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NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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COMMITTEE ON REACTOR
SAFEGUARDS (ACRS)

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

MARCH 1, 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

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5 MEETING: 470TH ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

6
7 U.S. Nuclear Regulatory Commission
8 11545 Rockville Pike
9 Room T-2B3
10 White Flint Building 2
11 Rockville, Maryland
12 Wednesday, March 1, 2000

13 The committee met, pursuant to notice, at 1:00

14 p.m.

15 MEMBERS PRESENT:

16 DANA A. POWERS, ACRS Chairman
17 GEORGE APOSTOLAKIS, ACRS Vice-Chairman
18 THOMAS S. KRESS, ACRS Member
19 MARIO V. BONACA, ACRS Member
20 JOHN J. BARTON, ACRS Member
21 ROBERT E. UHRIG, ACRS Member
22 WILLIAM J. SHACK, ACRS Member
23 JOHN D. SIEBER, ACRS Member
24 ROBERT L. SEALE, ACRS Member
25 GRAHAM B. WALLIS, ACRS Member

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P R O C E E D I N G S

[1:00 p.m.]

CHAIRMAN POWERS: The meeting will now come to order.

The is the first day of the 470th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting the committee will consider the following. Development of Risk-Informed Revisions to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." The committee will look at proposed reports and discuss topics for the meeting with the NRC Commissioners on Thursday, March 2nd.

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

We have received no written statements from members of the public regarding today's session. We have received a request from Mr. Bob Christie of Performance Technology for time to make oral statements regarding the development of risk-informed revisions to 10 CFR Part 50.

A transcript of portions of the meeting is being kept and it is requested that speakers use one of the microphones, identify themselves, and speak with sufficient clarify and volume so that you can be readily heard.

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1 I am going to begin by drawing the members'
2 attention to the items of interest. You may want to pay
3 particular attention to the alert at Indian Point 2 and to
4 look at some of the civil penalties imposed in connection
5 with misidentification of plant status. Think of those in
6 terms of the performance indicators, which has a three
7 strikes and you're out clause, versus one strike you're out
8 clause.

9 Also, members may be interested in an article that
10 appeared in the Energy Daily on NRC Staff opinions
11 concerning the Reactor Oversight Program.

12 Are there any comments the members would like to
13 make before we enter into today's discussion?

14 [No response.]

15 CHAIRMAN POWERS: Well, in that regard, our first
16 topic for the meeting is a relatively simple subject. It is
17 development of risk-informed revisions to 10 CFR Part 50,
18 and George, you are going to give us a quick thumbnail tour
19 of this?

20 DR. APOSTOLAKIS: Yes. My problem is I don't see
21 the Staff here.

22 MR. MARKLEY: The Staff is not here.

23 DR. APOSTOLAKIS: Well, there is a problem with
24 the times, because here it says 1:20; this says 1:00.

25 CHAIRMAN POWERS: Okay. Well, while we are

1 waiting I will call the members' attention to the proposed
2 letters, and we have several -- I guess a total of seven,
3 seven letters that we are trying to do.

4 [Discussion off the record.]

5 CHAIRMAN POWERS: Are we in a position to go
6 ahead?

7 DR. APOSTOLAKIS: Mary, are we ready to start?

8 MS. DROUIN: Absolutely. Do I have a choice?

9 [Laughter.]

10 DR. APOSTOLAKIS: Always, ask Mark. Is Mr. King
11 coming as well?

12 MS. DROUIN: He will be late.

13 [Discussion off the record.]

14 DR. APOSTOLAKIS: Okay, this session comes back
15 to, as the Chairman said, an easy subject, so it should be a
16 breeze. Risk-informing 10 CFR Part 50, Domestic Licensing
17 of Production and Utilization Facilities.

18 Today's session will be only a briefing session.
19 I understand there is no request for a letter or anything.

20 And you can focus this a little bit. And the
21 discussion will also be focused, in addition to the
22 projector, on Option 3, I understand, correct?

23 MR. CUNNINGHAM: Yes.

24 DR. APOSTOLAKIS: And you held the workshop last
25 week with stakeholders. You plan to brief us on that one, I

1 hope. So without further ado, the floor is yours.

2 Introduce everyone at the table, first, please.

3 MS. DROUIN: Yes. I'm Mary Drovin with the Office
4 of Research. To my left is ...

5 MR. KURITZKY: Alan Kuritzky.

6 MR. CUNNINGHAM: Mark Cunningham from the Office
7 of Research.

8 CHAIRMAN POWERS: Do we know you, sir?

9 MR. CUNNINGHAM: We've met somewhere in the past,
10 vaguely, I believe, yes.

11 MS. DROUIN: As was mentioned, we are just here to
12 give a briefing of the status of where we are on Option 3 on
13 risk-informing the technical requirements of Part 50. We
14 aren't at this time requesting a letter from the ACRS on
15 this. It's just a briefing to let you know where we are.

16 DR. APOSTOLAKIS: You will tell us when you will
17 request a letter, what your plan is for future activities?

18 MS. DROUIN: Yes, we're going to go through future
19 activities.

20 DR. APOSTOLAKIS: Okay.

21 MR. CUNNINGHAM: The short answer is, probably
22 this Fall sometime.

23 DR. APOSTOLAKIS: Okay. So I can start writing
24 it.

25 MS. DROUIN: As you mentioned, we did have a

1 workshop last week. We're going to talk about what we felt
2 or what we thought we heard was the feedback from the
3 various stakeholders at the workshop.

4 We will also talk about the scope, the approach,
5 and what progress we have made to date over the last four
6 months, and where we plan to go, particularly over the next
7 three months, because we have identified a new milestone for
8 the June timeframe; and then where we plan to be by the end
9 of December.

10 So are our future plans, but our future plans in
11 terms of this calendar year.

12 Just briefly, as you know SECY 99-264 was issued
13 last Fall. That went through what our plan was for
14 risk-informing the technical requirements. It had a
15 schedule in there of what our major milestones were, and
16 this is what went forward to the Commission.

17 And we received an SRM this past February that
18 gave us approval to move forward with our plan, and also if
19 there was something we could identify in an expedited
20 manner, to also do that. And we were, of course, encouraged
21 to maintain communication with and input from stakeholders.

22 We're doing that through various mechanisms. One
23 of them is through workshops. We had a second workshop
24 which was last week. We had our first workshop back in
25 September, and we have also implemented a website which is

1 up and running.

2 If you want to access the website, you go to the
3 NRC website and click on nuclear reactors, and there will be
4 a line there that says risk-informed Part 50, Option 3. You
5 can click on that.

6 As we create things that we feel are ready to
7 start sharing with the public, we have been putting in on,
8 and a lot of what you see today has already been put on that
9 website and has been on there for about a month.

10 In looking at risk-informing Part 50, the
11 technical requirements, when we talk about risk-informing
12 it, there are three approaches or -- I'm not sure what the
13 correct word is here to use -- but we aren't talking about
14 just revising, necessarily.

15 We certainly are talking about revising where
16 that's appropriate. But it also might be considering adding
17 new requirements or expanding where we think is necessary,
18 and also deleting unnecessary requirements.

19 So there are three aspects to it when we talk
20 about revising. And the change might also entail a deletion
21 or addition, depending on what is the most appropriate as we
22 look at the risk significance of the different requirements.

23 We aren't covering fire protection. There are
24 already a lot of efforts going into that, and also out of
25 the scope is emergency planning.

1 CHAIRMAN POWERS: Could you explain that to me?
2 You say there's a lot of effort going on in fire protection.
3 It's proving to be a fairly significant potential initiator
4 accidents, and certainly not negligible, certainly not
5 outside of the cut sets of the kinds of things that you are
6 worried about.

7 There has been in an interest in the past in some
8 quarters on risk-informing Appendix R, and a candidate
9 Appendix S was actually generated by some people. I don't
10 know that it is consistent with the kind of risk information
11 that you're talking about here, but it certainly was a cut
12 in that direction.

13 Why wouldn't you address fire protection?

14 MR. CUNNINGHAM: I think that the basic thing was
15 that there were parallel activities already underway in NRR
16 to risk-inform the fire protection requirements, so in a
17 sense, they were one step ahead of us in this. They had
18 already made the decision to start down that road and try to
19 modify the fire protection requirements.

20 So there wasn't a need for us to do it. It's not
21 that it's not important; it's just that they were already
22 working on it.

23 MR. KURITZKY: I think also that the contribution
24 to risk from fire sequences is being included in our
25 evaluation. We're looking at full-scope PRAs.

1 We're looking at shutdown also, and --

2 CHAIRMAN POWERS: When you say a full-scope PRA,
3 what does that mean?

4 MR. KURITZKY: We're looking at internal and
5 external events. We're looking at full-power operation and
6 low power and shutdown states also. I mean, ideally, we
7 want to address the entire PRA model.

8 CHAIRMAN POWERS: So you have a model for all of
9 these things?

10 MR. KURITZKY: Well, what we're doing is, when we
11 make our risk-informed decisions, what we're going to do is
12 look for the basis for what we're going to make our
13 decision. It should hopefully not rely just on information
14 on, for instance, internal events PRAs for Level I.

15 Obviously, that's where we have the most
16 information, and so that's going to be a major driving
17 forces, but where available, we would also like to bring in
18 insights from other modes of operation, and also other,
19 external events.

20 CHAIRMAN POWERS: I guess I'm perplexed. That
21 happens a lot. It seems to me that Mr. Cunningham here was
22 in a group that came to us and made us a very clear
23 presentation at one time that said when you're making
24 risk-informed decisions on ranking pieces of equipment and
25 things like, that you ran into a problem.

1 If there was a problem disparity in the level of
2 conservatism in your PRA, that is, if you were realistic in
3 one quarter and then you put in a bunch of conservative
4 bounding things, that the kinds of predictions you got out
5 of it that were useful for ranking were probably not
6 reliable; they were questionable.

7 And now you're telling me I'm going to do a
8 full-scope PRA, but there are some things that are stronger
9 and some things that are weaker, which I assume must be
10 similar to some things are treated realistically and some
11 things are treated very conservatively.

12 And that goes into your decisionmaking process.
13 Don't you run into the same kind of dubious input to the
14 decision when -- in what Mr. Cunningham spoke of earlier?

15 MR. KURITZKY: Yes, I would say that you obviously
16 are going to come into those types of situations where we
17 have inconsistency in the level of information.

18 But what we're doing is, unlike maybe a ranking --
19 and I wasn't there during that discussion -- in a ranking
20 where you want to have everything on the same level playing
21 field.

22 Here we're taking insights into the information.
23 If we have more confidence in a certain type of information
24 that we have available to us, we'll place more emphasis on
25 it.

1 But that doesn't mean we're going to ignore other
2 areas of information, just because we don't have as much
3 confidence in them.

4 We may tailor the impact that has on our
5 decisionmaking, based our confidence in that information,
6 but it doesn't mean that we would want to exclude that.

7 CHAIRMAN POWERS: After you're done with these
8 decisionmaking processes, is there going to be a document
9 that I can read that says, okay, we had this information and
10 we had confidence level 10 on it, and we had this
11 information over here and we had confidence level .2 on
12 this, and therefore the weighting factors were roughly the
13 reciprocals of those or something like that?

14 MR. KURITZKY: To my knowledge, we're not
15 attempting to quantify that type of information.

16 CHAIRMAN POWERS: So it would be impossible for
17 anyone to replicate your decisionmaking?

18 MR. KURITZKY: Well, we hopefully supplied the
19 basis, and maybe in qualitative form. The process you're
20 discussing would be some type of actual quantifying, ranking
21 the importance of different types of input information.

22 What I'm speaking of is just in a qualitative
23 sense.

24 MR. CUNNINGHAM: As you may recall, we talked a
25 number of times about the whole issue of expert panels being

1 used by decisionmakers, mostly in the context of licensee
2 expert panels.

3 One of the things -- if I can go back to Reg Guide
4 1.174 space, I think we tried to say that there needs to be
5 some sort of documentation of that expert panel to the point
6 you can get some sense of how they made certain decisions.

7 Again, it's not going to be quantitative, I
8 suspect, but we had a goal that you could, if not replicate,
9 at least try to get an understanding of why certain
10 decisions were made.

11 CHAIRMAN POWERS: Here's what I'm interested in:
12 Suppose that I'm a member of the public, and I look around
13 and, for instance, you say, gee, you can not worry too much
14 about fire barrier penetration seals. Now, I understand
15 you're not going to treat fire, but let me use that example,
16 because it's particularly germane to the point I want to
17 make.

18 And I know from my own experience that fire
19 barrier penetration seals sound like pretty important
20 things. They keep fire from spreading.

21 And these guys are saying that they're of low risk
22 significance, and I need to understand more about this
23 because it's contrainuitive. I think you can't preclude
24 getting contrainuitive results coming out of risk
25 assessments because that's been the great attraction; that

1 they're better than our intuition.

2 Am I going to be able to go back and say, yes, now
3 I -- verily, I know my intuition about fire barrier
4 penetration seals was wrong, and I agree with them, that,
5 verily, they can go to low-risk significance? I don't know
6 that they are, but it's just an example.

7 MR. CUNNINGHAM: I guess that, again, in the
8 context of licensees making decisions like that, presumably
9 they ought to be developing that documentation.

10 I think that what Alan was talking about earlier
11 was how -- and what we started off on here was if we go in
12 and decide that a certain regulation does or doesn't merit
13 change, how do we make the decision process a little more
14 transparent than it might otherwise be, and how do we decide
15 how we consider shutdown risk and that sort of thing?

