10(-5th). The ten percent came from the earlier discussion
19 and the 10(-5th) comes from the figure.

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

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

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

1 that.

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

6 MR. KRESS: Well, from the point --

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

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

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

17 MR. APOSTOLAKIS: But not with this document. They
18 would be very implicitly, right.

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

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

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

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

5 MR. APOSTOLAKIS: That is worst.

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

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

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

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

12 MR. KING: No risk base.

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

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

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

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

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

4 MR. KING: Actually, that word is --

5 MR. APOSTOLAKIS: And that is (inaudible)

6 MR. KRESS: Yeah, that is definitely true.

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

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

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

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

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

18 MR. KRESS: It is still there.

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

21 MR. KING: Not in the original statement. In the
22 1990 SRM.

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

25 MR. KRESS: Well, in the defactor.

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

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

10 MR. HASKINS: You can look at 1150 in that

11 MR. APOSTOLAKIS: Yeah, yeah, yeah.

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

17 MR. HASKINS: You will still have a problem

18 MR. KING: Level 3 is a challenge.

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

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

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

6 MR. KRESS: Well, it just expands on

7 MR APOSTOLAKIS: It is assuming.

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

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

13 MR. KRESS: Yes, it does.

14 MR. APOSTOLAKIS: It does.

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

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

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

22 MR. APOSTOLAKIS: I'm sorry, four?

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

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

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

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

6 MR. KRESS: It is not guidelines.

7 MR. APOSTOLAKIS: It is not guidelines.

8 MR. KING: We will look at it.

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

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

17 MR. APOSTOLAKIS: Yes.

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

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

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

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

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

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

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

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

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

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

1 say more about that.

2 MR. KRESS: Yes.

3 MS. DROVIN: You have a different recommendation.

4 MR. KRESS: No, I haven't done the exercise either.

5 But I was starting from the latent death quantitative health
6 objective, and do something like you did to get a LERF and
7 show that the --

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

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

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

24 MR. KING: Okay.

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

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

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

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

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

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

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

5 MR. KING: Like working backwards to what?

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

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

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

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

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

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

1 perform an intended function. Can I do that?

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

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

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

12 MR. APOSTOLAKIS: Which page, 3-8?

13 MR. KRESS: 3-8. Into my view the (inaudible) for
14 50.46, dealing with the ECCS acceptance criteria is the only
15 risk component I see to that is that the acceptance criteria
16 gives you a level of assurance and when you turn on the
17 ECCS, and when I say terminate the accident, and not lead to
18 an uncoolable geometry later on. So you have these safety
19 margins in there to deal with the fact of how well the ECCS
20 has to work. It is a statement of how good the ECCS has to
21 be in order to assure a coolable geometry that doesn't get
22 you in trouble later on. That to me is -- I don't see how
23 you risk inform that because you have to ask yourself, well,
24 what probability am I willing to live with that this doesn't
25 actually terminate the accident like I thought it was going

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

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

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

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

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

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

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

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

13 MR. KING: You get there with failing containers.

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

1 MR. KING: Let me get back to your question on
2 50.46. I mean, it seems to me you can risk inform. You can
3 risk inform it in two ways. One is the large break LOCA
4 still makes sense and all the assumptions that go with it,
5 given probability and risk arguments. You can take a look at
6 it from that respect. You can also look at -- I mean, I
7 think clearly you want to maintain coolable geometry that is
8 the ultimate goal. If you have a LOCA you don't want to
9 loose coolable geometry. But is the 2200 degrees and the 17
10 percent oxidation are they the right numbers to do that.
11 Maybe they are very conservative.

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

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

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

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

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

9 MR. KRESS: Not very much.

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

14 MR. KRESS: Yeah.

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

16 MR. SIEBER: Small break LOCA --

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

18 MS. DROUIN: It was in the plan.

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

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

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

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

6 MR. KING: It is not an easy task. I mean in
7 50.44, it took so long precisely because of going back and
8 looking at all the places that hydrogen issues show up, and
9 looking at things like, well, was the analysis just for
10 in-vessel hydrogen generation or did it consider ex-vessel
11 hydrogen generation? And, you know, how long did the
12 generation take place, and all that, and it took a long
13 time.

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

17 DR. POWERS: You always bring back news.

18 MR. KING: Yeah.

19 [Laughter.]

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

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

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

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

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

9 DR. KRESS: Yes.

10 CHAIRMAN APOSTOLAKIS: Can you accommodate that?

11 MS. DROUIN: I have to leave.

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

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

16 CHAIRMAN APOSTOLAKIS: Okay. And Eric?

17 SPEAKER: I have got an 8:00 flight.

18 CHAIRMAN APOSTOLAKIS: Oh, 8:00 is fine.

19 SPEAKER: I am taking Metro.

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

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

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

1 [Laughter]

2 DR. SEALE: Well, you can handle it.

3 MS. DROUIN: I can handle it.

4 DR. KRESS: This is our chance.

5 DR. POWERS: Now is your chance, Tom.

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

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

11 DR. KRESS: It depends on what we ask.

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

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

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

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

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

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

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

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

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

1 estimate?

2 MR. KING: Yes. Yes.

3 CHAIRMAN APOSTOLAKIS: Yeah.

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

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

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

9 CHAIRMAN APOSTOLAKIS: That does what?

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

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

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

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

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

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

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

1 CHAIRMAN APOSTOLAKIS: Okay.

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

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

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

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

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

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

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

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

3 DR. KRESS: When you make a regulatory analysis.

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

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

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

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

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

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

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

1 whole document.

2 CHAIRMAN APOSTOLAKIS: Yeah, this is the essence.

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

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

8 CHAIRMAN APOSTOLAKIS: Huh?

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

10 [Laughter.]

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

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

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

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

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

24 MS. DROUIN: Tomorrow.

25 MR. KING: Tomorrow.

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

3 Okay. So we are recess for seven minutes.

4 [Recess.]

5 CHAIRMAN APOSTOLAKIS: We are back in session.

6 Mr. Robert Christie has the floor.

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

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

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

18 One is, George, I am not talking about hydrogen
19 50.44 today, that is tomorrow.

20 CHAIRMAN APOSTOLAKIS: Okay.

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

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

3 I don't see anywhere in that proposed rulemaking
4 that says we are using the ultimate capability. We are just
5 saying that the large drives are going to check their
6 containment capability. We don't use ultimate capacity. We
7 just say for high probability events, check your containment
8 capability. Whether you use design, whether you use
9 ultimate, whatever you do, that is for the people at the
10 plant to decide how to do that, and they have done that in
11 their previous works.

12 The last thing I would like to check, the staff
13 has stated today that no one has objected to the framework
14 document, and that is definitely untrue. In the February
15 meeting that we had to talk about the framework document,
16 which isn't exactly the same as what we have had today, and
17 we had probably one of the most, as I stated in our March
18 1st meeting, the most contentious meetings I have ever been
19 to with respect to the interactions of the industry and the
20 NRC.

21 So, there were violent objections to the framework
22 document in that meeting. We came to you and we went on the
23 record on the March 1st. We provided you documentation
24 that, you know, put down our objections to what the
25 framework document is. And then last, I guess, last week,

1 you know, you called me up and asked me, did you hear what
2 they said to me, and do you agree to that, you know, et
3 cetera? I said, no, I don't agree to that framework
4 document.

5 So, it is not true that the industry has not
6 objected to the framework document. That is not true at
7 all.

8 Okay. What I would like to talk to -- those are
9 just to clarify some other things. I would like to talk to
10 you today. I would like to, you know, just quick, five
11 subjects, adequate protection, the policy statement on
12 safety goals, the June 15th, 1990 staff requirements, goal
13 allocation and summary. And I don't think we have to spend
14 a lot of time on it. This is, again, the primary basis -- I
15 mean primary responsibility-wise with the people running it,
16 and the Nuclear Regulatory Commission is the adequate
17 protection, public health and safety.

18 The definition that is generally used, and we will
19 talk about that, if a nuclear power plant is in compliance
20 with the regulations, it is presumed that nuclear unit
21 provides adequate protection of public health and safety. I
22 think that is pretty well straightforward.

23 DR. KRESS: Except what do you mean by presumed?

24 MR. CHRISTIE: I have no idea. I am just quoting
25 from what the NRC puts in their paperwork.

1 DR. KRESS: Okay.

2 MR. CHRISTIE: I am just saying that is the
3 definition.

4 DR. KRESS: Okay.

5 MR. CHRISTIE: Okay. We have the 1986 Nuclear
6 Regulatory Commission policy statement on safety goals for
7 the operation of nuclear power plants. It consists of two
8 parts. Basically, the qualitative part having to do with
9 individual members of the public, and then the societal risk
10 to life and so. We have seen those before.

11 From the qualitative goals, we go down to what is
12 known as the quantitative health effects objectives. And
13 here we see the .1 percent rules. .1 percent rule means .1
14 percent of the background. For accident fatalities, that is
15 called the top fatality goal, and then we have got the
16 latent cancer fatalities, which, again, is .1 percent.

17 Where do the numbers come from after that? It is
18 pointed out in the staff presentation, you figure out the
19 numbers and so you get approximately 100,000 accidental
20 deaths per year in, you know, 200 million. So it comes to
21 one in 2,000. For latent cancers, it is 400,000 per 200
22 million, and it is one in 500. Okay.

23 I think, you know, that is pretty straightforward.

24 I want to talk to you now about this document that
25 has been referred to a couple of times, and I don't know

1 whether you have read it or not. I have read it millions of
2 times. But this is the -- you know, the document defines
3 how safe is safe enough in adequate protection. And the
4 first statement that is in here is that the Commission
5 agrees that it must not depart from or be seen as obscuring
6 the arguments made in court defending the backfit rule.
7 Okay. These arguments clearly establish that there is a
8 level of safety that is referred to as adequate protection.
9 This is a level that must be assured without regard to cost
10 and, thus, without invoking the procedures required by the
11 backfit rule.

12 Beyond adequate protection, if the NRC decides to
13 consider enhancements to safety, costs must be considered
14 and a cost benefit analysis required by the backfit rule
15 must be performed.

16 The safety goals, on the other hand, are silent on
17 the issue of cost, but do provide a definition of how safe
18 is safe enough that should be seen as guidance on how far to
19 go when proposing safety enhancements, including those
20 considered under the backfit rule.