16 That's a fair question. I don't think we've
17 thought much about how we would lay out all those decisions
18 and document those decisions.

19 But I think it's an important element of making a
20 convincing case.

21 DR. SEALE: I have a question. Maybe you guys
22 have hidden some pretty significant commitments in this
23 slide. In particular, there is the recognition that you may
24 be adding new requirements, and you may be deleting old
25 requirements.

1 Now, I personally concur with the point that it
2 makes no sense to go through such an enormous effort like
3 this clearly is, without exerting some hindsight-driven
4 quality control on the relevance of some of the things that
5 are in Part 50.

6 Yet the other side of that is that you -- those
7 processes of making those kinds of changes are, in my
8 understanding, fairly formal and fairly detailed.
9 Essentially, you're rulemaking.

10 MS. DROUIN: Okay, we're going to get into some of
11 that later.

12 DR. SEALE: You're going to tell us how much of
13 that you've bitten off in going into this; is that right?

14 MS. DROUIN: We're going to have a whole
15 discussion here on implementation issues.

16 DR. SEALE: Okay, fine.

17 MS. DROUIN: Which will address that.

18 DR. APOSTOLAKIS: I have another question: We
19 have seen Mary and Mark many times. Alan, you're new here.

20 The standard question is, what qualifies you to
21 sit over there?

22 MR. KURITZKY: Because Mary told me to come here.

23 [Laughter.]

24 DR. APOSTOLAKIS: That's not a qualification;
25 that's why you came. So can you give us a little bit of

1 your background?

2 MR. KURITZKY: Yes. I started in the PRA field
3 out of college in 1981. And I have worked --

4 DR. APOSTOLAKIS: '81?

5 MR. KURITZKY: '81. I worked on a lot of PRA,
6 both in this country and overseas. And I have worked for a
7 number of contracting companies. I worked as a contractor
8 at Northeast Utilities, Mr. Banaca. And I have -- I worked
9 for two years at the NRC, many, many years ago, and I have
10 since come back in November. And since I've come back, I've
11 been involved in this risk-informing technical requirements
12 for Part 50 as the Project Manager.

13 DR. APOSTOLAKIS: Good. Thank you.

14 MR. CUNNINGHAM: In his early days at NRC, many
15 years ago, he was involved in providing -- helping develop
16 the technical basis for the station blackout rule. So lest
17 he be overly modest there --

18 DR. APOSTOLAKIS: Which college did you attend?

19 MR. KURITZKY: Maryland, University of Maryland.

20 DR. APOSTOLAKIS: Thank you very much. Let's go
21 on.

22 MS. DROUIN: Okay.

23 DR. APOSTOLAKIS: You're going very slowly, Mary.
24 You're still --

25 MS. DROUIN: Yes. I will try to make up for that.

1 Probably the two points I want to make on this slide before
2 we move on, is that we aren't just looking at the
3 regulations themselves, but we are looking at the
4 implementing documents that are associated with these
5 regulations.

6 So we would be looking at the Regulatory Guides,
7 the Standard Review Plans, but also looking at how the
8 regulations interact with each other. So we're going to be
9 talking more on 50.44, but whatever regulation we may be
10 looking at, we not only look down, but we also look across
11 to see how it interfaces, interrelates with other
12 regulations.

13 The last point is that we do intend to keep the
14 design basis concept. We might have a new set of design
15 bases, but to maintain a design basis concept. Now, I'm
16 trying to move on to the next one.

17 CHAIRMAN POWERS: It perplexes me. Please go
18 ahead, because it will come up on the next one as well, I
19 think. I mean, it just strikes me as surprising to hear
20 someone so clearly identified with probabilistic risk
21 assessment methodologies, speak at all with complimentary
22 words about design basis concepts.

23 And it seems to me that the two have an
24 orthogonality to them. Can you tell me why you're
25 preserving the design basis concept? I mean, it doesn't

1 show up. 1.174 says preserve the defense-in-depth, but it
2 doesn't seem to mention anything about preserve the design
3 basis concept. Why are you doing that?

4 DR. SEALE: It's a robust subset.

5 MS. DROUIN: I don't even know where to begin.

6 CHAIRMAN POWERS: Well, begin by telling me why
7 it's a useful concept. Because haven't -- isn't the whole
8 point of the risk informed approach to take a holistic view
9 of the vulnerabilities of a plant, rather than focusing on
10 one hypothesized accident or a set of hypothesized
11 accidents?

12 MS. DROUIN: But I do think that it is
13 fundamentally a good design concept to design something
14 against something. I think you want those to be where you
15 think your most likely accidents are going to occur.

16 CHAIRMAN POWERS: Why can't I design against a
17 risk metric? I can design against a hurricane and what I do
18 is I go out and figure out what is the biggest hurricane
19 that I can have and high velocity winds and I say, okay,
20 that is what makes the difference.

21 Why can't I equally say, gee, I want the risk to
22 be 10 to the minus third or less. I mean that seems like a
23 good design to objective.

24 MS. DROUIN: I think you are now moving more into
25 a design -- a risk-based more than a risk-informed concept

1 here, when you start bringing in that kind of idea.

2 CHAIRMAN POWERS: Okay, so you just didn't want to
3 be accused of being risk-based. You wanted to have some
4 defense that said I am only risk-informed so I will keep the
5 design basis concept?

6 MS. DROUIN: No.

7 [Laughter.]

8 CHAIRMAN POWERS: Okay. Can you un-perplex me?

9 MS. DROUIN: I am going to let Mark un-perplex you
10 because I don't think I am going to be successful.

11 MR. CUNNINGHAM: I guess a couple of points. One
12 is if we back up a little bit, you recall that our
13 implementation of the modifications to the technical
14 requirements of Part 50 is intended will likely end up in
15 many cases being a voluntary initiative, so one of the
16 reasons for not walking away from the design basis accident
17 type of concept is that the more you walk away from that to
18 go to a more, if you will, risk-based argument, the more you
19 will see a differentiation or separation between the plants
20 that choose not to be risk-informing and the plants that
21 are, and that may complicate this whole process even more
22 than it already is.

23 CHAIRMAN POWERS: I would have thought the
24 argument would go the other way. I mean a proponent of
25 abandoning the concept would say yes, let's make a clear

1 differentiation and not get a confusion by retaining this
2 anachronistic concept of the design basis accident in these
3 plants that are risk-informed.

4 DR. APOSTOLAKIS: What exactly does it mean to
5 retain the design basis concept?

6 MR. CUNNINGHAM: What we are talking about again
7 is that there are a set of design basis accidents on the
8 books and then there is what has become a stylized
9 implementation of those design basis accidents. I think at
10 the conceptual level those provide some sort of measure of a
11 way of implementing the concepts of defense-in-depth and
12 margins and that sort of thing.

13 Where people have had problems with them, one of
14 the reasons people have problems with them is that the
15 probabilities of some of the accidents are extremely low and
16 they are stylized to the point that they convolute the
17 single failure criterion into many, many different systems
18 and things like that and it becomes a very artificial and
19 improbable circumstance, so the idea of retaining the
20 concept is you might be able to back off on this particular
21 types of -- detail types of accident that you consider, but
22 you want to still have some sort of a concept where you are
23 having defenses against a broad spectrum of accidents,
24 different types of initiators, if you will, and retaining
25 margins and defense-in-depth and that sort of thing, but

1 again perhaps developing a new set of accidents that might
2 have more sense in the context of what we understand about
3 risk.

4 DR. APOSTOLAKIS: New sets in the sense that we
5 have new initiators or a new way of doing this stylized
6 analysis?

7 MR. CUNNINGHAM: It could be -- I was thinking of
8 new initiators perhaps.

9 DR. APOSTOLAKIS: New initiators?

10 MR. CUNNINGHAM: Well --

11 DR. APOSTOLAKIS: My first reaction to that would
12 be what's wrong with the current initiators? I mean you
13 still have to worry about the various LOCAs.

14 MR. CUNNINGHAM: Yes.

15 DR. APOSTOLAKIS: We have to worry about
16 reactivity insertion, don't you?

17 MR. CUNNINGHAM: Maybe we are just at semantics
18 here.

19 DR. APOSTOLAKIS: You may want to add or subtract
20 or something a group --

21 MR. CUNNINGHAM: Yes.

22 DR. APOSTOLAKIS: -- but it seems to me though the
23 place where you can really make a difference is this
24 stylized emphasis.

25 MR. CUNNINGHAM: I guess that is what I meant --

1 DR. APOSTOLAKIS: Okay.

2 MR. CUNNINGHAM: -- when I said you can have a
3 large LOCA as initiator but compounded with that over years
4 has become that you have to have this type of failure and
5 this type of failure and loss of offsite power and that set
6 of things put together creates an accident sequence, if you
7 will, of extremely low probability or frequency. You may be
8 able to redesign -- you may be able to keep the large LOCA
9 but better design the requirements for the mitigating
10 systems and things like that to be more balanced based on
11 our knowledge of PRA.

12 CHAIRMAN POWERS: Isn't it just -- I mean you
13 don't end up in the same position -- you come back and say,
14 okay, I am going to keep this large LOCA concept and most of
15 the plants say, well, gee, our big pipes just don't break,
16 but okay, he wants to analyze big pipes, and to be realistic
17 he says do this and this, but my plant doesn't have that.
18 My plant is different from the one that they had in mind
19 when they did this. Now what do I do? Whereas if you gave
20 me a risk criterion, then I could pick any accident I wanted
21 to.

22 MS. DROUIN: Well, I don't think you necessarily
23 end up at the same place, because if you look at the large
24 break LOCA, what we are talking about is maybe when you talk
25 about a large break LOCA you are not talking a large

1 double-ended guillotine type break LOCA. It is a different
2 type LOCA. Now which it is I am not prepared to say at this
3 point, but it is not this extreme case.

4 CHAIRMAN POWERS: Whatever you write down about
5 this, this new design concept, as soon as you write it down,
6 some plant somewhere is going to say, ah, but my plant is
7 different. Now you are back into -- I mean you have got to
8 do something about this guy because he says my plant is not
9 only different, it is better than the one you had in mind
10 and this stuff is not applicable to me.

11 Well, why don't you want a regulation that applies
12 to anybody? The nice thing about a risk criterion is that
13 it applies to anybody. Even if I come in with an LMFBR and
14 natural enrichment fuel with heavy water as the secondary
15 working fluid, I don't know why you would, but if you did,
16 it would be just as easy for you.

17 MR. CUNNINGHAM: You know, perhaps the classic
18 example -- when we talked about having a criteria, a core
19 damage frequency criteria and/or a risk criterion is the
20 example that is always brought up is that there was a
21 proposal at one time to have HDGRs, modular HDGRs -- I
22 believe this was a DOE proposal -- that the reactor vessel,
23 the concrete reactor vessel would act as the containment.
24 They wanted to know whether that could be licensed by NRC
25 standards and because of defense-in-depth arguments and

1 things like that we basically said no, you have got to have
2 a containment. I don't care what the probability of
3 frequency of core damage is, you are going to have a
4 containment.

5 That is probably some of the underlying thought
6 that went into if we want to keep this design basis concept.

7 DR. APOSTOLAKIS: You may get a license
8 application, say five years down the line, of the new South
9 African design, the pebble bed reactor --

10 MR. CUNNINGHAM: Yes.

11 CHAIRMAN POWERS: They claim that there is no need
12 for a containment, so the question then for the Agency will
13 be do we really demand it no matter what or do we look at
14 what they have done and do the regulations that allow us to
15 do something else?

16 But I think the concept of design basis accidents
17 is really an important one, so I don't know why you decided
18 to say that you retained the concept, although concept of
19 course can be many things.

20 Mary's point earlier that you really need to give
21 something to the designers to design against, which goes
22 beyond I guess what you meant, it goes beyond what Dr.
23 Powers said, just 10 to the minus 4 core damage frequency,
24 for example, or some allocation to the accident sequences,
25 that is not something we should abandon easily.

1 MR. CUNNINGHAM: Yes.

2 DR. APOSTOLAKIS: But how far we go I don't know.
3 Mario?

4 DR. BONACA: I still believe that somehow you have
5 to at some point design equipment -- pumps, valves and so on
6 and so forth. Now I do believe that if you look at, if you
7 use risk informed concepts you are going to find that what
8 you are going to design this equipment to is to a different
9 kind of targets, objectives, because you are not going to
10 have double-ended guillotine break as the one defining the
11 size of your HPSIs and LPSIs. Most likely you are going to
12 have a more probable range of conditions you are going to
13 address, but you know I would expect that I can live with
14 the concept of design basis. It may shift as a basis and it
15 may include probabilistic targets which you are talking
16 about, but still you would have to have some basis to design
17 your equipment.

18 CHAIRMAN POWERS: Regulators do not tell people
19 how to design things in detail, and so maybe a designer does
20 say okay, I have this risk criterion that I have to meet,
21 but because I want to get on with the design and things like
22 that I will conceive of some accidents that are possible at
23 my facility and I will design against them and then I will
24 get my PRA analysts and they will tell me if I meet the
25 criterion or not, but in the meantime I can do some fairly

1 traditional things against those.

2 I mean I am not taking those away from the
3 designer --

4 DR. BONACA: I understand now, because I didn't
5 understand before, so what you are saying is rather than
6 regulating the set of events that the designer is using to
7 demonstrate that certain targets are met you simply impose
8 certain targets. Oh, absolutely. That is a different
9 concept, yes.