21 And on your point, Tom, where did we get the bit
22 about -- read the footnote on a related point. The
23 presumption is that compliance with our regulations provides
24 adequate protection. I don't know what presumption means.
25 I don't like the definition, but that is something else.

1 Okay. What the Commissioners, to me, clearly said
2 in that, that there is a level of adequate protection
3 somewhere, and there is also a thing called -- how safe is
4 safe enough? And the quantitative health objective is to
5 find, how safe is safe enough?

6 So, let's take the individual, which, you know,
7 everybody generally agrees is the most restrictive. And you
8 look at it and you take the background as one in 2,000, and
9 you go to .1 percent, and it comes out to be one in 2
10 million. And below that point, the NRC is not to impose
11 requirements even if cost beneficial. That is pretty clear
12 to me in the safety goal policy statement.

13 Okay. Now, they said somewhere above that line
14 lines something called adequate protection. Okay. And this
15 is my curve from my Delphi Process, where I asked everybody
16 that I knew, including the members of the ACRS, to
17 contribute to the Delphi Process to see if we could get this
18 curve defined with adequate protection. And as I told you
19 before, we didn't get a heck of a lot of response. No one
20 from the NRC, including no member of the ACRS, responded.
21 We got a limited from the industry, and it turns out that
22 most of the people are coming in between 1 and 10 percent,
23 with kind of a mean, you know, somewhere 3 to 5, as I have
24 told you before.

25 So, now, if that were true, this would be the

1 curve that would be used to define adequate protection.
2 Above that line, the NRC imposes requirements without regard
3 to cost, between the adequate protection line and this "how
4 safe is safe enough?" that we would be using the 10 CFR
5 50.109. Why do I have 10 CFR 10.109 on there? Sorry about
6 that. I just caught that.

7 And in there, we would be using the 200 person-rem
8 conversion factor based on the \$3 million value for health
9 detriment.

10 DR. KRESS: So your Delphi Process would say
11 currently, today, adequate protection is like a factor of 10
12 above the safety goals?

13 MR. CHRISTIE: I would say 30 to 50, but a factor
14 of 10 for sure.

15 DR. KRESS: Just go out to the --

16 MR. CHRISTIE: Three to 5 percent versus .1.
17 Adequate protection over here is about 3 to 5 percent.

18 CHAIRMAN APOSTOLAKIS: Of what?

19 MR. CHRISTIE: Of background. Which is an order
20 of 30 to 50 more than .1 percent.

21 DR. KRESS: But this was just a Delphi Process.

22 MR. CHRISTIE: Right.

23 DR. KRESS: So it is --

24 MR. CHRISTIE: You know, again, I have had a
25 conversation with Dr. Joe Murphy about this, and Joe says

1 people don't think in terms of 3 to 5 percent, they think --

2 DR. KRESS: In terms of 10.

3 MR. CHRISTIE: Ten.

4 DR. KRESS: Ten.

5 MR. CHRISTIE: So, you know, what he recommends is
6 we go -- well, he doesn't recommend, but he said it would be
7 more logical if they used just 1 percent.

8 DR. KRESS: Yeah.

9 CHAIRMAN APOSTOLAKIS: For adequate protection.

10 MR. CHRISTIE: For adequate protection.

11 DR. KRESS: That would be the factor of 10.

12 CHAIRMAN APOSTOLAKIS: Of what, 1 percent of the
13 background?

14 MR. CHRISTIE: 1 percent of background.

15 DR. KRESS: It is a factor of 10.

16 MR. CHRISTIE: Everything is --

17 CHAIRMAN APOSTOLAKIS: 10 to the minus 6 then.

18 DR. KRESS: Yeah.

19 CHAIRMAN APOSTOLAKIS: No.

20 MR. CHRISTIE: It would be if you used 1 percent.
21 For me, it would be 5 times to the minus per year.

22 CHAIRMAN APOSTOLAKIS: Right. So, an order of
23 magnitude above the safe enough.

24 MR. CHRISTIE: Right.

25 CHAIRMAN APOSTOLAKIS: Yeah.

1 MR. CHRISTIE: And in that region between 1
2 percent and .1 percent, we would be using the backfit rule.

3 CHAIRMAN APOSTOLAKIS: Well, this is a three
4 region approach we have asked for several times, right?

5 DR. KRESS: That is exactly what it is.

6 CHAIRMAN APOSTOLAKIS: And the staff and the
7 industry are against it.

8 MR. CHRISTIE: The staff and what industry? I am
9 for it. I know that the next head of the ANS is for it.

10 CHAIRMAN APOSTOLAKIS: NEI was against it.

11 MR. CHRISTIE: Well, I am just telling you that
12 there are -- you know, industry is not represented entirely
13 by NEI.

14 DR. KRESS: The staff actually uses this approach.

15 CHAIRMAN APOSTOLAKIS: This is like risk-based.

16 MR. KING: This is, in effect, what the staff
17 uses. We are not against it.

18 DR. KRESS: This is, in effect, what the staff
19 uses.

20 CHAIRMAN APOSTOLAKIS: I'm sorry?

21 MR. KING: This is, in effect, what the staff
22 uses, a three region approach.

23 DR. KRESS: I mean whether it is spelled out or
24 not, that is what they use.

25 MR. KING: I mean we just haven't --

1 CHAIRMAN APOSTOLAKIS: That is what we said in our
2 letter, Tom, that, in effect, people are using it.

3 MR. KING: Exactly. We just haven't put a number
4 on adequate protection.

5 DR. KRESS: Right.

6 CHAIRMAN APOSTOLAKIS: And, of course, we did it
7 in the context of CDF and you might object to doing that for
8 the CDF. I know you --

9 MR. CHRISTIE: Depending on which CDF is chosen.

10 CHAIRMAN APOSTOLAKIS: You like the risk?

11 MR. CHRISTIE: We will get to that point in a
12 minute, George.

13 CHAIRMAN APOSTOLAKIS: Oh, I never doubted that,
14 Bob.

15 MR. CHRISTIE: Okay. And you have heard me
16 before. The best requirements are those that define a
17 criteria to be met, do not specify how to meet. The
18 criteria should lead to a comprehensive approach to the
19 whole plant, defining the overall criteria is better than
20 defining a set of lower criteria.

21 All right. And then, again, we get to the
22 problem. The public health risk is different for each unit,
23 and it changes with time. All right.

24 DR. KRESS: What happens if you cure all the
25 cancers?

1 MR. CHRISTIE: We have been through that last --
2 two years ago, Tom. If you cure all the cancers, the latent
3 doesn't even appear anymore and we are down to the
4 immediates.

5 DR. KRESS: No, no, the latent then becomes
6 dominant.

7 MR. CHRISTIE: No, the latents is zero. You can't
8 have a latent cancer fatality anymore.

9 DR. KRESS: Yeah, but you have got --

10 MR. CHRISTIE: Zero is zero, Tom.

11 DR. KRESS: -- .1 percent of zero that you meet
12 that.

13 MR. CHRISTIE: No, Tom, zero is zero. 1 percent
14 of zero is zero. 100 percent of zero is zero.

15 DR. KRESS: It is hard to meet zero is what I am
16 saying.

17 MR. CHRISTIE: But if they cured cancer, then we
18 wouldn't have latents.

19 Okay. Now, the staff is in here.

20 CHAIRMAN APOSTOLAKIS: Yes.

21 MR. CHRISTIE: And this is what we, you know,
22 again, we object to this pretty vehemently. I mean it is
23 such a complicated affair. Just think about writing your
24 PRA three times now. You are going to run your PRA for --
25 what do they call them? -- anticipated initiation. You are

1 group all the ones that are, you know, somewhere between 10
2 to the minus 2 and 1, and you are going to run it again
3 between all the ones that 10 to the minus 5. You can do all
4 you can all your conditions, containment capabilities.

5 DR. POWERS: I guess I am lost. Why do you have
6 to run them multiple times?

7 MR. CHRISTIE: How are you going to separate out
8 the transients that are between 10 to the minus 2 and 1? If
9 you just run it once, all of them are lumped together and
10 all your event trees, et cetera, et cetera.

11 DR. POWERS: No, they are not. No, not my PRAs,
12 they aren't. All spit out nice and separately.

13 DR. KRESS: And when you say --

14 MR. CHRISTIE: No.

15 DR. KRESS: When you say you are going to have to
16 do this, do you think this is going to be the licensees
17 having to do this?

18 MR. CHRISTIE: Absolutely.

19 DR. KRESS: Oh, I thought NRC was going to do
20 that.

21 MR. CHRISTIE: Well, what code is it is going to
22 do, code is the NRC going to use to do this for a
23 plant-specific PRA that varies individually from plant to
24 plant?

25 DR. KRESS: The same ones that they use now for

1 regulatory analyses is what I was told.

2 MR. CHRISTIE: Right. Right. And do you think
3 they are going to get accurate results?

4 DR. KRESS: I don't know. Accurate enough for
5 making regulations maybe.

6 MR. CHRISTIE: Anyway, this is a very --

7 CHAIRMAN APOSTOLAKIS: Your argument, Bob, is that
8 what really matters is the bottom box, quantitative health
9 objectives, is that your argument?

10 MR. CHRISTIE: No. What matters to me is adequate
11 protection of public health and safety. That is my limit.

12 CHAIRMAN APOSTOLAKIS: I thought you are objecting
13 then -- this is a clarification. You are objecting to two
14 things that the staff is doing. First, they are going
15 deeper than just the quantitative health objectives. You
16 have always argued that that is the only thing that matters.

17 MR. CHRISTIE: No. I have never argued it is the
18 only thing that matters. I have always argued --

19 CHAIRMAN APOSTOLAKIS: You have argued this for
20 years.

21 MR. CHRISTIE: I have always argued that adequate
22 protection of public health and safety is the standard to
23 which plants are licensed and the thing that counted. And
24 if you want to go below that, then you can go down to the
25 backfit rule.

1 At the time I was saying it might be easier if all
2 we did was demonstrate we are below the quantitative health
3 objectives, because then we wouldn't even worry about the
4 backfit rule. But the standard that I am held to today, at
5 every license in the in the United States, is adequate
6 protection of public health and safety.

7 CHAIRMAN APOSTOLAKIS: So you are -- I mean that
8 is why I raised the issue three hours ago. Would the fact
9 that we are using the goals create any problems?

10 DR. SHACK: You have to meet the regulations.
11 Now, the regulations give you adequate protection, but
12 nobody pretends that they are based solely on adequate
13 protection. They clearly include safety enhancements that
14 go beyond adequate protection.