10 DR. APOSTOLAKIS: But we have said many times that
11 this is not the only thing the Agency cares about. We may
12 not be designers but we do care about many more things than
13 just the core damage frequency.

14 CHAIRMAN POWERS: Yes, but is going to a design
15 basis concept the way to get to that? These other things
16 that we consider, that are concerned about besides core
17 damage frequency, is the appropriate way to get to them via
18 the design basis concept. I think that is a very
19 convoluted --

20 DR. KRESS: Yes, I think you are right, Dana. I
21 would define regulatory objectives, those other things, and
22 make those as part of the criteria that have to be met, but
23 they certainly wouldn't be specified because they are hard
24 to meet by design basis accidents.

25 DR. BONACA: But you would want to make sure that

1 the licensee, for example, considers a set of events that is
2 broad enough.

3 DR. KRESS: Well, that is the PRA. That is the
4 PRA.

5 DR. APOSTOLAKIS: That's the defense-in-depth
6 issues that come up and so on.

7 DR. BONACA: With PRA again, yes --

8 DR. APOSTOLAKIS: I guess what we are telling them
9 is that instead of saying we retained the design basis
10 concept, which really is a concept of bottom-up, we are
11 telling them to go top-down.

12 CHAIRMAN POWERS: Well, I think I would just like
13 to see a little more persuasive case. What I am afraid of
14 is exactly what we have seen, that they have chosen to
15 retain the design basis to meet objectives that are not
16 articulated, and if they have, it may well be that that is
17 the way to do them, but I would like to see what the
18 objectives are and why this is the preferred way to handle
19 it, because I see a lot of downside to retaining the
20 concepts of design basis.

21 The idea that you can use risk metrics as design
22 to targets I think is open to question. I know that
23 certainly the people at Oak Ridge have successfully done
24 that and are very enthusiastic about using risk metrics as
25 design targets.

1 My own experience has been less successful in
2 doing that, so it is open to debate.

3 DR. APOSTOLAKIS: I think you will gain some
4 insights into the weaknesses of this process of design basis
5 if you look back the last 20 years and see what PRAs have
6 found that have made the Agency or forced the Agency to
7 actually issue new rules, for example, and ask yourself why
8 did we have to do this, why didn't the original design basis
9 accident envelope protect us from this. Why did we need an
10 ATWS rule? Why did we need the station blackout rule?

11 In my mind these are failures of the design basis
12 accident concept because we came back afterwards doing a
13 different analysis and we said, gee, we better do something
14 about this. If our original envelope was good enough, we
15 wouldn't have had to do that, so maybe you will gain some
16 insights there as to whether the concept deserves to be
17 retained or modified or abandoned.

18 MS. DROUIN: I think there is a misunderstanding
19 here. Maybe when we get into the framework it will clarify
20 it more, because when we say we are going to retain the
21 design basis concept that doesn't mean in the implementation
22 of risk informing the requirements that we come from a
23 starting point or a perspective of here is the DBA and we
24 move forward. In fact, that is not how we are looking at
25 risk informing the requirements, so I think this is a little

1 bit misleading here.

2 I think if we move on and we get into the
3 framework I think some of your concerns will be alleviated.

4 DR. APOSTOLAKIS: So maybe the word "retain"
5 should be replaced?

6 MS. DROUIN: I am not sure what we should replace
7 it with, but perhaps it should be replaced with another
8 word.

9 DR. APOSTOLAKIS: "Revisit" the concept.

10 MS. DROUIN: We will take that under advisement.

11 DR. APOSTOLAKIS: Oh, I didn't expect you to agree
12 right here.

13 MS. DROUIN: I'll try and go through the next
14 couple of slides very quickly. They are just background.

15 When you looked at SECY 264, it talks about that
16 the plan has a two-phased approach. Phase 1 deals with this
17 year, whereas, come December, we plan to make
18 recommendations to the Commission for approval on proposed
19 changes to Part 50.

20 And then in Phase 2, we would be performing the
21 regulatory analysis on those recommendations that have been
22 approved by the Commission, and move forward into
23 rulemaking.

24 DR. WALLIS: How do you approve without doing this
25 technical basis first? Don't you have to make arguments for

1 decisions?

2 MS. DROUIN: We will be doing some analysis in
3 terms of the feasibility of it, but the detailed regulatory
4 analysis would be done after the Commission approval. So
5 there is some analysis done up front, just to show the
6 feasibility.

7 In looking at Phase 1, just where we are right
8 now, this is what we're doing to talk about today. There
9 have been three main things that have been done? I
10 apologize, but ignore that last bullet, because we haven't
11 made really any advancements on that fourth bullet.

12 But we're going to talk about the framework for
13 risk-informing the regulations. And this really is probably
14 the most important thing. We put a lot of thinking into the
15 process because it sets the foundation of how we plan on
16 moving forward on any regulation that we undertake.

17 And we want to really get -- to try and give you a
18 good understanding of what we mean by this framework.

19 CHAIRMAN POWERS: I'm going to apologize for my
20 own ignorance or poor memory, but 50.44 is the hydrogen?

21 MS. DROUIN: The hydrogen.

22 CHAIRMAN POWERS: Okay, my memory isn't as bad. I
23 just don't remember them by numbers.

24 MS. DROUIN: Later on, I start using words instead
25 of numbers to try to help out.

1 CHAIRMAN POWERS: Good. I want you to be
2 quantitative, but not in all things.

3 MS. DROUIN: Yes. Also, we're going to talk about
4 the selection of the candidate regulations and the DBAs, and
5 we also talked about in SECY 264 that we wanted to do a
6 trial implementation, and the regulation that was selected
7 for trial implementation was 50.44, which is the hydrogen
8 rule, the gas control.

9 DR. WALLIS: Can you say what you mean by a
10 framework? I looked through the documents you sent us, and
11 I wasn't sure I saw a framework.

12 MS. DROUIN: Well, that's what I'm going to get
13 into next.

14 DR. WALLIS: Is that something else?

15 MS. DROUIN: That's what I'm going to talk about
16 next. That is the framework.

17 We thought that how we approach these regulations,
18 how we implement, you know, risk insights, that we needed a
19 framework or a structure under which that we would be
20 proceeding forward.

21 And that's what we have tried to put together and
22 what we're going to try to walk you through and explain what
23 we mean by this framework.

24 So, starting off, in the development of it, there
25 were certain approach concepts. I'm not sure what is the

1 right word, that we wanted to inherently build into the
2 framework.

3 And so we wanted to identify a goal. We wanted to
4 identify an approach, strategies.

5 CHAIRMAN POWERS: Let me ask you this question,
6 Mary: How quibbling are people going to be over this? You
7 say maintain the goal of protecting public health and
8 safety.

9 If I were a quibbling sort -- and you know I'm not
10 -- I would say, gee, I didn't think that was the objective
11 at all. I thought the objective was to provide adequate
12 protection to the public health and safety.

13 Protect the public health and safety could be
14 interpreted by quarrelsome people as being an absolute
15 that's probably unattainable.

16 MS. DROUIN: At one version of the slide we had
17 adequate protection, but we're getting into a legal ground
18 now, and I was told that I couldn't use those words.

19 MR. CUNNINGHAM: Obviously there is a shorthand
20 here of we want to provide reasonable assurance of the
21 adequate protection.

22 CHAIRMAN POWERS: I'm just concerned on
23 perceptions and the fact that words actually count at this
24 stage of formulating a regulatory process.

25 And we need to be careful because --

1 DR. APOSTOLAKIS: Actually this is very important.
2 Late on, I understand you're talking about goals. And goals
3 are not the same as adequate protection.

4 So, I mean, I peaked.

5 MS. DROUIN: You peaked, you snuck ahead.

6 DR. APOSTOLAKIS: And also we had a presentation,
7 I believe, on the slide --

8 MS. DROUIN: Right, you've seen some of these
9 slides before.

10 DR. APOSTOLAKIS: And those were goals. So I
11 don't think the word, adequate protection, is really your
12 goal. You want to achieve a certain goal of public
13 protection that the Commission has said are the safety
14 goals.

15 But you're not dealing with adequate protection in
16 this analysis. Is that correct?

17 Because we don't have anything quantitative
18 defining or contributing to the definition of adequate
19 protection.

20 MR. CUNNINGHAM: That might be better to come back
21 to when we get to the figure.

22 DR. APOSTOLAKIS: I think the word, goal, belongs
23 there. And you have to modify the rest to say -- or maybe
24 meet the goals of the Commission.

25 CHAIRMAN POWERS: When you look at the Atomic

1 Energy Act, it has implicit in it, a requirement to -- or at
2 least various articulated incarnations that the Commission
3 has interpreted as having a requirement that they define
4 what they mean by adequate protection.

5 Are you going to create a risk-informed
6 definition?

7 MS. DROUIN: No. In looking at the development,
8 starting at the high level, as I was saying, we want to
9 maintain the goal of protecting the public health and
10 safety, and then underneath that, to develop an approach
11 that builds upon the defense-in-depth concept or philosophy
12 or principle. I'm trying to remember all the different
13 words that are used.

14 DR. APOSTOLAKIS: Philosophy and principle are
15 different things.

16 CHAIRMAN POWERS: Don't try to mix them up.

17 MR. CUNNINGHAM: We have a principle to maintain
18 the defense-in-depth philosophy.

19 DR. WALLIS: My impression is that you invoke
20 defense-in-depth but not in a meaningful way. So let's see
21 if you actually do something else.

22 MS. DROUIN: We're going to get --

23 DR. WALLIS: I think if you could abolish the
24 words, defense-in-depth entirely, it wouldn't change
25 anything in your framework.

1 MR. BARTON: Yes, it would

2 MS. DROUIN: I would disagree. We build upon -- I
3 mean, I feel very strongly that we do build upon the concept
4 of defense-in-depth in what we're trying to do, and are
5 developing strategies that would implement that.

6 DR. WALLIS: Show me why it helped you make a
7 decision between A and B. They had more defense-in-depth or
8 something.

9 MR. KURITZKY: Show him an example in 50.44 ice
10 condensers, for example.

11 MR. SIEBER: Well, it seems like you're trying to
12 maintain the concept of defense-in-depth while applying this
13 kind of a regulatory framework, the risk-informed regulatory
14 framework. So you aren't really building on it, it's there,
15 built into the regulations already.

16 You just don't want to lose it.

17 DR. APOSTOLAKIS: And there is the practical
18 limitation that you already have a body of regulations.

19 MR. SIEBER: That's right.

20 DR. APOSTOLAKIS: They're not static. You're not
21 starting with a blank piece of paper, right?

22 MR. CUNNINGHAM: That's correct.

23 DR. APOSTOLAKIS: Is that the idea you are
24 conveying here, that you have certain natural constraints,
25 and that you're not going to start writing new regulations

1 that perhaps differ too much from what we have now; is that
2 right?

3 MR. CUNNINGHAM: Yes, I think that's correct.

4 MS. DROUIN: That is true, and what we're trying
5 to say is that, you now, whatever options we propose, we're
6 going to build upon this defense-in-depth concept.

7 DR. APOSTOLAKIS: But building upon is the
8 expression, because you start -- that implies that you start
9 with defense-in-depth and then you apply risk information to
10 the best extent possible.

11 And as you know, there are conflicting viewpoints
12 regarding -- or opposing viewpoints regarding the meaning of
13 defense-in-depth. In the rationalist point of view,
14 subordinate to PRA and risk information, and the
15 structuralist is the supreme principle.

16 MS. DROUIN: Exactly, and you'll see that on the
17 next slide.

18 DR. BONACA: But it seems to me that here you're
19 committed to maintaining the philosophy unnecessarily the
20 implemented condition defense-in-depth today.

21 You may find through the PRA that you have better
22 ways of implementing it, the intent of defense-in-depth.
23 Still, you're not committing to maintain all the
24 implemented, existing implemented defense-in-depth
25 commitments.

1 MS. DROUIN: Not today, necessarily. And that's
2 why we get down to our last one, and we felt that we needed
3 for our purposes to say what we meant by defense-in-depth,
4 and to create a working definition.

5 And that we were going to try and stay consistent
6 with this definition.

7 DR. APOSTOLAKIS: Now this third bullet, you say
8 that you want to be consistent with a safety goals and with
9 the cornerstones. These are the cornerstones of the new
10 oversight process.

11 MS. DROUIN: Yes.

12 DR. APOSTOLAKIS: And that clearly you're talking
13 about all modes of operation, right, not just power
14 operations?

15 MS. DROUIN: Correct.

16 DR. APOSTOLAKIS: So then the cornerstones, the
17 idea of the cornerstones applies to low power and shutdown.
18 That confuses me a little bit.

19 On the one hand, I hear arguments that the risks
20 from low power and shutdown, you know, may be comparable to
21 power operations or an amount of control and so on.

22 On the other hand, we have this principle of
23 cornerstones, and we know that during those operations, at
24 least three of the cornerstones are compromised to some
25 extent, right?

1 You have initiating events, you have mitigating
2 system availability. Clearly, that one is compromised,
3 deliberately.

4 And then the primary system pressure boundary. Am
5 I allowed to use the concept of the cornerstone and say,
6 gee, even though the public risk is very low from these
7 operations, the mere fact I compromise so many of my
8 cornerstones, you know, would demand that I understand this
9 better and maybe do a more quantitative analysis.