15 MR. CHRISTIE: If you use the backfit rule.

16 DR. SHACK: Yeah.

17 MR. CHRISTIE: Right. That is the scheme that all
18 of us are licensed to, and the scheme that is embedded in
19 the law. And if you want to change that scheme, you have
20 got to go back and change the law and go through the
21 Congress and go through the courts.

22 CHAIRMAN APOSTOLAKIS: I'm confused.

23 MR. CHRISTIE: That's the way life is, George, in
24 licensing a nuclear power plant.

25 CHAIRMAN APOSTOLAKIS: I understand that. I am

1 trying to understand your objection to what the Staff is
2 doing.

3 MR. CHRISTIE: I am objecting that the standard
4 that they are now setting to us is how safe is safe enough,
5 which to me is -- not only they are not setting it as how
6 safe is safe enough, they are even setting it below.

7 They are not even going to write rules for
8 adequate protection in a risk-informed rule.

9 CHAIRMAN APOSTOLAKIS: So they are -- you are
10 objecting --

11 MR. CHRISTIE: They are changing the Atomic Energy
12 Act.

13 CHAIRMAN APOSTOLAKIS: You are objecting to their
14 use of the goals to write regulations without looking at the
15 backfit rule?

16 MR. CHRISTIE: Right. Absolutely.

17 CHAIRMAN APOSTOLAKIS: Which is something we
18 discussed earlier.

19 The second one, which you surprise me today, I
20 thought you have always argued that what really matters is
21 ultimate public health and safety -- fine, and not CDF and
22 conditional core damage and conditional --

23 MR. CHRISTIE: Absolutely.

24 CHAIRMAN APOSTOLAKIS: So you are also objecting
25 in terms of that figure to all the boxes they have above

1 the -- that talk about prevention versus mitigation?

2 MR. CHRISTIE: Absolutely.

3 CHAIRMAN APOSTOLAKIS: Well, now I understand.

4 MR. CHRISTIE: You have got your letter from Dr.
5 Seale to Chairman Jackson, you know -- we all know that. If
6 you choose a core damage frequency of 10 to the minus 4, you
7 are more conservative than the quantitative health
8 objectives.

9 CHAIRMAN APOSTOLAKIS: But the Staff told us today
10 that the Commission has blessed this.

11 MR. CHRISTIE: Well, I will talk about that in a
12 minute. As a matter of fact, here's the next slide.

13 The Staff says in the June 15th memorandum from
14 the Commissioners to Staff that they gave them permission to
15 use the 10 to the minus 4, and let's start looking at what
16 they say in that memorandum.

17 It says implementation and safety goals may
18 require development and use of, quote, "partition
19 objectives. In general the additional objectives should not
20 introduce additional conservatism. The Staff should bring
21 its recommendation on use of each subset of the area
22 objectives to the Commission in the context of the specific
23 issue for which it will be useful and appropriate and
24 explain its compatibility with the safety goals."

25 Then they go on to say, "For the purposes of

1 implementation the Staff may establish subsidiary
2 quantitative core damage frequency and containment
3 performance objectives through partitioning of a large
4 release guideline. These subsidiary objectives should anchor
5 or provide guidance on minimum acceptance criteria for
6 prevention and mitigation and thus assure an appropriate
7 multibarrier defense-in-depth balance in design. Such
8 subsidiary objectives should be consistent with the large
9 release guideline and not introduce additional conservatisms
10 so as to create de facto new large release guideline."

11 And as we know, in the safety goals they couldn't
12 even come up with the large release guideline.

13 They said a core damage probability of less than
14 one in 10,000 per year reactor appears to be a very useful
15 subsidiary benchmark in making judgment about that portion
16 of the regulations which are directed toward accident
17 prevention.

18 Okay? Now how are you going to get that and still
19 be, quote, "not introduce some additional conservatisms" is
20 the dilemma that I have with a problem with.

21 CHAIRMAN APOSTOLAKIS: Would you say these SRMS is
22 not self-consistent?

23 MR. CHRISTIE: I would say that statement is not
24 self-consistent.

25 DR. KRESS: Do you know what core damage frequency

1 the current regulations were designed on an average to
2 achieve?

3 MR. CHRISTIE: I have no idea -- it would depend
4 on each individual plant would have its own specific core
5 damage frequency that would meet the regulation.

6 DR. KRESS: Well, and that could vary. On the
7 average, this might be the number they were shooting for
8 with the current regulations and still use it --

9 MR. CHRISTIE: Could be.

10 DR. KRESS: -- and might not add any more
11 conservatisms.

12 MR. CHRISTIE: Could be, but if I again look at
13 the fact that I am working off the QHOs and a 10 to the
14 minus 4 QHO -- I mean 10 to the minus 4 core damage
15 frequency drives me down below the quantitative health
16 objectives, then obviously this is inadequate protection
17 because adequate protection according to this document is
18 above the quantitative health objective.

19 DR. KRESS: If it drives every plant down below,
20 then maybe on the average.

21 MR. CHRISTIE: So in the average it is all right
22 to have half of the plants get more restrictive, to pick the
23 10 to the minus 4 as the core damage frequency --

24 DR. KRESS: Yes, that's what you mean by that.

25 MR. CHRISTIE: It's great that half of the plants

1 don't meet that -- couldn't meet the QHOs, don't meet the
2 CDF?

3 DR. KRESS: Right. I think that's what you mean
4 by it.

5 MR. CHRISTIE: I'm sorry. I'm not going to have
6 half of the plants in the United States not meeting a
7 subsidiary objective --

8 DR. KRESS: So you would rather have a fixed
9 number that they all have to meet?

10 MR. CHRISTIE: I would like for them to meet
11 adequate protection, which I hope some day to be able to
12 define in terms of background. I would like for them, below
13 that, to go with the backfit rule, and I would like for them
14 not to have to meet any NRC regulations --

15 CHAIRMAN APOSTOLAKIS: What you are asking, Bob,
16 is really for the Commission to define adequate protection
17 in terms of some frequency number, some risk number.

18 MR. CHRISTIE: It would solve a lot of problems.
19 But, you know, again, that's their -- now go look at the
20 next statement however. The Commission has no objection to
21 the use of a 0.1 containment conditional failure probability
22 for the evolutionary design -- for the evolutionary design.

23 Now there's some thought that when they put this
24 in the same paragraph and partitioning that they also meant
25 the core damage probability of less than one in 10,000 per

1 year to be for the evolutionary designs also, because the
2 Commissioners in 19 --

3 CHAIRMAN APOSTOLAKIS: 1990 --

4 MR. CHRISTIE: -90, when they were writing this
5 knew that the existing plants didn't meet the 10 to the
6 minus 4.

7 CHAIRMAN APOSTOLAKIS: And they were not aware of
8 Rick Sherry's work I don't think at the time.

9 DR. SEALE: But they were aware of the criteria
10 that were in the utility requirements document for the
11 evolutionary designs that talked about 10 to the minus 5th.

12 CHAIRMAN APOSTOLAKIS: That's correct.

13 MR. CHRISTIE: Again, I am just going off what is
14 stated here in the document.

15 CHAIRMAN APOSTOLAKIS: So what is your point from
16 all this?

17 MR. CHRISTIE: I just want one more slide on the
18 large early release frequency because I want to --

19 CHAIRMAN APOSTOLAKIS: By the way, just as a
20 clarification, Tom, when you told us earlier that an SRM
21 would confirm the 10 to the minus 4, you are referring to
22 this one?

23 MR. KING: Yes.

24 CHAIRMAN APOSTOLAKIS: Okay, thank you.

25 MR. CHRISTIE: Okay -- and Tom Kress and I will go

1 over it again.

2 On the large early release frequency of 10 to the
3 minus 5, you got the statement in the SECY that says, hey,
4 we took the 1150 plants, we raised them all up to a certain
5 level, we added a whole bunch of stuff up, and we picked the
6 10 to the minus 5 on the basis of those that are closest to
7 the QHOs, okay? -- and Tom said, no, that's not exactly what
8 we did is we drew a line, a kind of median, and so basically
9 half of the plants if we choose 10 to the minus 5, choosing
10 10 to the minus 5 is more restrictive for half of the plants
11 and maybe not that restrictive for the other half to meet
12 the QHOs.

13 DR. KRESS: I don't think either of those is what
14 has actually happened.

15 MR. CHRISTIE: Do you believe that there are
16 plants in the United States who have a large early release
17 frequency in your definition let's say of a 10 to the minus
18 4 and still meet the QHOs?

19 DR. KRESS: 10 to the minus 4 and still meet the
20 QHOs? There may be some limited sites --

21 MR. CHRISTIE: So some plants in the United States
22 could have a large early release in 10 to the minus 4 and
23 still meet the quantitative health objectives?

24 DR. KRESS: It's possible, depending on the sites.

25 MR. CHRISTIE: Okay, so again picking a 10 to the

1 minus 5 means that there's some plants in the United States
2 that's more restrictive than the quantitative health
3 objectives?

4 DR. KRESS: Probably yes.

5 MR. CHRISTIE: Okay. That's what I think too --

6 CHAIRMAN APOSTOLAKIS: Let's look at summaries.

7 Let's look at the summaries.

8 MR. CHRISTIE: All right, summary. And here's --
9 so we know where we are at.

10 Staff is proposing requirements for risk-informed
11 regulations for the existing nuclear units far beyond the
12 standard of adequate protection, okay? They're saying this
13 is voluntary, so if we stick in the existing deterministic
14 rule the standard is adequate protection. If we go over
15 into the probabilistic world, the standard is how safe is
16 safe enough. Oh, boy.

17 Number two, the Staff is ignoring the requirement
18 of the backfit rule when the Staff wishes to go beyond
19 adequate protection. The Staff is ignoring the express wish
20 of the NRC Commissioners in the thing where they said not
21 only said use it, but don't give any appearance of not using
22 it.

23 Three -- the Staff is proposing subsidiary
24 quantitative objectives for existing plants that the NRC
25 Commissioners said were applicable to the evolutionary

1 plants -- to .1 for containment conditional probability is
2 for evolutionary plants, new plants.

3 The framework they are using today uses .1.

4 CHAIRMAN APOSTOLAKIS: But not the 10 to the minus
5 4, as Dr. Seale pointed out. They were aware of the 10 to
6 the minus 5 --

7 MR. CHRISTIE: I don't know what that 10 to the
8 minus 4 meant.

9 CHAIRMAN APOSTOLAKIS: I think it was an allowance
10 for the existing plants.

11 MR. CHRISTIE: But at least to .1 is for the
12 evolutionary plants and now the Staff is applying it to
13 existing plants.