10 In other words, why are we using the cornerstones
11 in certain areas and giving them a lot of importance, and
12 then we completely ignore them in other areas?

13 Either they are important or they are not.

14 MR. CUNNINGHAM: I don't think in the context of
15 the Oversight Program that they are ignoring shutdown
16 operations.

17 DR. APOSTOLAKIS: They are not.

18 MR. CUNNINGHAM: They are not, and so the
19 cornerstones I think as you said that would apply, full
20 power operations, shutdown operations or whatever, the
21 question then becomes okay, given that you are going to
22 compromise some of these barriers what do you have to do to
23 counter-balance that compromising to make sure that we
24 continue to maintain safety, adequate safety or adequate
25 protection.

1 DR. APOSTOLAKIS: Well, it is not just to manage
2 it, because, you know, the oversight process has clear
3 numerical criteria for some of these things. In other
4 words, for the unavailability of systems it gives me
5 criteria, right?

6 MR. CUNNINGHAM: Yes.

7 DR. APOSTOLAKIS: It says -- okay.

8 MR. CUNNINGHAM: Yes.

9 DR. APOSTOLAKIS: Shouldn't I apply the same
10 criteria to low power and shutdown? Just because I do it
11 deliberately it doesn't count anymore?

12 MR. CUNNINGHAM: I have to admit I haven't thought
13 much about this, how you would deal with some of the
14 performance indicators and things like that, how you would
15 use them in shutdown operations -- I guess I haven't thought
16 much about that. I don't know.

17 DR. APOSTOLAKIS: Okay.

18 DR. KRESS: I still wanted to ask a question about
19 the same bullet. I thought you were through though.

20 I wanted to know what they mean by consistent with
21 the safety goals in terms of prevention and mitigation. I
22 am reading into that 10 to the minus 4 CDF and 10 to the
23 minus 5 LERF, but I don't know what "consistent with" means
24 in that concept. Could you maybe expand on that a little?

25 MS. DROUIN: Can you hold on? I think --

1 DR. KRESS: Oh, you are going to get into that
2 later?

3 MS. DROUIN: We are going to get into that.

4 DR. APOSTOLAKIS: So I guess what I questioned was
5 the consistency with the cornerstones and you questioned the
6 consistency with the safety goals.

7 DR. KRESS: Yes.

8 DR. APOSTOLAKIS: It seems to me that the
9 cornerstones are not used the same way in all regulations.
10 They are important for certain things but then we go to
11 other things and somehow they disappear.

12 MR. CUNNINGHAM: Again I am not sure that they
13 really disappear but how they are handled --

14 DR. APOSTOLAKIS: Oh, they may be there but again
15 I don't know that there is any serious effort to really try
16 to see whether we are below the goals that are given in the
17 new oversight process document.

18 MR. CUNNINGHAM: Yes. There is not somebody here
19 from the new oversight process to really get at that, but
20 clearly there should be an answer to that question of how
21 they deal with the cornerstones during shutdown operations.

22 DR. APOSTOLAKIS: Let me change the flavor of the
23 question a little bit to make it more relevant to your
24 presentation.

25 I full agree with you that the oversight people

1 will have to do that, but the question is when you develop a
2 framework like this, what role are you going to give to the
3 cornerstones? Is it a tool only for the inspection and
4 enforcement part of the Agency or also part of the
5 development of a new framework for risk informing 10 CFR
6 Part 50?

7 MS. DROUIN: It's your latter.

8 DR. APOSTOLAKIS: So then I will expect to see
9 them taken seriously, right? I mean you will have something
10 that will refer to the cornerstones in the framework?

11 MS. DROUIN: Yes. We are going to get to that.

12 DR. APOSTOLAKIS: Okay.

13 MS. DROUIN: Before I actually show the picture of
14 the framework --

15 DR. APOSTOLAKIS: Yes, in the interests of saving
16 time, Mary, unless you have something important to say on
17 this one, I think we are familiar.

18 MS. DROUIN: Let me skip --

19 DR. KRESS: I would like to correct the risk --
20 rationalist view a little bit. I think they have read
21 something into what we have said that's not quite true.

22 MS. DROUIN: Then please correct us.

23 DR. KRESS: Well, the regulations on risk
24 information with defense-in-depth employed to validate the
25 risk information and to assure the proper balance between

1 prevention and mitigation is not to compensate for
2 uncertainty or incompleteness in knowledge here.

3 DR. APOSTOLAKIS: I think on that point there is a
4 third view that is missing here. There is a structuralist
5 and the rationalist, which I think are described well. The
6 third view is the one you are describing, which we call the
7 pragmatic approach in the paper.

8 DR. KRESS: Well, I think that is the rationalist
9 view though.

10 DR. APOSTOLAKIS: I mean the pragmatic approach we
11 said, you know, defense-in-depth at a high level and then --

12 DR. KRESS: I think that is a third view, you're
13 right.

14 DR. APOSTOLAKIS: There is a third view, the
15 pragmatic --

16 DR. KRESS: I think in the rationalist view
17 defense-in-depth is not employed to compensate for
18 uncertainty or incompleteness of knowledge.

19 I don't think that is a correct statement for the
20 rationalist view.

21 CHAIRMAN POWERS: If they had access to the letter
22 that we sent to the Commission I think it is a fair
23 interpretation within that letter. I think things have
24 evolved some to bring out those concepts of balance a little
25 more strongly.

1 DR. APOSTOLAKIS: But again I think that that
2 issue of balance becoming more important is really what we
3 call a preliminary proposal, which is a pragmatic compromise
4 between the two and for some reason people tend to ignore
5 that. They focus on the structuralist and rationalist.

6 There is a third bullet there that is missing that
7 is really the pragmatic approach, if you follow the
8 terminology of that paper, which is sort of a mix of the
9 two.

10 CHAIRMAN POWERS: I think you're right, that
11 people do tend to look at the holes in that, but I also
12 think that that pragmatic view has grown within the clique
13 of authors in ways that they probably couldn't have
14 anticipated.

15 DR. KRESS: You may be right.

16 CHAIRMAN POWERS: I think today we would write
17 three.

18 MS. DROUIN: Point taken. I think the big thing
19 though is the recommendation and we tried to, when we
20 developed our working definition --

21 DR. APOSTOLAKIS: Actually what we call a
22 recommendation is a variation of the pragmatic view,
23 actually.

24 MS. DROUIN: Okay, good, because that's what we
25 have tried to take into account, and as we go through these

1 next sets of slides to take that into account in our
2 development of our working definition.

3 DR. WALLIS: This is where I have some problem
4 because it seems to me that the four things you list are
5 simply obvious. You have got to have an initiating event.
6 You could have core damage. You could have release and you
7 have got to have a target to the public. This is just
8 physics. It has nothing to do with defense-in-depth. It's
9 just what happens.

10 DR. KRESS: It is something to do with
11 defense-in-depth. If you --

12 DR. WALLIS: If you choose to intervene --

13 DR. KRESS: If you allocate between those four
14 things --

15 DR. WALLIS: Defense-in-depth is something above
16 all this which tells you how to allocate among all those
17 things.

18 DR. KRESS: That is what I was saying the
19 rationalist view is, but the key word in those four things
20 to me is the word "limit" --

21 DR. APOSTOLAKIS: Yes.

22 CHAIRMAN POWERS: But I think it is the wrong
23 word.

24 DR. KRESS: Well, I am interested in what their
25 view of limit is.

1 CHAIRMAN POWERS: I think that now we would have
2 encouraged them to say something like balance among the
3 measures taken to limit -- limit frequency, limit
4 probability.

5 DR. WALLIS: Unless your defense-in-depth tells
6 you how to balance, you haven't used it.

7 MS. DROUIN: We are still walking through this
8 whole thing. We are walking through it here, but can't put
9 it all on one slide, I'm sorry.

10 DR. WALLIS: Well, I am telling you,
11 defense-in-depth you are simply invoking it without using it
12 in any way. These are simply four physical events which are
13 going to happen, and listing them doesn't tell me anything
14 about what you mean by defense-in-depth.

15 MS. DROUIN: We are going to get to the figure
16 that brings it all together. We were just trying to walk
17 you through.

18 If it is easier for me to jump right to that
19 figure, I will do that. I mean if you want me to skip over
20 these next slides.

21 DR. WALLIS: I will still have the same question.

22 MS. DROUIN: Let's go to the figure.

23 DR. APOSTOLAKIS: Okay.

24 DR. WALLIS: I think in your big framework you
25 could simply remove the defense-in-depth box altogether. It

1 wouldn't change anything.

2 MS. DROUIN: There's two figures that bring all of
3 this together. What we are trying to show here is to go
4 through these different concepts that we have a goal. We are
5 going to achieve this goal by trying to maintain
6 defense-in-depth and we have four strategies for maintaining
7 the defense-in-depth. We have two prevention strategies and
8 we have two mitigation strategies, and then we have tactics
9 that we are going to implement.

10 DR. WALLIS: These would be strategies if you
11 didn't use defense-in-depth at all.

12 MS. DROUIN: It is defense-in-depth in that we are
13 doing both. We aren't just doing mitigation. We are doing
14 prevention and mitigation.

15 DR. KRESS: I would agree that it is
16 defense-in-depth.

17 MR. CUNNINGHAM: But it is implicit in this
18 picture that each of the four legs of this -- there is a
19 balance between the four legs.

20 DR. WALLIS: The obvious thing to do is to prevent
21 and mitigate. It just makes common sense, and to say you
22 are doing something wonderful like defense-in-depth is
23 really misleading people.

24 DR. KRESS: It is not obvious because some people
25 say all you need to do is limit the public health effects,

1 that's it, and not have those other things.

2 DR. WALLIS: Well, how do you do that? You do it
3 by preventing and mitigating.

4 DR. KRESS: Or you may do it by just mitigating or
5 just preventing.

6 MR. SIEBER: It's the degree to which you do each
7 of these things that encompasses or embodies the concept of
8 defense-in-depth.

9 DR. BONACA: That's right.

10 DR. WALLIS: Then give me a rationale for
11 balancing. Then you are getting somewhere.

12 MR. SIEBER: That is what risk informed is.

13 MS. DROUIN: That is what we are going to get to.

14 I want to answer a question that Dr. Powers
15 brought up was the use of the word "limit" because we did
16 deliberately put the word "limit" there because when we get
17 to the next slide we are trying to identify "limits." What
18 we are not trying to do here is doing an ALARA type approach
19 where we are just going to keep pushing down and pushing
20 down and pushing down with no goal in mind, that we want to
21 identify a limit and once we're there, that's good enough.

22 Now maybe "limit" is the wrong word but that is
23 the idea we are trying to get across.

24 CHAIRMAN POWERS: You are telling me that you are
25 going to create maybe a -- what is it? -- how do I

1 articulate it? -- a fuzzy line akin to the fuzzy lines that
2 you have in 1.174 that relate to initiator frequency.

3 MS. DROUIN: I hate to say yes, Mark, but like you
4 --

5 MR. CUNNINGHAM: I'm sorry. I'm just not sure I
6 understood the question.

7 CHAIRMAN POWERS: Well, she says that they're not
8 going to push down and push down. There is clearly some
9 point at which you've done enough in eliminating initiator
10 frequency.

11 And recognizing the speaker's abhorrence of bright
12 lines, I suggested, was there going to be a fuzzy line akin
13 to fuzzy lines I find in Reg Guide 1.174 that speaks to the
14 issue not of CDF, but of initiator frequency?

15 MR. CUNNINGHAM: There will be shadings of gray,
16 yes.

17 DR. KRESS: I don't see how you can do that, Mark.
18 We're writing a set of regulations.

19 When you put them down on paper, they are there,
20 and some people are going to do something to their plant
21 based on those regulations. And they're going to end up
22 with some initiating frequency and some core damage
23 probability.

24 I don't see where the fuzziness enters into this
25 picture. I don't see how you have any -- I mean, the

1 fuzziness before was related to what further things NRC
2 would do, but now you're putting down a set of regulations
3 beforehand.

4 DR. APOSTOLAKIS: But if they are frequencies, you
5 can't really have bright lines. I mean, if they say as a
6 guidance --

7 DR. KRESS: I can't --

8 DR. APOSTOLAKIS: If they say the mean frequency
9 of medium loca should be 10 to the minus 3 or less, and
10 somebody comes up with 1.5, ten to the minus three, what do
11 you do?

12 You see, there is some distribution there.

13 DR. KRESS: I would support your earlier proposal
14 some time ago that a three-Region is a great way to get
15 without bright lines and not have them at the same time.

16 But --

17 CHAIRMAN POWERS: You still run into the problem
18 on the --

19 DR. APOSTOLAKIS: Decreasing the fuzziness.

20 CHAIRMAN POWERS: On the limits that you put on
21 either one of them. You would never write something that he
22 says. You wouldn't say mean probability of ten to the minus
23 third.

24 You would say that there should be a 95-percent
25 confidence that the mean probability --

1 DR. KRESS: That, to me, is a bright line. I'm
2 sorry.

3 DR. APOSTOLAKIS: Yes, it is a bright line.

4 CHAIRMAN POWERS: What you get out of the problem
5 that he's talking about, which is what do you do when it's
6 1.1.

7 DR. APOSTOLAKIS: But your 95th percentile, again,
8 could be one point something.

9 I think there has to be some allowance for this
10 fuzziness. It can't be bright.

11 DR. KRESS: What you do with the fuzziness is, you
12 make two bright lines. You're in a finite different type
13 situation.