14 CHAIRMAN APOSTOLAKIS: I must say that I am really
15 troubled by the first bullet -- I mean the first comment
16 there, as I stated earlier today.

17 I think we are using quantitative health
18 objectives that were meant to indicate safe enough without
19 using them in option three, which is intended to be for
20 adequate protection.

21 I think Bob is right.

22 DR. KRESS: I don't think so, George. I think
23 we're mixing up the concept of requiring individual plants
24 to meet their goal versus writing the regulations so that on
25 the average they can meet the goal.

1 CHAIRMAN APOSTOLAKIS: But the individual
2 regulations will be imposed upon the individual plants --

3 DR. KRESS: As they are now, and I think they had
4 the same goals in mind when they wrote the --

5 CHAIRMAN APOSTOLAKIS: Well, that's where we don't
6 know. We don't what the goal was --

7 DR. KRESS: Now we don't know.

8 CHAIRMAN APOSTOLAKIS: -- when they were writing
9 something in 1973.

10 DR. KRESS: I know we don't know that.

11 DR. SHACK: Any new regulation will have to meet
12 the backfit rule.

13 DR. KRESS: That's right.

14 CHAIRMAN APOSTOLAKIS: I don't understand that.
15 If you use option three, it won't.

16 DR. KRESS: They will probably do the backfit
17 anyway, even if it's volunteer.

18 CHAIRMAN APOSTOLAKIS: Wait a minute, wait a
19 minute. If I use option three, and it is finished, okay? --
20 and the NRC writes a regulation --

21 DR. KRESS: Right.

22 CHAIRMAN APOSTOLAKIS: -- then they will have to
23 use the backfit rule to justify it?

24 DR. KRESS: They won't have to, but they will
25 because it's sort of standard procedure nowadays.

1 CHAIRMAN APOSTOLAKIS: What do you mean, they
2 don't have to but they will?

3 MR. KING: That is one of the issues that we are
4 going to raise to the Commission.

5 There is a line of thought that when we propose an
6 alternative, a risk-informed alternative, if that
7 risk-informed alternative adds additional requirements there
8 ought to be a backfit analysis to show that those would pass
9 the backfit test.

10 MR. CHRISTIE: But you don't have to ask for the
11 policy statement. The policy statement already exists --
12 June 15, 1999 the Commissioners told you that in the
13 implementation of the safety goals you use the backfit rule.
14 Don't even be perceived as not using the backfit rule.

15 CHAIRMAN APOSTOLAKIS: I am afraid we are
16 ratcheting up the regulations if we use the goals.

17 DR. KRESS: I don't think we know that.

18 DR. BONACA: I don't think we do.

19 CHAIRMAN APOSTOLAKIS: You don't think we do what?

20 DR. KRESS: Look at the plants now. Where do they
21 fall as a spectrum of plants on a safety goal plot? I don't
22 know where they fall, but I'll bet you most of them meet the
23 safety goals and that is because --

24 CHAIRMAN APOSTOLAKIS: Not according to the
25 gentleman to my left.

1 DR. KRESS: Well, you know, we can debate this
2 issue, but I would say --

3 CHAIRMAN APOSTOLAKIS: Well, let's take the
4 subsidiary goals. You know they don't.

5 DR. KRESS: Most of them probably do.

6 CHAIRMAN APOSTOLAKIS: Most of them do but --

7 DR. KRESS: That is why you write the regulations
8 so that the average meets them and if most of them meet it,
9 well, the average meets it.

10 CHAIRMAN APOSTOLAKIS: I am very uncomfortable
11 with that concept, that on the average if I look at the
12 population they meet it, because all they need is one
13 accident.

14 DR. KRESS: I've always had --

15 CHAIRMAN APOSTOLAKIS: An accident on the
16 average --

17 DR. KRESS: I have always had a problem with that.

18 CHAIRMAN APOSTOLAKIS: That bothers me.

19 DR. KRESS: I have always had a problem with that
20 too, George.

21 CHAIRMAN APOSTOLAKIS: Yes.

22 DR. KRESS: But that is the way the system is said
23 to be designed. I have had a problem --

24 CHAIRMAN APOSTOLAKIS: We're supposed to fix the
25 system.

1 DR. KRESS: Okay, but that is a different issue.

2 CHAIRMAN APOSTOLAKIS: I don't understand that.

3 When we issue a particular rule --

4 DR. KRESS: To fix that issue you have to go to
5 saying each plant has to be required to meet a particular
6 CDF or a particular LERF, and the Commission has just over
7 and over said they are not going to do that, so, you know, I
8 would like to change that, and I have fought to change that,
9 but we are not getting very far with it.

10 CHAIRMAN APOSTOLAKIS: But that doesn't mean that
11 I can develop a new approach to Part 50 that has some
12 fundamental if not flaws, fundamental questions embedded in
13 it.

14 DR. KRESS: I think there are questions but I
15 think we disagree on whether or not this is actually a
16 ratchet or not.

17 CHAIRMAN APOSTOLAKIS: I am willing to be
18 convinced otherwise, guys, but right now I think we are
19 ratcheting up.

20 DR. KRESS: Well, the question of the ratchet is
21 what does the current set of plants meet in terms of the
22 safety goals.

23 How many of them meet it? How many of them don't?

24 I think you would say then with the new
25 regulations are we requiring more of them to meet it or are

1 you still going to get the same distribution?

2 I don't know the answer to these questions but I
3 have no --

4 DR. BONACA: I agree with Tom, but the other
5 thing, adequate protection right now means that you meet the
6 regulation, the regulation that we have in the books.

7 CHAIRMAN APOSTOLAKIS: That is not what it means.
8 The Commissioner makes it very clear.

9 If you meet the regulations, there is a
10 presumption of adequate protection. If there is adequate
11 protection, that does not necessarily mean you meet all the
12 regulations, and it is not necessary and sufficient. It is
13 necessary, not sufficient -- which leaves open a huge hole
14 for us to justify, you know, a lot of things.

15 MR. CHRISTIE: No, I do not believe it leaves a
16 huge hole to justify other things except by use of the
17 backfit rule. It is not a huge hole. It is a very
18 well-defined hole.

19 DR. BONACA: I agree with that. I agree.

20 MR. CHRISTIE: So all we have to do from now on is
21 everything that we want to add to the thing say it meets the
22 backfit rule, go through the 51.09 analysis and make sure it
23 meets the backfit rule.

24 DR. BONACA: The question I have is if we did not
25 use the goals but we used some definition of adequate

1 protection, how would we go about risk-informing Part 50? I
2 mean has anybody got any idea how to do that?

3 DR. KRESS: You would have to explicitly spell
4 those out.

5 DR. BONACA: Exactly.

6 DR. KRESS: So since we can't, we have to use
7 something different, because we can't explicitly spell those
8 out.

9 CHAIRMAN APOSTOLAKIS: But you see --

10 DR. BONACA: We wrote a letter, right?

11 CHAIRMAN APOSTOLAKIS: But is it inconceivable
12 that as an agency we'll want to have it both ways?

13 We don't want to define adequate protection
14 quantitatively and yet we want to risk-inform the
15 regulations.

16 DR. BONACA: But the point though that I would
17 like to make is that, first of all, we had a regulation in
18 place before there was any definition or goals,
19 historically.

20 Then we began to talk about goals and, you know,
21 these goals these members here, they were the AIF, American
22 International Forum put them forth in the early '80s, late
23 '70s, and now there has been always an intent of filling the
24 gap with regulation, with the use of PRA.

25 How have we done that? By looking at CDF and LERF

1 and in cases we found there was a gap in the regulation,
2 that there was no adequate protection on some plants, there
3 were some changes made in the research of vulnerabilities.
4 There was a process that ended up with the IPEs and so on
5 and so forth.

6 So I don't think this concept here presented by
7 NRC is inconsistent with all these developments.

8 CHAIRMAN APOSTOLAKIS: It is inconsistent.

9 MR. CHRISTIE: George, let me --

10 CHAIRMAN APOSTOLAKIS: 1.174 -- it refers to
11 individual plants and says if you're changing CDF from what
12 you have now, which presumably satisfies adequate protection
13 criteria, is this and that, we approve or we don't approve.

14 This is a very different approach. This starts
15 with the QHOS.

16 DR. KRESS: It ought to be. It ought to be --

17 CHAIRMAN APOSTOLAKIS: It doesn't start with the
18 existing CDF at this plant.

19 DR. KRESS: George, it ought to be a different
20 approach -- 1.174 can be viewed as a formal way to do
21 exemptions.

22 CHAIRMAN APOSTOLAKIS: Changes.

23 DR. BONACA: It has to be plant-specific.

24 DR. KRESS: And this is not exemptions. This is
25 rewriting the rules and they should not be -- the two of

1 them shouldn't be thought of except in general principles,
2 you know, the principles are applicable in both cases but
3 they are not the same thing.

4 CHAIRMAN APOSTOLAKIS: My point is that in 1.174
5 precisely because you are talking about changes the issue
6 did not arise, because you are not relying fundamentally on
7 the QHOs. You are saying we are allowing this guy to
8 operate, therefore there is a presumption of adequate
9 protection. Now he wants to change it a little bit and here
10 are some rules.

11 Here we are taking a very different approach.

12 MR. KING: No.

13 CHAIRMAN APOSTOLAKIS: We are not looking at what
14 the guy is doing. We are starting with the QHOs.

15 MR. KING: 1.174 started with the QHOs and backed
16 out.

17 CHAIRMAN APOSTOLAKIS: No.

18 DR. KRESS: They did.

19 MR. KING: LERF, 10 to the minus 5th LERF number
20 shows up in 1.174 as well as the 10 to the minus 4 CDF as
21 cutoffs as to where --

22 CHAIRMAN APOSTOLAKIS: No, but there you are
23 allowing to go higher. Come on.

24 MR. KING: But the changes have to be, you know,
25 so small that they are almost negligible but there is a

1 cut-off in there and it is based upon the safety goals. It
2 is not based upon adequate protection.

3 CHAIRMAN APOSTOLAKIS: You look at the figures you
4 have. They go to the right and then there is a zig-zag line
5 that says, you know, we really don't know where this is, but
6 that is exactly the adequate protection, that you are
7 approaching now regions where even a small delta is not
8 tolerable.