14 DR. APOSTOLAKIS: I understand.

15 DR. KRESS: You can't have an infinite number of
16 lines. That's my point.

17 DR. APOSTOLAKIS: The three-region, I think,
18 addresses really different issues, which is goal versus
19 adequate protection.

20 DR. KRESS: No, because it tells you -- it does
21 have a way to have a fuzziness in there because within
22 certain region, you do something that's different than in
23 other regions.

24 DR. APOSTOLAKIS: I depends on how you define the
25 limits, yes, I agree. I mean, I look those words they used

1 in 1.174, increased management attention. That was really
2 nice. It was a stroke of brilliance.

3 CHAIRMAN POWERS: You're in a different realm now.

4 DR. APOSTOLAKIS: I know, I know. I still think
5 you will have some problem with a numerical thing, but I
6 wanted to offer another suggestion here.

7 I think there will be instances where it will not
8 be possible to have this nice separation between mitigation
9 and prevention, or at least not having the four boxes.

10 You may have mitigation/prevention, but not the
11 four boxes inside. For example, bypass sequences.

12 DR. KRESS: This is on the average and related to
13 all -- I mean, you have a different set of these for each
14 sequence.

15 DR. APOSTOLAKIS: Let me finish.

16 DR. KRESS: I'm sorry.

17 DR. APOSTOLAKIS: For external events, you can
18 have an earthquake. So perhaps what we need to do here is
19 have another super box that includes prevention and
20 mitigation. So now you have big box, prevention and
21 mitigation inside it, two boxes you have and then the two
22 boxes within the each within prevention and mitigation.

23 And somewhere in the text, or if there is a way to
24 show that graphically, that would be great, to indicate that
25 the nature of the accident sequence you are regulating --

1 DR. KRESS: I think this is a good slide here.

2 MS. DROUIN: I think this one, because it gets to
3 the two different implementation strategies, where here in
4 this one -- I mean, our preferred one is this one here where
5 we can address each one of the four individually.

6 But there are those cases, as you pointed out,
7 where you can't. So then we come up here to just prevention
8 and mitigation.

9 DR. APOSTOLAKIS: But what if, for example, for
10 some sequences, you may want to just say because of the
11 nature of the sequence, that the frequency of -- oh, you're
12 going all the way to the fatality.

13 MS. DROUIN: No, no. The two strategies are these
14 two here.

15 DR. APOSTOLAKIS: But look at this, you say that
16 prevention is core damage frequency, mitigation is
17 conditional -- individual fatality.

18 DR. KRESS: That's a number that they can use as a
19 pragmatic number to multiply the other two by to get to that
20 metric. It's not a design -- it's not one of the limits;
21 it's just a number they can use.

22 DR. APOSTOLAKIS: Wait a minute. If I multiply
23 ten to the minus four by ten to the minus two, I get ten to
24 the minus six.

25 DR. KRESS: Right.

1 DR. APOSTOLAKIS: Which is close to the -- it's
2 higher than the early fatality, though.

3 MR. CUNNINGHAM: It's less than or equal,
4 presumably.

5 DR. APOSTOLAKIS: My point is that -- and maybe
6 it's already there. That's what I'm trying to understand.

7 If I have a very strong earthquake that demolishes
8 the containment and the core and everything, should I use as
9 a criterion for that sequence --

10 DR. KRESS: Look at the title called infrequent
11 initiatives.

12 MS. DROUIN: You've got your anticipated, your
13 infrequent, and your rare.

14 DR. APOSTOLAKIS: Right. No, but my point is that
15 I cannot implement -- I mean, I can't say anything about the
16 conditional core damage probability. Do I care?

17 What I care about is the whole sequence now.

18 MR. CUNNINGHAM: Right, there's a set of accidents
19 or initiators that are going to be so extreme so that you're
20 not going to design the containment for the ultimate
21 earthquake. You can't.

22 DR. APOSTOLAKIS: But my point is that --

23 DR. KRESS: Is that what you mean by retain the
24 design basis concept?

25 MR. CUNNINGHAM: There is a set of numbers that

1 you just have to maintain the frequency of those challenges
2 somehow, so long. I was thinking of vessel rupture or
3 something as well.

4 DR. APOSTOLAKIS: I understand. Let me tell you
5 what I was trying to say:

6 I think -- and maybe it's already there; I don't
7 see it -- that there will be certain situations, classes of
8 accidents, for which the only thing I can do is worry about
9 the very top box, try to meet the early fatality safety goal
10 criteria, because I cannot break it up into other things.

11 Then there is another class for which the second
12 tier applies; prevention/mitigation. And then there are all
13 these internal events, really, for which the last tier
14 applies. Is that the idea here?

15 It doesn't have to be. All I am saying is that I
16 think you're going to have that problem.

17 MR. CUNNINGHAM: Yes, that's right.

18 MS. DROUIN: Yes.

19 MR. CUNNINGHAM: We'll have that problem to face,
20 and you'll have to --

21 DR. APOSTOLAKIS: Okay, because, in other words,
22 you cannot always demand the four boxes at the bottom. For
23 certain accident sequences, it's just not practical.

24 It doesn't make sense.

25 MS. DROUIN: That's exactly right.

1 DR. APOSTOLAKIS: Okay, fine.

2 DR. KRESS: Now, let me ask another question. I'm
3 sorry, I thought you were through, George. Go ahead.

4 DR. APOSTOLAKIS: For mitigate, for the second
5 tier, why did you put individual fatality there. I thought
6 you were going to put something related to releases of
7 radioactivity or -- I mean, you are going all the way to the
8 health consequences.

9 MS. DROUIN: Yes.

10 DR. APOSTOLAKIS: Why? Why not LERF or something
11 else?

12 DR. KRESS: That is almost a LERF, George.

13 MS. DROUIN: Because staying in consistency back
14 with this, our mitigation.

15 DR. APOSTOLAKIS: Oh, you are focusing on that.
16 Okay, fine, fine.

17 MS. DROUIN: But it is a combination, the number
18 is trying to take into account, you know, both of these.

19 DR. WALLIS: When you put these numbers in this
20 table, is this where you apply defense-in-depth, when you
21 choose to distribute numbers this particular way?

22 MS. DROUIN: Yes.

23 DR. APOSTOLAKIS: Yes.

24 DR. WALLIS: When you're using defense-in-depth?

25 MS. DROUIN: Yes.

1 DR. WALLIS: You're saying we won't put all of our
2 numbers in one box?

3 MS. DROUIN: That's correct.

4 DR. WALLIS: And who chose these numbers and on
5 what basis?

6 MR. SIEBER: Distribution.

7 MR. CUNNINGHAM: At this point, those numbers are
8 out there for debate and discussion.

9 DR. WALLIS: Someone could easily have a reactor
10 which has a completely different distribution of numbers?

11 DR. APOSTOLAKIS: Sure.

12 DR. WALLIS: You can justify it? Someone could
13 come in and say we have such very good numbers in Box No. 3
14 at the bottom here, they're so small that we don't really
15 need them to be so big in the other boxes?

16 MR. CUNNINGHAM: Then the question that you're
17 getting to is, does that provide sufficient
18 defense-in-depth.

19 DR. APOSTOLAKIS: No, actually the way it's going
20 to work at some point -- you see, defense-in-depth is an
21 issue for the Commission. It's a policy issue.

22 DR. WALLIS: But ten to the minus six is the
23 product of all these numbers.

24 DR. APOSTOLAKIS: So the Commission has already
25 stated the top box. The Commission in its safety goal

1 policy statement gave us the top box.

2 MS. DROUIN: Right.

3 DR. APOSTOLAKIS: At some point, after the debate
4 that Mark mentioned and so on, the scrutiny and everything,
5 some form of this will have to go to the Commission for
6 approval, because it's a policy issue.

7 MS. DROUIN: That's exactly right.

8 DR. APOSTOLAKIS: In which case then, a licensee
9 cannot come back here and claim that they have such a good
10 condition on early containment failure probability that they
11 can afford to have a higher core damage frequency.

12 DR. WALLIS: So this is where you have exercised
13 some kind of defense-in-depth by saying we're more sure
14 about one of these boxes than another; therefore, we've
15 given this box more importance than another?

16 MS. DROUIN: Exactly.

17 DR. KRESS: It's not necessarily more sure. It
18 could be one of the criteria.

19 DR. WALLIS: Less uncertain then?

20 DR. KRESS: Well, that could be one of the
21 criteria. The other criteria could be we value not having
22 that thing a lot more than the other.

23 DR. WALLIS: So this is where you've actually used
24 defense-in-depth consciously?

25 MS. DROUIN: Very consciously.

1 DR. APOSTOLAKIS: In fact, the agency, de facto,
2 has declared that preventing core damage is roughly 1,000
3 times more important than the condition of early containment
4 failure.

5 DR. WALLIS: That would seem to be putting your
6 eggs in one basket.

7 MR. SIEBER: On the other hand, these numbers are
8 already there because the plants are already built, and
9 that's the way they will come out.

10 MS. DROUIN: And these are also guidelines for us.
11 These numbers are not going to show up in any regulation.

12 DR. KRESS: That's the part I was going to ask.
13 They're not going to show up --

14 MS. DROUIN: Not in any regulation.

15 DR. KRESS: That, I think --

16 MS. DROUIN: As we go and risk-inform something --

17 DR. KRESS: Those might be in a Reg Guide, though?

18 DR. APOSTOLAKIS: Have to be somewhere.

19 DR. BONACA: Let me just say that there is a lot
20 of striking similarity between the bottom line and the ANSI
21 standards that were used to design the current plants. They
22 didn't talk about core damage frequency; they talked about
23 something very similar.

24 Infrequent means that you can have some fuel
25 damage. Very frequent, you can have defined fuel damage.

1 Clearly, in absence of core damage frequency, they
2 had to use some surrogate. But there are similarities
3 there, so in that case you had ANSI standards that the NRC
4 endorsed the regulation.

5 Now you don't have that, but somewhere, these had
6 to be, because it really replaces those standards. That's
7 what this is, the whole structure.

8 MS. DROUIN: And there are issues that we're still
9 grappling with in the implementation, you know, of this
10 framework.

11 I mean, for example, you know, do you this by a
12 whole group of initiators, or do you do it by a class?

13 I mean, say that you have a class of initiators
14 such as loss of offsite power. It fails a particular
15 criteria, but can you meet if the whole aggregate of your
16 set of initiators meet it?

17 There are issues embedded in here that we're still
18 working our way through.

19 CHAIRMAN POWERS: I guess one of the surprising
20 things about this, especially the bottom row, very important
21 document that this agency's produced that I personally am
22 very fond of, and derive a great deal of information from on
23 the insights from the AIPE exercise.

24 In there they show on some nice plots that, gosh,
25 the containment, conditional containment failure

1 probabilities for BWRs exceed all but perhaps the
2 bottom-most limit you have written down there, whereas many
3 PWRs would not exceed any of the limits that you put down
4 there. Then it goes on -- but not to worry because the
5 conditional core damage probabilities of these BWRs is so
6 much lower, so there is approximately equivalent safety.

7 I rather suspect you are familiar with that
8 document.

9 MS. DROUIN: No, I am not at all.

10 [Laughter.]

11 CHAIRMAN POWERS: I mean it looks like it. Why
12 are those two things, in the face of all this evidence we
13 got from the IPES it says we ought not separate conditional
14 core damage probability into one set of cases and
15 conditional early containment probability into another set
16 because our existing plants don't separate nicely that way,
17 did you go ahead and create two columns there?

18 MS. DROUIN: I guess I didn't view it that way,
19 that these were contradicting each other.

20 CHAIRMAN POWERS: What I am saying is it is
21 contradictory to your experience with the existing set of
22 reactors and I think as Jack Sieber pointed out we have got
23 plants that are built now and one would think that at the
24 very minimum you would want to write this risk informed set
25 of regulations so that they were applicable to the plants

1 now.

2 As I read this, it would be suitable only for the
3 PWRs. I mean it is a PWR-biased categorization here.

4 DR. KRESS: I agree with you, Dana, and the
5 question I was going to ask is if we had a quantification of
6 what we call adequate protection, that is what you are
7 talking about. That is a quantification of it in the IPEs
8 and it seems to me like if our goal with risk informing the
9 regulations is to maintain the same level of adequate
10 protection the numbers we would have under "prevent" and
11 "mitigate" would be different than those numbers that we
12 have up there.

13 Those are the goals. They are not adequate
14 protection, and that is what concerns me a little about the
15 whole thing. I think we need things in there that are
16 different numbers than those just because of the reason you
17 said.

18 CHAIRMAN POWERS: I mean the alternative, it seems
19 to me, based on experience, based on this wonderful document
20 produced by an incredibly insightful senior author --

21 [Laughter.]

22 CHAIRMAN POWERS: -- that comes back and says now
23 do not create two columns here because that is not the
24 way -- the risk insight we got from the IPEs says that you
25 really shouldn't do that.

1 DR. KRESS: I think you could create two columns
2 but they would be different numbers than what they have up
3 there.

4 DR. APOSTOLAKIS: Have you read that report, Ms.
5 Druin?

6 CHAIRMAN POWERS: Let the record show Ms. Druin is
7 in fact the senior author of this very, very good document.

8 DR. KRESS: My point is that two columns are fine.
9 That is a manifestation of defense-in-depth. It's just that
10 the numbers are not compatible with adequate protection.

11 CHAIRMAN POWERS: Tom, I still think that the
12 compatibility with defense-in-depth is achieved with three
13 columns. The violation of what I think the lessons learned
14 from IPE is -- it should be one column. I mean it could be
15 one column. That is one way to get around it.

16 The other way to get around it is to change the
17 numbers.

18 MR. CUNNINGHAM: Another way to get around it is
19 differentiate, have different numbers for PWRs and BWRs or
20 different design containment classes.

21 DR. KRESS: Yes, but that doesn't make any sense
22 at all -- I think that would be a real mistake.

23 CHAIRMAN POWERS: I think you take the ground
24 rules and I think the implicit ground rules and it may in
25 fact be even explicit, it says let's risk inform these

1 regulations pursuing what reactors are going to have to deal
2 with, and that is a fairly finite set. I mean it's
3 certainly ones we have got now, very much it's the ones we
4 have got now. It might even be the evolutionary reactors
5 and the advanced reactors that we have certified I still
6 think you're compatible.

7 Do you get to a reactor like the pebble bed?
8 Maybe the designers come in and say that they are persuaded
9 that it doesn't need a containment. I think they have
10 got -- the burden of proof is on their shoulders.

11 DR. APOSTOLAKIS: But shouldn't this regulation be
12 written in a way that provides sufficient flexibility to
13 accommodate all these various cases?

14 CHAIRMAN POWERS: I think it would be very
15 desirable to do that. I think that is asking an awful lot.

16 DR. BONACA: I think there is only one
17 accommodation. What I mean is that for a BWR really what we
18 are doing for a BWR really what we are doing right now, we
19 are cashing in some extra prevention capability we have for
20 less mitigation that we have because of containment.

21 I don't think the opposite would be allowed by the
22 goals we have because 10 to the minus 4 is a goal that we
23 have in place for plants and I don't think you would say,
24 all right, 10 to the minus 3 core damage frequency is
25 acceptable because I have a containment that has a 10 to the

1 minus 3 mitigation capability.

2 DR. KRESS: Well, there is a rationale, Mario, to
3 say that sort of stuff, and I wish -- I want to get it on
4 the table eventually, and it is a rationale for having
5 perhaps different numbers for BWRs and PWRs and that is what
6 you want to do is have an acceptable uncertainty in the
7 final answer.

8 Now if you make that, if you can get that --
9 that's an undefined number, that acceptable uncertainty, but
10 if we had a number for it, if you could meet that acceptable
11 uncertainty better by doing it one way versus the other,
12 then that ought to be the way to do it, as long as the
13 uncertainty is acceptable. That is the key that is missing
14 here.

15 DR. APOSTOLAKIS: You know what? This is
16 beautiful. This conception -- those guys have to implement
17 it. I don't know how beautiful it is for them.

18 You are going down the list here, having as
19 guidance the uncertainty in the numbers that the assessment
20 gives you -- that is another way of saying what Dr. Kress
21 just said. If you can demonstrate with reasonable assurance
22 that you meet the early fatality safety goal and the latent
23 cancer fatality safety goal you don't have to do anything
24 else. Now in practice of course it is doubtful you are
25 going to do that, so you go to the next level.

1 Are you demonstrating with good -- I don't want to
2 use reasonable assurance, but, you know, with sufficient
3 confidence that you have met the core damage frequency goal
4 and the conditional containment. If you have, then stop
5 there. You don't have to go below.

6 DR. KRESS: If you haven't, you do something else.
7 You go more.

8 DR. APOSTOLAKIS: But if you don't then you better
9 give us additional assurance. Go to the four columns you
10 have there.

11 This brings me to another question. Where are the
12 cornerstones?

13 DR. KRESS: Actually those four columns could be
14 viewed as cornerstones.

15 DR. APOSTOLAKIS: But they are not "the"
16 cornerstones. No, I think we should take that list very
17 seriously. We can't just say this is only for enforcement
18 and inspection. Either we worry about these things or we
19 don't.

20 DR. KRESS: Those pretty well parallel the
21 cornerstones.

22 DR. APOSTOLAKIS: But they are not the same.

23 DR. KRESS: They have left out things like
24 security --

25 CHAIRMAN POWERS: Let me interject and ask the

1 subcommittee chairman where we stand on getting through
2 this. I do have some time constraints today.

3 DR. APOSTOLAKIS: I understand that.

4 CHAIRMAN POWERS: Should we perhaps let the
5 speaker get through the next 10 viewgraphs, just to find out
6 what she has to say?

7 DR. APOSTOLAKIS: I would propose something
8 else --

9 MS. DROUIN: Money.

10 DR. WALLIS: I would like you to do something for
11 me. My colleagues are far too complicated. They get into
12 all these details. In principle, what you are saying I
13 think is that if you have some sort of template like this
14 you could take all the existing regulations, LOCA and stuff,
15 and you could see how it fits into this framework of stuff,
16 and you could see whether or not they are overly
17 conservative or overly liberal of whatever they are, and
18 then you could then decide whether to change them.

19 MS. DROUIN: Right.

20 DR. WALLIS: In principle it should be possible to
21 apply this to the whole body of regulations as they now
22 stand.

23 MS. DROUIN: Correct.

24 MR. SIEBER: Actually, you are going a step
25 further than that in trying to regulate to a set of numbers

1 that is something like this in these different boxes, is
2 that not true?

3 MS. DROUIN: Well, if I go back to our other
4 figure, in getting to Dr. Wallis's point, when we look at --
5 this is just an example here --

6 DR. WALLIS: Go to PTS and say what does it buy
7 you in terms of these 10 to the minus whatever.

8 MS. DROUIN: And see where do the regulations map
9 into here and how well do they map and have they done it the
10 best way, the best risk informed way.

11 MR. SIEBER: But it is a mistake to think that all
12 the body of regulations that you have cover all the elements
13 of risk and uncertainty in the plant.

14 MS. DROUIN: That's correct.

15 MR. CUNNINGHAM: Right.

16 MR. SIEBER: It's probably one small fraction of
17 that.

18 MS. DROUIN: Right. What we don't have a
19 viewgraph on here is that this is looking at the regulations
20 in a sense from a bottom-up -- or, you know, people call it
21 different things -- but one of the things that we are doing
22 is taking the insights from that wonderful document and
23 seeing where there are risk significant concerns and then
24 mapping those to how have they been covered in the
25 regulations or if they have been covered in the regulations,

1 and if not, should they be covered in the regulations, so
2 that is another process that as we look at this framework --
3 to see if there's potential holes.

4 DR. WALLIS: This is where I was looking for a
5 different sort of framework. I would sort of I guess be
6 willing to start off with this figure at the beginning of
7 your discussion without any discussion whatsoever and then
8 give me a framework for how you are actually going to apply
9 it. That is what I didn't see.

10 MS. DROUIN: That's correct. You haven't seen
11 that.

12 DR. WALLIS: Because I could have taken this, I
13 think, with about five minutes of discussion. I don't know
14 why we spent all this time.

15 DR. APOSTOLAKIS: Well, we are trying to give some
16 help to the guys. I mean we are not just criticizing -- I'm
17 sorry, had you finished, Graham?

18 DR. WALLIS: Yes, I think so.

19 DR. APOSTOLAKIS: I have to intervene. You can't
20 through all your viewgraphs -- you use your judgment and hit
21 the important points and wrap it up by 2:55 --

22 MS. DROUIN: I think so.

23 DR. APOSTOLAKIS: 2:55 you are out, right?

24 MS. DROUIN: Okay.

25 DR. APOSTOLAKIS: In the middle of a sentence.

1 MS. DROUIN: All right.

2 DR. APOSTOLAKIS: Because we have to give some
3 time to Mr. Christie.

4 MR. BARTON: You are taking away her time, George.

5 DR. APOSTOLAKIS: She can actually leave now.

6 [Laughter.]

7 MR. CUNNINGHAM: Just to be clear, you want Mary
8 to keep talking until 2:55 and then you will talk or --

9 DR. APOSTOLAKIS: No.

10 MR. CUNNINGHAM: -- or we will have the complete,
11 the Staff's presentation will end at 2:55?

12 DR. APOSTOLAKIS: Yes, because Mr. Christie has
13 requested time.

14 MS. DROUIN: I understood that is what you meant.

15 MR. MARKLEY: And NEI.

16 DR. APOSTOLAKIS: And NEI?

17 MS. DROUIN: I am not going to spend a lot of time
18 on this --

19 DR. APOSTOLAKIS: Wait, that changes it. The
20 total is 15 minutes? Okay, 2:55.

21 MS. DROUIN: 2:55? Now if I finish earlier, do I
22 get a bonus?

23 DR. APOSTOLAKIS: Yes. Buy you a cup of coffee.
24 Why don't you go to what you consider are the key issues
25 that you would like to bring to the attention of the

1 committee and maybe get some feedback.

2 MS. DROUIN: One of them is where Dr. Wallis left
3 off, where we are just now starting. You know, we have
4 gotten this framework but now how do we implement it? That
5 is, you know, the \$80,000 question and this is not meant to
6 list all the issues.

7 Here are just some of the issues that we are
8 coming across.

9 I'm sure that as we get into it, there are going
10 to be more issues that we are going to unravel.

11 But here, we're just --

12 DR. APOSTOLAKIS: And as you talk to this
13 Committee.

14 MS. DROUIN: Excuse me?

15 DR. APOSTOLAKIS: And as you come to this
16 Committee.

17 MS. DROUIN: And as we come to this Committee,
18 absolutely.

19 But the application of the single-failure
20 criterion, whether you should do it, how you implement it,
21 is an issue.

22 How we --

23 CHAIRMAN POWERS: Why does it even exist in a
24 risk-informed regulation?

25 MS. DROUIN: That's one of the issues.

1 MR. CUNNINGHAM: That's a fair question.

2 MS. DROUIN: A very fair question; does it make
3 sense in a risk-informed environment to have the single
4 failure criterion?

5 CHAIRMAN POWERS: Is there any convolution of the
6 logic that would lead to it?

7 MR. CUNNINGHAM: Yes, there is. Again, the
8 question of single-failure criterion as a concept or as it
9 has been applied, the application has evolved considerably
10 with time to be perhaps more constraining than the original
11 intent.

12 The original intent may still make sense, but --

13 DR. APOSTOLAKIS: Well, you know, as a general
14 principle, I mean, there is such a thing as the principle of
15 conservation of requirements, perhaps, or knowledge. I
16 mean, you are creating new requirements at a higher level.

17 Something has to give at the lower level. I mean,
18 we can't preserve everything we've been doing for 40 years
19 and on top of it say, now we want this frequency for core
20 damage. I mean, that would argue against the single-failure
21 criterion, in my view.

22 So, bear that in mind, that we are not here just
23 to add to the regulations. I mean, the fact that you put
24 those big requirements up there has to have some impact on
25 what you put --

1 DR. KRESS: You may be able to meet them only with
2 the single-failure criterion.

3 DR. APOSTOLAKIS: But that's a separate issue.

4 MR. CUNNINGHAM: In this environment, the question
5 is, is it a practical concept to use, to continue to use,
6 given this framework and application?

7 DR. APOSTOLAKIS: It's the whole issue of
8 practicality, and conceptually also.

9 MR. CUNNINGHAM: Conceptually, also, yes. Is it
10 --

11 DR. WALLIS: Now, these numbers in your boxes are
12 plant-specific. So how do you do this mapping without
13 looking at the particular plant?

14 DR. KRESS: They weren't intended to --

15 DR. WALLIS: How do you map generic regulations
16 into PRA.

17 DR. KRESS: They weren't intended to be
18 plant-specific.

19 DR. WALLIS: But they are. These probabilities,
20 when you calculate them, are plant-specific, aren't they?

21 DR. KRESS: Well, the idea is to --

22 DR. WALLIS: So isn't that one of the biggest
23 problems with mapping general regulations into PRA.

24 MS. DROUIN: But you can see where the group of
25 plants have fallen in a particular area, and one of the

1 things I'm going to get to after this slide is walk you
2 through 50.44, because that's our trial implementation.

3 And where you might have it on a plant-specific
4 basis, you still have here's what the industry as a whole
5 has told you, so it's not really applied on a plant-specific
6 basis in that regard.

7 We've had a lot of discussion on that second main
8 bullet, on how we're going to use these quantitative goals.
9 And all of that, we're still thrashing out, and as we move
10 forward, hopefully -- I'm sorry?

11 DR. APOSTOLAKIS: The cornerstones.

12 DR. KRESS: No, George, don't keep bringing up
13 these cornerstones.

14 DR. WALLIS: I just want to say, what happens if
15 you try and do it?

16 DR. APOSTOLAKIS: These are issues, these are
17 implementation issues.

18 MS. DROUIN: Real quick, to your cornerstone
19 thing, George, it might not be the exact words, but here are
20 four of the cornerstones right here, and the other ones are
21 up here in this box. So we are not ignoring the other
22 cornerstones.

23 DR. APOSTOLAKIS: What I'm saying is that there is
24 an explicit cornerstone regarding the unavailability of
25 mitigating systems. And you have put it inside the core

1 damage probability, which is combined now with other things.

2 And my question is, why doesn't it stand alone?
3 Why do I care about it when I inspect and enforce, and I
4 don't care about it when I write new frameworks?