9 DR. KRESS: That is because you are dealing with
10 individual plants, not the body of regulations.

11 DR. BONACA: Exactly. That is the point -- 1.174
12 applies to the individual plants.

13 DR. KRESS: If you are going to risk-inform the
14 regulations, in my opinion you are going to have to have in
15 mind some risk objectives that you are trying to achieve.
16 That is the only way you can risk-inform it.

17 Now if I were going to use as my risk objectives
18 this factor of 10 above the safety goals that we saw on Bob
19 Christie's plants, I would be in real trouble, I think. I
20 think that would be real mistake to try to risk-inform the
21 regulations.

22 DR. SHACK: And who would be -- the meaning of the
23 safety goal at that point?

24 DR. KRESS: Nobody.

25 CHAIRMAN APOSTOLAKIS: No, the goal I think was

1 stated very well. It is if you are below the goal, we leave
2 you alone. We don't even raise the issue of backfit.

3 DR. KRESS: That is when you deal with specific
4 plants.

5 MR. CHRISTIE: Agreed.

6 CHAIRMAN APOSTOLAKIS: That is exactly what it was
7 always supposed to be.

8 DR. KRESS: But that's when you deal with specific
9 plants.

10 MR. CHRISTIE: And that was the intent of the
11 Commissioners.

12 CHAIRMAN APOSTOLAKIS: I don't think anybody is
13 disputing that.

14 MR. CHRISTIE: Okay. Let me explain. We do not
15 need this framework to risk-inform the regulations.

16 CHAIRMAN APOSTOLAKIS: Why not?

17 MR. CHRISTIE: Well, because we have another
18 framework which we will talk about again tomorrow, which I
19 have already explained to you on the hydrogen, where the
20 framework is. You go through the existing regulations. You
21 retain what is effective and efficient in addressing public
22 health risk. You add what is necessary that comes out of
23 your risk assessments and you delete what is not effective
24 and efficient.

25 CHAIRMAN APOSTOLAKIS: Well, then the Staff might

1 tell you that we are developing all this to help us decide
2 what is necessary.

3 MR. CHRISTIE: Well, they can have a framework
4 where half the plants in the United States don't meet the
5 regulations, which to me is just a debacle of the nth order.
6 It's almost ludicrous when you think about it.

7 Do I want to be an in the half of the plants that
8 don't meet it and go out there and say, hey, I don't meet
9 the regulations but it's all right?

10 DR. KRESS: Well, there's going to be two sets of
11 regulations and you'll have to meet one or the other.

12 I think that is a problem we have had but I don't
13 see any way around that.

14 MR. CHRISTIE: Okay. We are going to have a set
15 of regulations where the plants that can meet all the
16 quantitative health objectives and treat quantitative health
17 objectives and even below the quantitative health objectives
18 as adequate protection and meet all those are going to be
19 over here in one set of rules and then we are going to have
20 another set which can't meet all the quantitative health
21 objectives as adequate protection and the subsidiaries, et
22 cetera, and they are going to be up at another level?

23 DR. KRESS: Probably. That is probably what is
24 going to happen.

25 CHAIRMAN APOSTOLAKIS: That is another thing that

1 makes me very uncomfortable, Tom.

2 DR. KRESS: I know, but --

3 CHAIRMAN APOSTOLAKIS: And you know very well -- I
4 think all of us know that a lot of licensees will start to
5 pick and choose.

6 DR. KRESS: Of course they will.

7 CHAIRMAN APOSTOLAKIS: Then what happens?

8 DR. KRESS: That is the issue of selective
9 implementation, that we have got a policy to deal with, and
10 we even wrote a letter once that we think you are going to
11 end up with a dual set of regulations and don't see any way
12 around it.

13 MR. CHRISTIE: Well, I see a lot of ways around
14 it.

15 There's no doubt in my mind I see a lot of ways
16 around it. I can risk-inform the regulations for everyone
17 using just exactly the framework that we just explained.

18 I don't think it is the most optimum but it
19 certainly can be done.

20 DR. KRESS: Well, you would make a new set of
21 regulations that would be mandatory for everybody --

22 MR. CHRISTIE: Absolutely.

23 DR. KRESS: -- a different framework.

24 MR. CHRISTIE: The proposed petition for 50.44 is
25 a mandatory application for petition for everyone. It

1 doesn't set -- and that is another problem we will talk
2 about tomorrow. It's got nothing to do with Option 3.

3 DR. KRESS: That is certainly another option. We
4 debated among ourselves some about that option.

5 CHAIRMAN APOSTOLAKIS: Let me understand something
6 in the context of the framework that was presented.

7 Let's say that in one of the entries for
8 infrequent initiators one of the facilities happens to be
9 higher than the numbers we have here and we say it's a goal,
10 it doesn't matter.

11 Then Quad Cities happens. Right or wrong,
12 somebody comes up with a sequence that is really violating
13 the goals, the numbers that the Staff has shown.

14 Where does the Staff start flying people over
15 there to find out what is happening and in fact order a
16 shutdown or the licensee itself shuts down the plant because
17 they feel they have entered the region now where we are
18 talking about adequate protection and all this remains with
19 this framework obscure.

20 DR. KRESS: I think they make a judgment call,
21 just like they do now.

22 CHAIRMAN APOSTOLAKIS: That's right, so this is
23 not helping that way.

24 DR. KRESS: It is not helping their part. They
25 will have to make a judgment call just like they do now.

1 CHAIRMAN APOSTOLAKIS: I think what makes it worse
2 is that you are allowing a plant to be higher than some of
3 these numbers but we don't know how high they are allowed to
4 be before we reach adequate protection.

5 DR. KRESS: Well, you and I know.

6 CHAIRMAN APOSTOLAKIS: I know.

7 DR. KRESS: I think the Staff knows.

8 CHAIRMAN APOSTOLAKIS: I think everybody agrees
9 that if you are in the 10 to the minus 3 for the reactor
10 core damage frequency, I mean the licensee itself proved
11 that they believe that's too high. They shut down.

12 I don't know why we have this great reluctance
13 to --

14 MR. CHRISTIE: Are they shutting down because of
15 public health risk --

16 CHAIRMAN APOSTOLAKIS: No.

17 MR. CHRISTIE: -- that they can't survive it, or
18 are they shutting down because the investment risk is too
19 high to lose \$4 billion?

20 CHAIRMAN APOSTOLAKIS: I think it is really a
21 combination, and you can add to that one probably the
22 reaction from the NRC and so on, but the truth of the matter
23 is that it seems to be consensus that a 10 to the minus 3 or
24 higher core damage frequency is something that we have to
25 act immediately upon.

1 DR. KRESS: Yes.

2 CHAIRMAN APOSTOLAKIS: I don't think you can
3 dispute that. Now you can argue about the reasons but this
4 is the truth.

5 DR. KRESS: So why don't we codify --

6 CHAIRMAN APOSTOLAKIS: Why don't we recognize
7 that?

8 DR. KRESS: Why don't we codify that --

9 CHAIRMAN APOSTOLAKIS: And yet the Commission
10 says, the Commission disapproved the proposed change to
11 elevate the qualitative statement of the prevention --
12 qualitative even -- of severe core damage accidents to a
13 qualitative safety goal. The Commission just flat out
14 disapproved it and now we can't do anything about it.

15 Anyway --

16 MR. CHRISTIE: I don't think -- you are just
17 focusing on the core damage frequency, which again is not
18 the reason for the Nuclear Regulatory Commission's
19 existence.

20 The reason for the Nuclear Regulatory Commission's
21 existence is the public health effects. The radiation that
22 is contained in the fission products in the core have a
23 significant impact during accidents, if we have accidents,
24 on the public health risk, and it is the role of the Nuclear
25 Regulatory Commission.

1 CHAIRMAN APOSTOLAKIS: I wonder, Bob, if there was
2 a core damage incident tomorrow and the New York Times and
3 Washington Post were after the Commission whether you would
4 stand up and say, hey, nobody was killed. Why are you
5 putting them on the hot seat?

6 MR. CHRISTIE: Absolutely. I would stand up there
7 without even blinking.

8 CHAIRMAN APOSTOLAKIS: I don't think the reporters
9 would listen to you.

10 MR. CHRISTIE: Again, you are predicating
11 everything on the front page of the New York Times and the
12 Washington Post and I know that the Staff does it also,
13 because I sat in on the meetings and they told me so, and
14 that is not an appropriate measure for the regulations of
15 the Nuclear Regulatory Commission nor the behavior of the
16 Staff.

17 CHAIRMAN APOSTOLAKIS: What is appropriate it
18 seems to me is what the American people say is their role.

19 Anyway, I think we are running out of time here.
20 Thank you, very much.

21 I don't know, now do you want to continue with --

22 MR. KING: It's up to you. Mary mentioned to me
23 that Section 5 has changed quite a bit, so if you have
24 comments on the old Section 5 it's probably not worth taking
25 time to go through them.

1 MS. DROUIN: I mean we have --

2 CHAIRMAN APOSTOLAKIS: I have comments on Section
3 4 and then I would be very happy to skip 5.

4 MS. DROUIN: I mean we substantially reworked 5.
5 The new version doesn't look anything like the old version.

6 CHAIRMAN APOSTOLAKIS: Will we have another chance
7 to look at 5, or the new 5?

8 MS. DROUIN: I mean you have it.

9 DR. KRESS: We have it here.

10 MS. DROUIN: I mean a chance to talk to you about
11 it. Tomorrow or the next day?

12 MR. KING: It won't be tomorrow. We are not --
13 the subject isn't on the agenda for tomorrow but certainly
14 we would ultimately like a letter on the framework in
15 support of our August paper. Now the timing of how to get
16 that we have got to talk about.

17 DR. KRESS: That's probably, that's something we
18 ought to talk about now, I guess.

19 MR. MARKLEY: The next meeting is August 30
20 through September 1st.

21 CHAIRMAN APOSTOLAKIS: Maybe we should postpone
22 then the discussion until then. I have a few comments but
23 they are --

24 DR. SHACK: Let me just ask what is intended in
25 Table 5-1 where you have this regulatory coverage of some

1 accidents important to risk.

2 I mean is the implication here that you need a
3 regulation addressing each of the accidents important to
4 risk, or can you take the argument that if you have achieved
5 a sufficiently low level of risk by some other means you
6 don't need to explicitly cover them?