5 MR. CUNNINGHAM: As you said, this is an issue we
6 have to deal with.

7 DR. APOSTOLAKIS: I understand that.

8 MR. CUNNINGHAM: And that's fair.

9 DR. APOSTOLAKIS: That's all I'm saying; that it's
10 much more explicit. I agree with Mary that everything that
11 is the limit core damage frequency box, but in the other
12 document, it's spelled out, the four of them. If you
13 multiply them, you get the core damage probability.

14 So why do I have four there and two here?

15 DR. BONACA: There is some issue, too, about --

16 MS. DROUIN: You have the same four.

17 DR. BONACA: -- here, the separation and
18 mitigation is typically by core damage. And the others were
19 not. I mean, clearly the mitigation was intended in the old
20 fashioned way of the old analysis whereby mitigating
21 equipment wasn't just to mitigate core damage; it was to
22 mitigate events.

23 So there is some other issue that has to be dealt
24 with to reconcile.

25 DR. APOSTOLAKIS: I think your major -- one of the

1 biggest issues you will have here is what of the -- which
2 ones of the existing regulations you want to eliminate.

3 MS. DROUIN: I'm sorry, I couldn't hear you?

4 DR. APOSTOLAKIS: Eliminate. The fact that you
5 are putting these multilevel requirements now, how far can
6 you go in eliminating existing requirements. The
7 single-failure criterion, for example, is one we discussed,
8 and I'm sure there are others.

9 This is a key implementation issue, in my view.

10 MR. CUNNINGHAM: Again, the single-failure
11 criterion is not a requirement; it's an implementation
12 mechanism or something like that, embedded in requirements.

13 DR. APOSTOLAKIS: It's essentially a requirement.
14 The licensee has got to meet it. No?

15 MR. CUNNINGHAM: Anyway, we're just -- that's
16 semantics, I think.

17 DR. APOSTOLAKIS: In the engineer's office, many,
18 many years ago, doing some drawings because we were coming
19 before the NRC, well, the single-failure criterion was very
20 prominent there.

21 MS. DROUIN: Okay, for time purposes, I'm going to
22 skip the whole next section and jump all the way over to
23 Slide No. 25. As I said, 50.44, the combustible gas control
24 regulation, is the one that we have done for trial
25 implementation.

1 And, in fact, we went into the workshop with
2 another recommendation on 50.44, and the stakeholder
3 feedback supported that recommendation. We're going to try
4 to move in 50.44 on a much more expedited basis, looking at
5 the timeframe of June of this year to go to the Commission
6 with preliminary recommendations, and not wait till
7 December.

8 We're going to try and really expedite 50.44. So
9 I want to quickly walk through what we're doing on 50.44 and
10 give you an idea of where we're at.

11 Just quickly, in terms of our framework,
12 remembering that the framework is looking at both prevention
13 and mitigation, what you see with 50.44 is that it addresses
14 the third strategy, of limiting our radionuclide releases.

15 As we look at 50.44 there's three things here that
16 I want to focus in on that as we risk inform the regulation
17 and start examining the requirements we are going to
18 determine if we can eliminate any non-risk significant
19 elements. Can we simplify it to make it more effectively
20 meet the objective? -- but also when we look at it to see if
21 there are any missing risk elements that might warrant that
22 unforgivable word of "adding" to it.

23 When you look at 50.44 there's six basic parts to
24 the regulation, six requirements there. The top three
25 here -- I don't think that my pen will work -- there's a

1 demarcation here, because there was two parts to 50.44,
2 pre-TMI and post-TMI, and this was the original rule and
3 then the rule was amended after TMI, which added on these
4 three other requirements, so prior to TMI what you are
5 seeing there is that the regulation was impacting all
6 containment types and then when you got into the amendments
7 post-TMI you were not necessarily impacting all the
8 different containments.

9 The other thing I want to point out, when we talk
10 about large Drys, that also includes the sub-atmospherics,
11 and that is an important point.

12 What I am going to do is take those six
13 requirements and walk through them and talk about the
14 requirements and get into how the licensee has implemented
15 the requirement, look at that implementation and the
16 requirement itself and evaluate the safety significance and
17 then some very early preliminary thoughts that we have right
18 now for options for consideration in terms of potential
19 recommendations.

20 DR. WALLIS: Evaluate safety significance means
21 some kind of a contribution to LERF?

22 MS. DROUIN: Yes.

23 MR. KURITZKY: CDF and LERF.

24 DR. WALLIS: CDFs already have --

25 MS. DROUIN: Yes. No, that would be LERF.

1 If I take our first requirement, which is
2 measuring the hydrogen in containment, that is what the
3 requirement states. The implementation of it has been to
4 put in safety grade instrumentation for hydrogen or oxygen
5 measurement. The fact that it is safety grade
6 instrumentation, that is not the actual requirement. The
7 requirement is what you always see here in bold and
8 underlined.

9 When you look at it, the hydrogen measurement
10 certainly has the capability of safety value for tracking
11 and managing the accidents and here is one that also gets
12 tied into Option 2, because some relaxation of the special
13 treatment requirement is imposed on the equipment also.

14 In looking at this particular requirement, what
15 our first thoughts are is to perhaps allow some grab
16 sampling instead of having a constant monitoring. You can
17 just go out and do some random sampling, and also what we
18 are starting to look at is trying to determine where has the
19 safety grade instrumentation been imposed. It certainly
20 hasn't been imposed by the regulation.

21 DR. WALLIS: How about not measuring it at all?

22 MS. DROUIN: Or not measuring it at all.

23 DR. WALLIS: How would you assess whether that is
24 valid? I mean you can look at the effect on LERF and it is
25 going to be very small.

1 How small does it have to be before you say you
2 don't need any measurement at all?

3 MS. DROUIN: What I see to recall in going back
4 and looking at the results from the IPEs and looking at
5 NUREG-1150 is that the hydrogen -- I am trying to remember
6 those numbers --

7 DR. WALLIS: Just measuring it though -- well, are
8 you going to apply some criterion?

9 MS. DROUIN: In looking at what was the
10 contribution to your early containment failure from a
11 hydrogen combustion, and then therefore what is the need to
12 measure it.

13 MR. KURITZKY: And it varies from plant type to
14 plant type and containment type to containment type.

15 DR. WALLIS: You don't necessarily need to measure
16 it. You just need to prevent it burning. I think it gets
17 very complicated when you look into the details of what you
18 actually buy from each one of these requirements.

19 MS. DROUIN: But when you get into some, you know,
20 hydrogen combustion in some particular accidents is a
21 relative contributor so there is some value in knowing what
22 your hydrogen concentration is for being able to measure it,
23 but whether or not you need your safety grade --

24 DR. WALLIS: There's a .1 probability of
25 containment failure in the box that you showed us. That is

1 much too crude to evaluate whether or not you need to
2 measure hydrogen in containment, so you need some other --

3 MR. CUNNINGHAM: Yes, that's right.

4 MS. DROUIN: Right.

5 MR. CUNNINGHAM: You need something more --

6 DR. WALLIS: Much more.

7 MR. CUNNINGHAM: Yes.

8 DR. WALLIS: That is what I was looking for was
9 more a framework for how you are going to actually make
10 these decisions, but may not have got that far yet.

11 MR. CUNNINGHAM: The framework that we talked
12 about before might give you an idea that this is an issue to
13 tackle. What it doesn't do is give you an idea of how you
14 really design what the requirements would look like.

15 DR. WALLIS: I was looking for your framework for
16 deciding whether or not a regulation was necessary or needed
17 to be modified. Maybe you haven't got that far yet.

18 MS. DROUIN: Would you state that again?

19 DR. WALLIS: When you make these comparisons, how
20 do you make a decision about whether or not we need to keep
21 measuring H2 in containment? That is the sort of framework
22 I was looking at, for your intellectual framework for how
23 you are going to start making decisions on the basis of risk
24 informing. Maybe you haven't gotten that far yet.

25 MR. CUNNINGHAM: We haven't gotten that far yet.

1 MS. DROUIN: That's correct. Going on to the next
2 requirement in terms of mixing, in looking at it from a risk
3 perspective, keeping a well mixed containment atmosphere
4 without hydrogen stratification we felt is important to
5 safety, so often when you look at this particular
6 requirement the systems that are used for mixing are also
7 generally used for other functions, so on this particular
8 requirement our preliminary thinking was we weren't
9 proposing any changes on this particular requirement.

10 CHAIRMAN POWERS: When we took a look at 50.59,
11 using the language that we have available to us now with
12 modern capabilities at risk we ran into all kinds of
13 problems with the quantitative adjectives that appeared in
14 there.

15 There was language to the effect of don't have any
16 increase in risk. At that time that language was put in
17 there they meant no increase in risk to the limits that you
18 could detect whether there was any increasing risk and the
19 detection capability was very crude at the time. Now it is
20 much better, and the lawyers have said that poses a
21 problem -- when it said none it meant none. Now you can
22 detect better and you can say that just about everything
23 does have some changes in the accidents that are possible,
24 so when you come in here and you have a requirement, "a
25 well-mixed atmosphere" there is nothing quantitative about

1 it. It just says a well-mixed atmosphere. Aren't you going
2 to run into the same problems that I can run a CFD code --
3 I'm sure Professor Wallis could lend me one that would be
4 superb --

5 DR. WALLIS: Sell you one.

6 [Laughter.]

7 CHAIRMAN POWERS: I should have known that.

8 [Laughter.]

9 CHAIRMAN POWERS: And I could come in and say,
10 aha! -- look right here, in this corner it is not well-mixed
11 in that corner and therefore it is an unacceptable
12 containment.

13 Aren't you inviting that kind of difficulty when
14 you don't address those adjectives?

15 MS. DROUIN: I don't disagree with that.

16 CHAIRMAN POWERS: Not going to change the
17 regulation anyway, right?

18 MS. DROUIN: I didn't say that.

19 DR. WALLIS: This is where you really come up
20 against the nitty-gritty.

21 MS. DROUIN: Yes.

22 DR. KRESS: That's right.

23 DR. WALLIS: Find out if it is possible to do the
24 job you are trying to do.

25 MR. CUNNINGHAM: That's right.

1 DR. APOSTOLAKIS: Remember, this is a work in
2 progress.

3 MS. DROUIN: Very much in progress.

4 DR. WALLIS: But the interesting part to me is
5 whether you can make it work on any one of these things.

6 MS. DROUIN: Absolutely.

7 MR. CUNNINGHAM: And 50.44 --

8 DR. WALLIS: Even a part of 50.44.

9 MR. CUNNINGHAM: Even a part of 50.44 is
10 relatively simple compared to some of the other regulations.
11 It is a good test but it is a fairly simple test at this
12 point.

13 MS. DROUIN: And the other part of 50.44 --
14 because what you see here in terms of the work in progress
15 is looking at 50.44 the way it is written today and how it
16 is implemented today.

17 The other thing that you don't see here, which we
18 are just right now starting -- we don't have anything to
19 present to you yet -- is saying let's not even look at what
20 is written. Let's look at the objective of what the rule
21 was and starting with a blank piece of paper, one, do we
22 even need a regulation that gets to controlling -- whatever
23 the title of our regulations are -- combustible gas.

24 You know, do we need such a regulation and if we
25 were to write that regulation with a blank piece of paper,

1 how would it be written from a risk informed manner, and so
2 we are also attacking it from that perspective and coming
3 from looking it this way, which we started by looking at the
4 separate requirements, now starting on a blank piece of
5 paper it will be interesting to see if the two converge
6 whether we end up at the same place. At this point I can't
7 tell you where we are going to end up.

8 DR. WALLIS: Can you imagine a regulation which is
9 a one-liner which says "Thou shalt design an H2 control
10 system or combustible gas control system so that some
11 probability is less than 10 to the minus X" and that's just
12 the regulation, one line.

13 MR. SIEBER: I can't imagine that.

14 DR. WALLIS: Then it is up to the designer to do
15 it or the licensee to show that it meets that criteria -- a
16 one-line regulation.

17 MS. DROUIN: I don't know.

18 DR. WALLIS: Is that sort of thing feasible, do
19 you think?

20 MR. CUNNINGHAM: Again, you can go into some of
21 the regulations that we have got on the books today, the
22 regulations themselves are very simple and they are not
23 quite that simple but they are very simple, but then they
24 will add on either an appendix to Part 50 or something that
25 complicates things or a Reg Guide or something, but in many

1 cases -- we have said this before in a different context --
2 sometimes the regulations themselves are not the issue here.
3 It is the implementing documents that complicate things
4 greatly.

5 DR. BONACA: I just would like to make a comment.
6 I made it before, but I don't think it was picked up. We
7 spoke before about correlating cornerstones with this
8 approach, and you are still working on it. I'd point out
9 again that there is an inconsistency in the definitions of
10 prevention and mitigations that you use here versus the
11 cornerstone.

12 In the cornerstone you use the traditional
13 approach whereby a diesel generator unavailability falls
14 into the mitigating systems. Here you are referring to core
15 damage.

16 MR. CUNNINGHAM: Yes.

17 DR. BONACA: And you are looking at a mitigation
18 as a condition of failure -- it's almost impossible to
19 relate --

20 DR. APOSTOLAKIS: Oh, but --

21 DR. BONACA: -- and I am pointing it out because
22 the new Oversight Program is supposed to be risk informed,
23 but you have to make sure at some point the two things
24 correlate.

25 DR. APOSTOLAKIS: Consistency. There has to be

1 consistency.

2 DR. BONACA: It's very important that you look at
3 it and I think it is a work in progress so therefore you
4 have the opportunity to either adjust one or the other.