7 DR. KRESS: Which Figure 5-1 are you looking at?

8 DR. SHACK: Table 5-1.

9 CHAIRMAN APOSTOLAKIS: Table 5-1.

10 MS. DROUIN: It's been awhile since I have looked
11 at this.

12 The only thing we were trying to say, and you
13 know, this is an early version, I can't tell you what the
14 new version looks like, is that we wanted to step back and
15 look at Part 50 and look at what are the risk insights
16 coming out of your PRAs -- what are your dominant accident
17 sequences, what are the contributors, and just kind of match
18 them up to the regulations to see at a quick, high level,
19 back-of-the envelope approach is there some glaring hole in
20 the regulations?

21 Is there some dominant accident class or some
22 contributor, some large contributor that is not being
23 addressed by a regulation.

24 This was just showing how -- you know, we went
25 through the accident types that are important to core damage

1 and to LERF and tried to map up where these are being
2 covered by the regulations, not to read any more into that
3 table than that.

4 DR. SHACK: You did seem to be determined to
5 preserve the concept of a design basis accident, and that
6 would somehow seem to be inconsistent with this notion that
7 all these accident classes -- or these would become new
8 design basis accidents?

9 MS. DROUIN: Not that these should become new.
10 This is just looking at here are the accidents coming out of
11 the PRAs, that PRAs have told us are important.

12 And we actually have regulations that are matching
13 up. And if there is something that is not a match, then we
14 would then therefore want to go look at to say this is a
15 hole in the regulation.

16 DR. SHACK: Okay, so we want to think about this?

17 MS. DROUIN: Yes, it's just a high level screening
18 tool for us.

19 CHAIRMAN APOSTOLAKIS: Have you really thought
20 hard about this position that the concept of design basis
21 accident should be preserved?

22 MS. DROUIN: Thought hard about it? I'm not sure
23 what you mean by hard. We've thought about it.

24 CHAIRMAN APOSTOLAKIS: You just took it for
25 granted that this is a good idea? We are doing a lot of

1 things that really go away beyond the design basis
2 accidents.

3 DR. SEALE: Like steam generator tubes.

4 CHAIRMAN APOSTOLAKIS: Yes. This is a beautiful
5 paragraph here, right below that table. Some
6 risk-significant accident types and related events do not
7 find any mention in the current regulations.

8 So I don't know that the DBAs are something worth
9 deserving.

10 MS. DROUIN: It may not be those DBAs, but I do
11 think the concept of having accidents against which you want
12 to design, personally I think that's a good concept.

13 CHAIRMAN APOSTOLAKIS: It is, but it could take a
14 different form than the current form of design basis
15 accidents.

16 MS. DROUIN: That's all we're saying. We want to
17 keep the concept.

18 CHAIRMAN APOSTOLAKIS: Yes.

19 MS. DROUIN: We aren't saying it's necessarily the
20 DBAs that are the books now will still be the same ones and
21 in the same form.

22 DR. POWERS: Your affection for the concept is
23 because of its design facility that it provides?

24 MS. DROUIN: I'm sorry, I didn't hear you.

25 DR. POWERS: The reason you have an affection for

1 this concept is because of the facility it provides to
2 design?

3 MS. DROUIN: Yes.

4 MR. KING: That's part of it, and part of it is
5 unless you go risk-based, I think you're pretty much forced
6 to come into some sort of design basis accident concept. So
7 as long as those design basis accidents really reflect the
8 risk considerations, and --

9 CHAIRMAN APOSTOLAKIS: But there is always a
10 residual risk.

11 MR. KING: Sure. There's a residual risk, even if
12 you want risk-based.

13 DR. BONACA: And under a probabilistic regime, I
14 mean, you would have to postulate some event to determine
15 the sizing of your pumps or the way you're injecting.

16 DR. POWERS: Well, what I'm asking -- you might
17 well do that, but the question I'm asking is, if it's just
18 the design and not this question of risk-based, and just a
19 question of design, why does the NRC want to get involved?
20 Why ought not that be up to the designer hypothesizing
21 anything you want to do?

22 Now, this other issue that Tom brings up, which is
23 that, in essence, we don't want to become risk-based because
24 we don't think our risk analysis tools are yet comprehensive
25 enough and robust enough that we can rely strictly on risk,

1 then gets into this question of there are certain kinds of
2 features of plants that we want to proscribe.

3 We want to proscribe plants that have an
4 end-stable reactivity profile. Just don't even bring them
5 to me, they're forbidden.

6 I think I'm putting words in your mouth, but
7 that's --

8 DR. KRESS: No, that's an accurate statement of
9 what I propose.

10 DR. POWERS: Once again, we come to the
11 possibility that because we can't set up a completely
12 self-consistent regime here, we have to legislate against
13 certain kinds of alternatives.

14 DR. KRESS: That makes sense to me.

15 DR. POWERS: So, we can't get rid of the concept
16 of design basis accidents.

17 DR. KRESS: Yes. I think even in the extreme of a
18 risk-based system, your design basis accident becomes the
19 whole spectrum of PRA.

20 DR. POWERS: Well, it does, but it might be
21 different for each plant.

22 DR. KRESS: It would be different for each plant.

23 DR. POWERS: Yes, or certainly each plant type.

24 DR. KRESS: It certainly would be plant-specific
25 design basis accident.

1 DR. POWERS: We discussed that before, because of
2 different locations, the risk profile must necessarily be
3 different.

4 DR. KRESS: Yes, and because of the different
5 reactor concepts.

6 DR. POWERS: All you've succeeded in doing is
7 persuading them, boy, I'm glad I'm not doing your job.

8 DR. KRESS: We don't think this is an easy job.

9 CHAIRMAN APOSTOLAKIS: I think the most
10 fundamental issue here is the adequate protection versus the
11 use of goals.

12 DR. KRESS: Yes. I think we have a fundamental
13 difference of opinion among some of the members on that
14 issue.

15 DR. POWERS: I think that's been adequately
16 reflected in the e-mail traffic.

17 DR. BONACA: To which we did not contribute
18 intently.

19 CHAIRMAN APOSTOLAKIS: Say again?

20 DR. BONACA: For which -- I follow that traffic
21 very, very carefully. I was going to help in a couple of
22 times, and I said, well, it's already said.

23 CHAIRMAN APOSTOLAKIS: I would say it's reflected
24 in today's discussion as well.

25 DR. KRESS: We probably should have added Tom and

1 Mary to this, and put our e-mail address on that. It might
2 have been interesting.

3 DR. BONACA: I would like to say at some point --

4 CHAIRMAN APOSTOLAKIS: How are we going to solve
5 this?

6 DR. BONACA: Wait. If we --

7 DR. SHACK: We're going to out-vote you, George.

8 [Discussion off the record.]

9 DR. BONACA: If we decided to go with adequate
10 protection, then we would have to quantify it in terms of
11 some risk measure. And I don't see why the one that we
12 propose would not be appropriate on an average basis.

13 CHAIRMAN APOSTOLAKIS: That's what bothers me,
14 that because it's the only risk measure that we have, we
15 resort to using that without thinking that its intent was
16 very different.

17 DR. SHACK: I still come back to my argument that
18 if you have goals, that your regulatory system ought to be
19 out to achieve those goals.

20 DR. KRESS: That's exactly what the Commission
21 said they were intended for.

22 MR. KING: I remind you that this issue is going
23 to go to the Commission in our August paper. I mean, we're
24 not going to decide this unilaterally. We're going to lay
25 this out for the Commission that we're using their safety

1 goals, subsidiary objectives for this purpose, and, in
2 effect what it means is, we're risk-informing the
3 regulations to achieve the level of safety that they -- that
4 was stated as their expectation in this Agency in the safety
5 goal policy.

6 DR. KRESS: I think that's --

7 CHAIRMAN APOSTOLAKIS: So now someone meets all
8 the regulations under Option 3, and then you promise to
9 leave them alone and you will never impose additional
10 regulations on them because they are safe enough?

11 MR. KING: Yes, unless some new information comes
12 up.

13 DR. KRESS: If you could write perfect
14 regulations.

15 CHAIRMAN APOSTOLAKIS: And the staff should
16 incorporate in the reactor safety goal policy statement that
17 it is the Commission policy that safety goals are goals and
18 not limits.

19 Now, what difference would that make? That some
20 plant may violate them and when you issue the rule or
21 whatever rule --

22 DR. KRESS: That's what it means; that's exactly
23 what it means.

24 CHAIRMAN APOSTOLAKIS: I don't understand that.

25 DR. KRESS: That's why they're goals.

1 CHAIRMAN APOSTOLAKIS: They issue a rule that
2 flows from this framework, what does that mean?

3 DR. KRESS: That means some plants will --

4 CHAIRMAN APOSTOLAKIS: Will not follow the rule?

5 DR. KRESS: No. They will follow the rules. It
6 says that the rules cannot be written so perfectly that
7 every plant in how it operates and how it designs and how it
8 runs its things, will not meet those numbers. It will meet
9 the rules, but it will not meet those specific numbers.

10 And that's the way the rules are written now, and
11 that's the situation we have now.

12 MR. SIEBER: Some plants may choose not to
13 risk-inform that rule.

14 DR. SHACK: Even if you assume --

15 DR. KRESS: Even if you choose all of them --

16 DR. SHACK: -- choose to do it, that's going to be
17 a fact of life, that when they do it, because they've done
18 it on a generic basis, some will make and some won't.

19 DR. KRESS: More than likely, the ones that choose
20 to do it will be the ones that know they can make it easily
21 anyway.

22 But that's not something we ought to debate.

23 CHAIRMAN APOSTOLAKIS: I don't think you're right
24 with your argument that if I have goals, I should strive to
25 achieve them, and otherwise, why do I have them? No.

1 The goals were specifically interpreted as meaning
2 that if you are below those, there's no reason to even
3 consider additional safety measures.

4 That doesn't mean that I will establish -- it's
5 safe enough; that's what it says.

6 DR. KRESS: I don't think that's what they said.

7 DR. SHACK: I think there was an expectation that
8 they would do that on the average.

9 DR. KRESS: On the average. I think that's
10 explicitly stated in there.

11 CHAIRMAN APOSTOLAKIS: But it's a safe-enough
12 statement.

13 DR. POWERS: There was an expectation that --

14 DR. KRESS: They made it on the average.

15 CHAIRMAN APOSTOLAKIS: That's different from the
16 expectation. The protection of the goal is that it's safe
17 enough in the sense that I will not ask you to do anything
18 else.

19 DR. KRESS: That's an additional interpretation.

20 CHAIRMAN APOSTOLAKIS: This is a --

21 DR. KRESS: Related to the backfit rule.

22 DR. POWERS: My perception, based on what I have
23 read about the history of things was they were interested in
24 the question of, is the body of regulation such that things
25 are safe enough now, or is there some tremendous omission

1 that we've made out there in this body of regulation?

2 And one needs only think about the history prior
3 to Appendix R and 50.48. Here's a tremendous omission.

4 I think they were really interested in, is there
5 evidence of some tremendous omission? And we derive that
6 evidence by looking at a lot of individuals, and seeing if,
7 on the average, things are well away from where our goals
8 are.

9 DR. KRESS: That's a good way to look at it.

10 DR. POWERS: But it doesn't obviate our problem.
11 If we want to regulate, if we want to go approve a
12 particular installation, what it wants to do, you need some
13 number to compare against, and they're just not giving it to
14 us.

15 DR. KRESS: Yes. They're not giving us that
16 number at all.

17 DR. POWERS: And I don't know why. I mean --

18 DR. KRESS: I don't know why they're reluctant to
19 do that.

20 DR. POWERS: They kind of have, in that they said
21 go ahead and use 1.174, okay, for changes. And I should
22 say, for the formal -- what method of granting exemptions,
23 go ahead and use this number, which seems to me a lot more
24 tenuous of a thing than saying prove the operation of this
25 plant.

1 I seems to me that granting exemptions, I'd be
2 more cautious with than just a general running of the plant.

3 It's curious.

4 DR. KRESS: It's curious.

5 DR. POWERS: Makes me glad that I don't have their
6 job either.

7 DR. KRESS: We've argued that they ought to do
8 that.

9 CHAIRMAN APOSTOLAKIS: Are there any other
10 important comments?

11 MR. HASKIN: I just want to make one comment.

12 CHAIRMAN APOSTOLAKIS: Yes.

13 MR. HASKIN: While I was at Sandia, one of the
14 jobs I had was to supervise the group that developed the
15 methods to do the uncertainty analysis in 1150. If you guys
16 recall, the uncertainty distributions on core damage
17 frequency from 1150, typically from the fifth to the 95th
18 percentile is two orders of magnitude.

19 If I establish a goal for core damage frequency at
20 adequate protection at 10 to the minus three, and I base
21 that on a mean, that means that there is a five percent
22 chance that my actual core damage frequency could be as high
23 as 10 to the minus two.

24 One of the things you haven't considered in this
25 discussion of safety goals versus adequate protection is

1 that if you want to set an objective based on adequate
2 protection for things like core damage frequency, you want
3 to base that on a mean, or do you want to put some
4 confidence level?

5 DR. KRESS: That's right.

6 DR. POWERS: It may have been neglected in this
7 discussion, but it has been neglected before, and I will
8 hasten to point out that the suggestion has been the 95
9 percentile for that particular goal.

10 DR. KRESS: Puts you right back to the safety
11 goals again. That's what I was kind of arguing all along.

12 CHAIRMAN APOSTOLAKIS: Well, this will come after
13 we decide what the limit -- what the goal is. And in 1.174,
14 we just -- because, you know, it was too soon for these
15 things, so we said there will be increased management
16 attention, which means a qualitative treatment.

17 But you're right, that this uncertainty has to be
18 taken into account. But that does not eliminate the
19 fundamental concern of goal versus adequate protection.

20 DR. POWERS: If you're striving for the safety
21 goal, I feel relatively comfortable making comparisons based
22 on mean.

23 CHAIRMAN APOSTOLAKIS: So now you're saying that
24 on the basis of defense-in-depth, I will use goals for
25 adequate protection?

1 MR. HASKIN: No, it's just something that has to
2 be considered in the deliberation.

3 DR. POWERS: What do we know about the history of
4 the nuclear inspection -- anyone in their goal limit --
5 structure?

6 CHAIRMAN APOSTOLAKIS: We have this in -- see,
7 the thing about documents that come out of Europe, as far as
8 I can tell, is that this concern about uncertainty that we
9 have here is not there.

10 So they tell you, individual risk, if it's less
11 than 10 to the minus six, it's broadly acceptable by
12 society, what we would call safe enough.

13 If it's 10 to the minus four or higher, it is
14 unacceptable, what we would call adequate protection is
15 violated.

16 In between, it's tolerable, in other words,
17 cost/benefit --

18 DR. POWERS: I'm aware of the words.

19 CHAIRMAN APOSTOLAKIS: But the fact that 10 to the
20 minus six may have two orders of magnitude uncertainty up
21 and down does not appear, at least explicitly, does not
22 appear.

23 DR. POWERS: So they must be prescribing methods
24 of analysis?

25 CHAIRMAN APOSTOLAKIS: Not that I have seen. The

1 documents that I have seen do not.

2 DR. POWERS: Well, maybe they're not prescribing a
3 particular method, but they're prescribing that the method
4 be acceptable to the regulator.

5 CHAIRMAN APOSTOLAKIS: Oh, I'm sure it has to be.

6 DR. KRESS: They can deal with it in that
7 prescription.

8 DR. POWERS: It's much more collegial and a less
9 confrontational system. So if regulatory and regulatee
10 agree on a method of analysis, yes, you can omit the
11 question of uncertainties.

12 DR. KRESS: Because it's implicit in that.

13 DR. POWERS: It's been implicit in the way you've
14 developed it, yes.

15 CHAIRMAN APOSTOLAKIS: Yes.

16 DR. POWERS: If you guys would just get along with
17 your licensees, instead of being so damn confrontational.

18 [Laughter.]

19 CHAIRMAN APOSTOLAKIS: Any other comments from the
20 members on issues that have not been addressed?

21 MR. KING: Do you want to talk timing of the next
22 Committee's action?

23 CHAIRMAN APOSTOLAKIS: This is a good idea. You
24 are supposed to send something to the Commission in August?
25

1 MR. KING: End of August, we owe a paper to the
2 Commission that will have the framework, the policy issue in
3 50.54.

4 DR. POWERS: Why don't you come present that
5 package to us at our September meeting?

6 DR. KRESS: And our letter would follow.

7 CHAIRMAN APOSTOLAKIS: Is that too late? That's
8 what my question was; when is the Commission expected to do
9 something about it, so that September will not be late?

10 MR. KING: I think if we could meet at your
11 September meeting, it would probably work out okay.

12 CHAIRMAN APOSTOLAKIS: Can we write the letter at
13 the September meeting?

14 DR. KRESS: Yes, I think we could do that.
15 George, that would be a nice letter for you to write.

16 DR. SHACK: I can work on my added comments.

17 [Laughter.]

18 DR. KRESS: You and I can get together and work on
19 our added comments.

20 MR. KING: Which means you probably want another
21 Subcommittee so that we can delve more into the policy
22 issues?

23 CHAIRMAN APOSTOLAKIS: I don't think another
24 Subcommittee will help, but I think we can have a three-hour
25 --

1 DR. POWERS: I think we would have great
2 difficulty trying to schedule another Subcommittee meeting,
3 but on the other hand, I think this is -- we've examined and
4 debated this enough that if you could just appear before us
5 and say here are the things that we call your attention to
6 that have been changed dramatically from what we've talked
7 to you about before --

8 I mean, just do that in a very terse fashion,
9 because, quite frankly, as has been apparent, we've been
10 going over this thing literally line-by-line.

11 CHAIRMAN APOSTOLAKIS: The other thing is, you
12 know, it depends on what they say in the letter to the --
13 the report they send to the Commission.

14 If they pose an issue and they say, look, we can
15 interpret it this way or that way, tell us what to do, then
16 I don't think there is a question of added comments, right?

17 DR. KRESS: Probably.

18 CHAIRMAN APOSTOLAKIS: If the staff comes back and
19 is de facto using certain things in a certain way, then some
20 members may disagree, so it depends very much on what you
21 guys write in the final.

22 MR. KING: You'd be interested in how we frame the
23 issue and what our recommendation is.

24 DR. KRESS: Yes, definitely that.

25 CHAIRMAN APOSTOLAKIS: If you offer options to the

1 Commission, arguing, you know, both sides of the coin, I
2 don't see why we would disagree.

3 DR. KRESS: They may have a preferred option.

4 DR. POWERS: I would presume the Commission would
5 like to get our thoughts on which option to take.

6 DR. KRESS: Or if there is another option.

7 DR. POWERS: This sage and insightful one that Tom
8 comes up with or the thing that we come up with.

9 CHAIRMAN APOSTOLAKIS: So we will have then a
10 presentation during the September meeting with the
11 expectation that we will write a letter at the time.

12 MR. KING: Okay, sounds good.

13 CHAIRMAN APOSTOLAKIS: Okay. Anything else?

14 DR. KRESS: That's a two-hour session.

15 CHAIRMAN APOSTOLAKIS: Members of the public?

16 [No response.]

17 DR. POWERS: I would try to make it short, the
18 presentation short.

19 CHAIRMAN APOSTOLAKIS: No, I think we should have
20 enough time for discussion. The presentation itself can be
21 short.

22 DR. POWERS: I think I'm very familiar with the
23 agenda for September, and I know there's no room to make it
24 a lengthy period, and I'm going to talk to you guys. I
25 think September is going to be a four-day meeting.

1 CHAIRMAN APOSTOLAKIS: The fourth day is Labor
2 Day.

3 DR. KRESS: I don't care; I'm retired.

4 DR. POWERS: Second of all, I don't think that's
5 the issue that we're confronting.

6 They will have a fait de complis; they will have a
7 list of options that are so well explained that there's no
8 clarification. All they need to do is call our attention to
9 it.

10 DR. KRESS: All we need is to have the documents
11 ahead of time.

12 DR. POWERS: Dr. Shack will be able to formulate
13 his clear and insightful points of view that will
14 undoubtedly be endorsed by the rest of the Committee at the
15 expense of others.

16 [Laughter.]

17 CHAIRMAN APOSTOLAKIS: I am not that these
18 comments deserve to be in the transcript. Does anyone have
19 anything of substance to say?

20 [No response.]

21 CHAIRMAN APOSTOLAKIS: Thank you very much, both
22 the staff, and Mr. Christie. This was a very informative
23 meeting today. I hope the debate will not be repeated in
24 September.

25 DR. SHACK: We tried to head it off with the

1 e-mails, George, but --

2 DR. KRESS: It didn't work.

3 CHAIRMAN APOSTOLAKIS: So we are adjourned. Thank
4 you.

5 [Whereupon, at 5:07 p.m., the meeting was
6 adjourned.]

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REPORTER'S CERTIFICATE

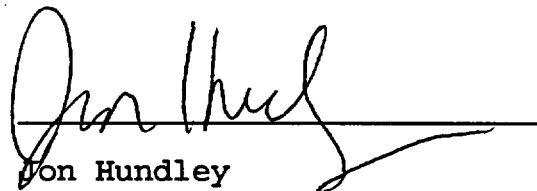
This is to certify that the attached proceedings
before the United States Nuclear Regulatory Commission in
the matter of:

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.

A handwritten signature in dark ink, appearing to read "Don Hundley", is written over a horizontal line.

Don 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 -

<u>TOPIC</u>	<u>PRESENTER</u>	<u>TIME</u>
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		1:05-2:45 pm
• Discussion of SECY-00-0086	ERIC HASKIN 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

**Performance Technology
P. O. Box 51663
Knoxville, TN 37950-1663
(865) 588-1444
FAX (865) 584-3043
performtech@compuserve.com**

Agenda

- A. Adequate Protection
- B. 1986 Policy Statement on Safety Goals
- C. June 15, 1990 Staff Requirements Memorandum
- D. Goal Allocation
- E. Summary

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.

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.

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

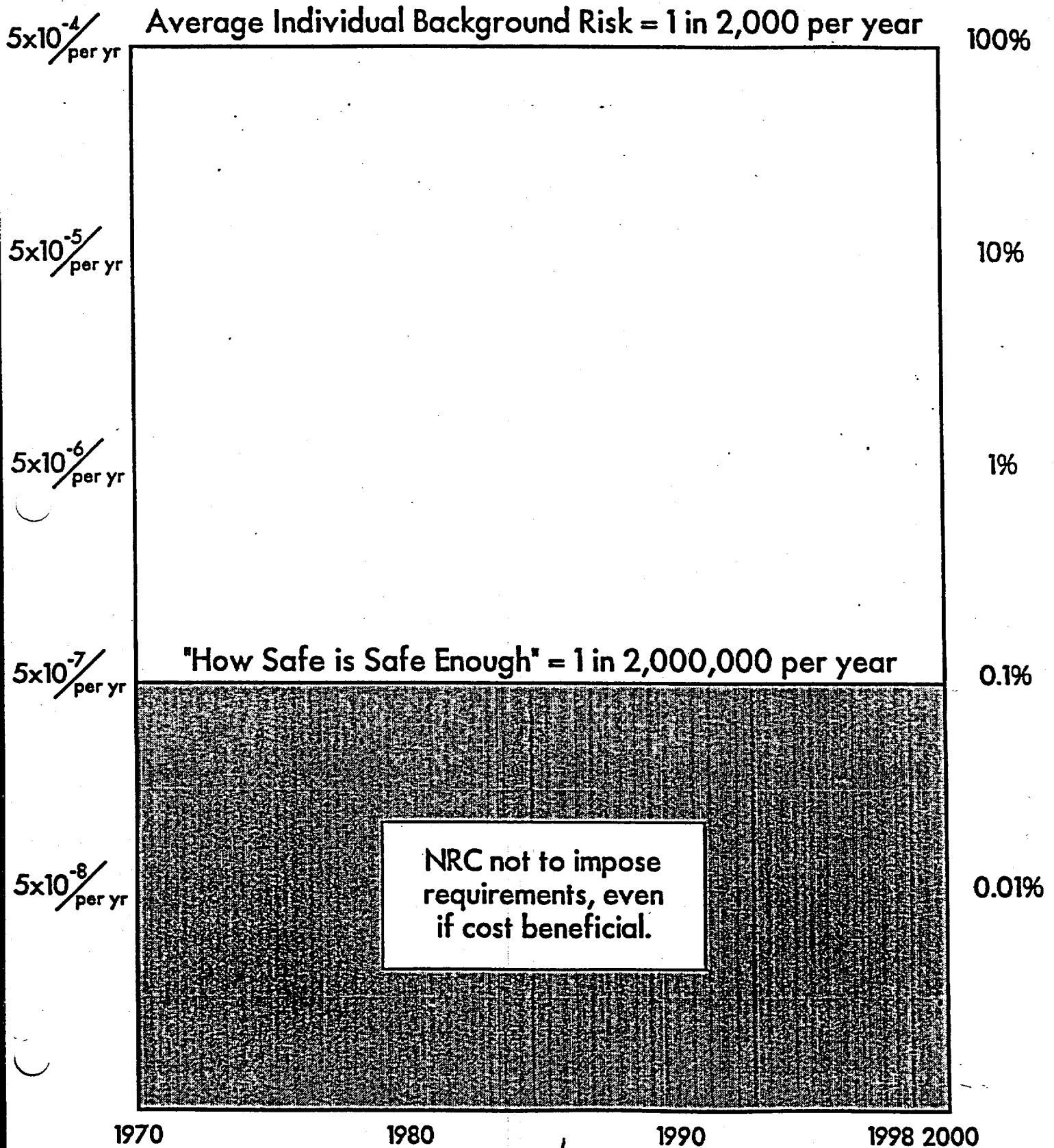
- 11) The Commission agrees that it must not depart from or be seen as obscuring the arguments made in court defending the Backfit Rule.

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)

5×10^{-4} / per yr

Average Individual Background Risk = 1 in 2,000 per year

100%

NRC imposes requirements
without regard to cost.

5×10^{-5} / per yr

10%

"Adequate Protection"

NRC imposes requirements
per 10CFR10.109, "backfit"

5×10^{-6} / per yr

\$2,000 per person rem conversion factor
based on \$3 million dollar value for health
detriment.

1%

5×10^{-7} / per yr

"How Safe is Safe Enough" = 1 in 2,000,000 per year

0.1%

5×10^{-8} / per yr

NRC not to impose
requirements, even
if cost beneficial.

0.01%

1970

1980

1990

1998 2000

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

3 Quantitative Objectives for the Framework

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.

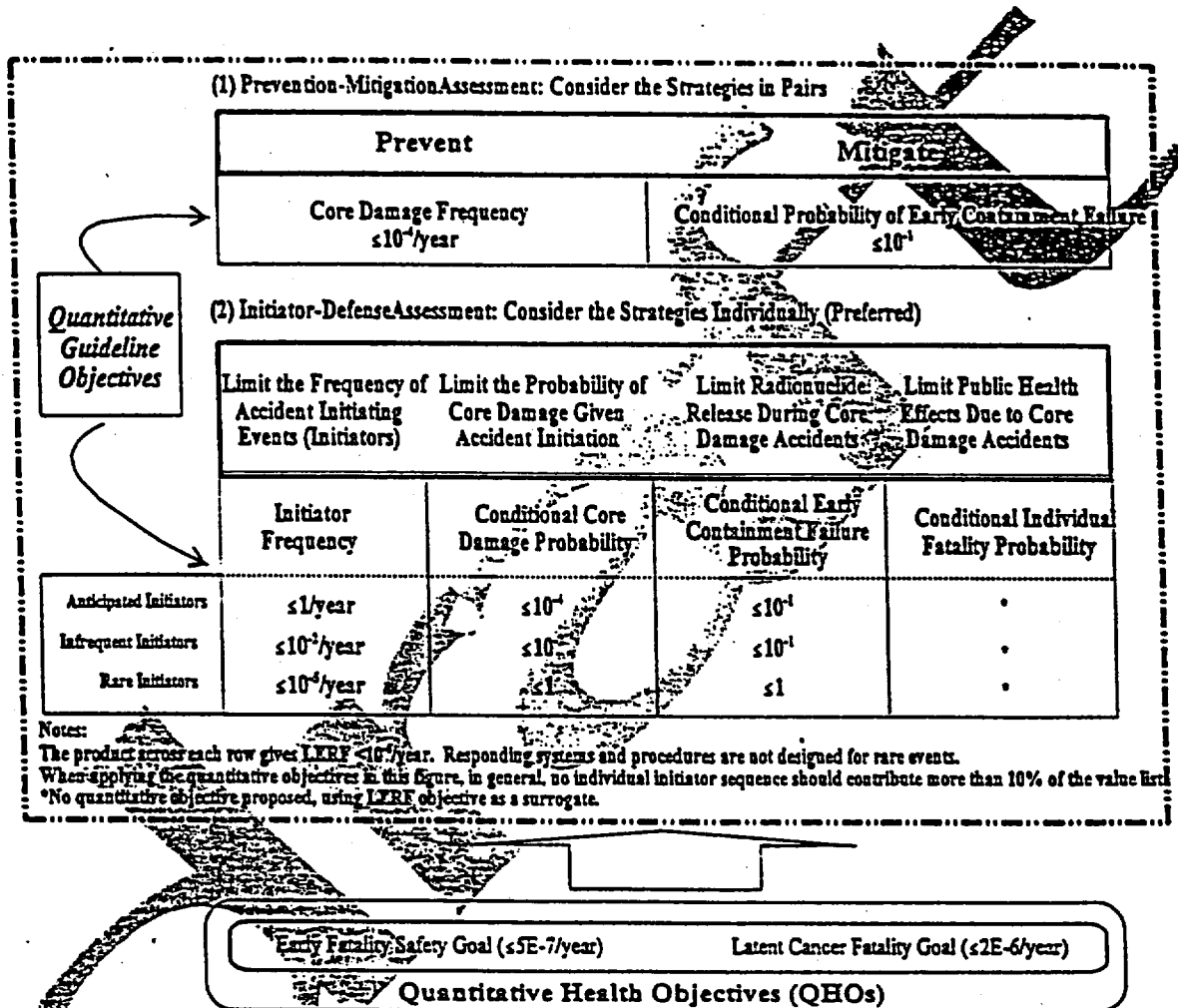


Figure 3-1. Quantitative Objectives for Risk-Informing Regulatory Requirements

(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 $10^{-4}/\text{year}$, and
- the probability of early containment failure (breach or bypass) given a core damage accident should be less than 0.1.

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 de facto 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....

...These partitioned objectives are not to be imposed as requirements themselves but may be useful as a basis for regulatory guidance.

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."

16/17

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 $< 1\text{E-4/yr}$
 - Conditional early containment failure probability < 0.1
 - Large early release frequency (LERF) $< 1\text{E-5/yr}$
(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 frequency (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?***