5 DR. APOSTOLAKIS: Yes, that's point of view. The
6 other point, which is related to what Graham just said and
7 we said earlier, is how do you decide in the diagram you
8 showed us earlier to go one step down? How do you decide to
9 go one step down, and the guidance has to be the confidence
10 you have in your results.

11 In other words, you could in some ideal world have
12 a one-line regulation, design a reactor so that the core
13 damage frequency is less than 10^{-4} per year,
14 nothing else. If you could do that with high confidence,
15 you wouldn't need anything else, so I think that is
16 something that I believe you should pay some attention to
17 and see how it would guide us to do everything else because,
18 yes, why do I have to worry as a regulator about measuring
19 hydrogen? There must be a reason, and the reason has to be
20 the uncertainty in the final result.

21 DR. WALLIS: If you're sure it won't burn -- sure
22 you don't have enough to burn, you don't need to measure it.

23 DR. APOSTOLAKIS: I mean this contributes to some
24 accident sequences.

25 MR. BARTON: Yes.

1 DR. WALLIS: With a humongous containment, fine.

2 DR. APOSTOLAKIS: So it is really the final number
3 that should count, so it is not just the point values we are
4 using and then incidentally we are saying these are mean
5 values and we think we're okay. I think that uncertainty in
6 the distribution itself is a key element here because it
7 dictates how far down you will go.

8 This is your last slide?

9 MS. DROUIN: Yes.

10 DR. APOSTOLAKIS: You are happy to tell us.

11 MS. DROUIN: Yes.

12 DR. APOSTOLAKIS: And you have to do it in
13 seconds.

14 Okay, I'll give you a minute.

15 MS. DROUIN: Thank you. As we said, we are in the
16 midst of preparing a status report that will go to the
17 Commission, that will address a lot of the policy issues
18 that we're going to need to go back on.

19 As I said, we had planned to move it on an
20 expedited basis on 50.44. We're planning on holding some
21 kind of public meeting in the April-May timeframe, as we get
22 more of these ideas more solidified to go back and get some
23 feedback from stakeholders, and go with the recommendation
24 to the Commission. I say that is approximately the June
25 timeframe; that is our target date.

1 We're looking at, in terms of other regulations,
2 DBAs, and preliminary recommendations on those to have some
3 ideas in the August 2000 timeframe. This would go beyond
4 the 50.44, and to hold a public workshop in September, and
5 hopefully come back and meet with you all in October.

6 DR. APOSTOLAKIS: So that would be the next time
7 we see you?

8 MS. DROUIN: Unless you wanted to meet beforehand,
9 but that was the next time we were intending on coming back.

10 DR. APOSTOLAKIS: This is really important for us.

11 MR. CUNNINGHAM: You asked at the beginning of the
12 meeting, when we were looking for a letter. I volunteered
13 that we were looking for a letter late this year.

14 That was not in the particular context of, for
15 example, 50.44. So I tend to agree. I'm not sure we should
16 be waiting until this Fall to be talking to you again.

17 DR. APOSTOLAKIS: We should have a supplementary
18 meeting first. So I will leave it up to you to judge when
19 it would be convenient and appropriate to have a
20 Subcommittee meeting, so you will have something more to
21 say, but it will not be near the end, so that additional
22 advice will really irritate you.

23 DR. WALLIS: I'm really puzzled because I don't
24 think you're anywhere near a recommendation yet.

25 DR. SEALE: That's right.

1 DR. WALLIS: You haven't even started to make any
2 decisions about anything. You have to decide how you're
3 going to make decisions. So what are you going to recommend
4 by June?

5 MS. DROUIN: In June we're just dealing with
6 50.44.

7 DR. WALLIS: But you haven't come near resolving
8 any of the issues on 50.44 yet.

9 DR. SEALE: You're right.

10 DR. APOSTOLAKIS: Well, it's March 1st.

11 DR. WALLIS: I don't think there's any hope at the
12 present speed.

13 MR. BARTON: It's a work in progress.

14 MS. DROUIN: Can I have 15 more seconds?

15 DR. APOSTOLAKIS: Okay.

16 MS. DROUIN: This will make you feel better,
17 George.

18 MR. BARTON: I doubt it.

19 MS. DROUIN: Jus real quick, we did have a
20 workshop --

21 DR. APOSTOLAKIS: We didn't talk about that, did
22 we?

23 MS. DROUIN: I just wanted to give you some
24 highlights from it. There was general agreement with our
25 approaching guidelines at a high level, but the thing was

1 that consistency with the plant oversights, with the
2 cornerstones, impact on workers, for us to keep and maintain
3 a good communication with the different owners groups and
4 the industry programs, because there's a lot happening in
5 these areas.

6 One of the things that came out is that if you
7 remember, at the very beginning, we said that out-of-scope
8 was emergency planning. We've got some feedback that we
9 shouldn't necessarily make that kind of statement.

10 There was a lot of agreement that we should try to
11 move ahead on an expedited basis on 50.44.

12 DR. WALLIS: But you don't have a plan yet.

13 MS. DROUIN: That doesn't necessarily mean that
14 it's on all of 50.44. Maybe there is a particular aspect of
15 50.44 that we can move quickly on, and that's what we will
16 be determining over the next three months.

17 And that's all I have.

18 DR. APOSTOLAKIS: Any other comments from the
19 members?

20 [No response.]

21 DR. APOSTOLAKIS: Thank you very much.

22 DR. WALLIS: I think you might be in trouble if
23 you didn't come back to us several times. You might come
24 back and we might say you haven't got there yet. It's still
25 a long way. I'm concerned about progress.

1 DR. APOSTOLAKIS: Late May, perhaps? Would that
2 be all right with you? We'll leave it up to the staff.

3 DR. WALLIS: You're too high level with all this
4 discussion. You don't really get down to how you're going
5 to do the job.

6 MR. CUNNINGHAM: I would think maybe the best way
7 to proceed would be using 50.44 as an example to get at just
8 what Dr. Wallis is saying, how do you take this from the
9 conceptual level to what is this requirement going to look
10 like level, and May is probably too late for that.

11 DR. APOSTOLAKIS: For reliability on PRA, but Dr.
12 Wallis will have to be there. You're not a member of that.

13 DR. KRESS: That's all right, we'll make him be
14 there.

15 DR. APOSTOLAKIS: Okay, thank you very much. I
16 appreciate it. NEI and Mr. Christie? You can both come and
17 sit there.

18 If you're going to stand, we'll give you the other
19 microphone. Okay, it's up to you. If you want to stand, we
20 give you the other microphone.

21 MR. CHRISTIE: Adrian has only got one slide. I
22 see new members. Do I have to introduce myself?

23 DR. APOSTOLAKIS: Yes, tell us who you are.

24 MR. CHRISTIE: My name is Bob Christie. I am the
25 owner of a firm in Knoxville, Tennessee that does consulting

1 work for nuclear power plants and railroads and anything
2 that has to do with risk and reliability evaluations.

3 My background is, I started with the Tennessee
4 Valley Authority in 1974. I did four years in hell doing
5 regular safety analysis, and then got the light, and I've
6 now done about 20 some odd years of PRA.

7 So, I was one of the utility representatives on
8 the PRA procedures guide. I have been involved in the
9 efforts over the years.

10 Presently, we've got in the industry, a lot of
11 things to risk-inform, to move towards some more effective
12 regulatory scheme by using risk-informed, performance-based
13 regulations.

14 Good enough, George?

15 DR. APOSTOLAKIS: Yes.

16 MR. CHRISTIE: Today we would like to talk a
17 little bit about the meeting that happened, the workshop
18 that happened last Friday. And you have a detailed comment,
19 so I'll try and make this short.

20 There were two documents handed out. One is
21 called the Framework for Risk-Informed Regulation. Another
22 is called Risk-Informing 10 CFR 44. Okay, they're both
23 pretty thick documents.

24 They were handed out at the beginning of the
25 meeting. I believe that I was probably the only person

1 crazy enough to read the documents at night and come back on
2 Friday having read the documents. Most of the other utility
3 people were smarter than I was and had not read them, and so
4 what can we say?

5 Okay, let's take the general approach. In the
6 first place -- and we said this in the meeting -- there's no
7 general agreement on the general approach.

8 I, particularly, am unclear on what it is. I
9 really don't understand it. It appears to me to be some
10 combination of risk-informed space regulation, which is
11 great for my part. But clearly they have statements in
12 there that, you know, we're picking things and going to be
13 consistent with the quantitative health objectives.

14 Then the first thing they do is use minus four
15 core damage frequency, which is inconsistent with the
16 quantitative health objectives, more conservative, et
17 cetera, et cetera.

18 You cannot use quantitative health objectives to
19 set regulations, because we all know that with quantitative
20 health objectives, safe is safe enough, but they're not
21 adequate protection.

22 The regulations are adequate protection, the
23 safety goals are how safe enough, and therefore you can't
24 set regulations on the quantitative health objectives or the
25 safety goals.

1 So, you know, there's no -- there is definitely no
2 general agreement on the approach.

3 DR. KRESS: Bob, do you think it would be possible
4 to have numbers like the ten to minus four and point one
5 containment, although not those particular numbers, but
6 numbers like that that would represent adequate protection?

7 MR. CHRISTIE: Again, Tom, you've got to recall
8 that years ago when I proposed what has become to be called
9 the whole plant program, I said we ought to know the whole
10 -- the numbers from top to bottom. We ought to start at the
11 top with the quantitative health objectives.

12 Well, I wanted to start at the top with defining
13 adequate protection. And you know I tried a delphi process
14 to define adequate protection. I have a definition of
15 adequate protection.

16 DR. KRESS: Well, would you like to share it with
17 us?

18 MR. CHRISTIE: Well, it's approximately three
19 percent of background, three to five percent of background.
20 That's what came out of the delphi process.

21 DR. APOSTOLAKIS: What background?

22 MR. CHRISTIE: Background, for immediate
23 fatalities and latent cancers.

24 DR. WALLIS: You mean the average background, not
25 the background in Denver or New England?

1 DR. APOSTOLAKIS: No, he's talking about risk,
2 background risk.

3 MR. CHRISTIE: The quantitative health objectives
4 are based upon .1 percent of the background for individual
5 fatalities and .1 percent of background for latent cancers.

6 And so when I asked people to go out and do a
7 delphi as to -- well, if -- and it was convoluted, but all
8 of you got a copy of what I sent out. I asked them, if we
9 define adequate protection as what is the level of risk
10 reached by the present regulations, what did you think the
11 present regulations were?

12 And I said -- and I provided a chart of my own and
13 thought I might influence people, but I put my chart in an
14 envelope, closed, so that they didn't too much to them and
15 so on and so forth.

16 Again, I have a definition in my own mind of what
17 adequate protection is on the risk curve. I now have a
18 definition of what the safety goals are on the risk curve,
19 and I want to know where every plant in the United States
20 stands with respect to what I consider adequate protection,
21 with respect to what I consider quantitative health
22 objectives, with what I consider to be emergency planning,
23 what I consider to be what we call, you know, release
24 categories; the plant damage states; the conditional
25 probability of systems working, and the initiating events.

1 I just want plants to have a PRA and to know where
2 they stand from top to bottom. And each plant is going to
3 be absolutely unique.

4 DR. KRESS: Let me ask you another question: How
5 much faith do you have in a delphi-arrived at definition of
6 adequate protection, and don't you think that could have
7 been done by just going to the IPEs, for example?

8 MR. CHRISTIE: No. I wanted to define adequate
9 protection. IPE has got nothing to do with adequate
10 protection. IPEs were risk evaluations.

11 DR. KRESS: Well, the plants that IPEs refer to
12 are the result of --

13 MR. CHRISTIE: Not of regulations.

14 DR. KRESS: -- of having met adequate protection.

15 MR. CHRISTIE: No, they're not the result of
16 regulations. All the plants that are a result of
17 regulations plus all the other things we do to make the
18 plant run well -- and adequate protection is, if you had a
19 plant and it was done just to the regulations, what would
20 the level of it be?

21 Okay, the plants are probably an order of
22 magnitude --

23 DR. KRESS: It's the worst plant you could build
24 and meet the regulations; that's what you're saying.

25 MR. CHRISTIE: Not the worst plant; just a plant

1 built to the regulations. If you had to just sit down and
2 go to through the regulations and you took out all the other
3 things we do that aren't in the regulations, and make the
4 plant run better, et cetera, et cetera --

5 DR. KRESS: That's what your delphi says.

6 DR. WALLIS: What would the level of protection
7 be?

8 MR. CHRISTIE: Right, what would the level of
9 protection be?

10 DR. WALLIS: Adequate is superfluous.

11 MR. CHRISTIE: If we define adequate protection --

12 DR. WALLIS: Real protection, is what you're
13 saying.

14 MR. CHRISTIE: It's not the real. The real
15 protection consists of the piece that comes from regulation
16 and the piece that come from without the regulations.

17 And the piece without the regulations is what has
18 driven us down to probably an order or two magnitude below
19 the safety goals, not the regulations.

20 DR. APOSTOLAKIS: So what you're saying is that
21 what you found was that the adequate protection level was a
22 factor of 20 to 30 higher than the goal?

23 MR. CHRISTIE: Give or take.

24 DR. APOSTOLAKIS: Twenty to 30.

25 MR. CHRISTIE: Somewhere in there.

1 DR. APOSTOLAKIS: Do you have a document where you
2 describe this?

3 MR. CHRISTIE: No.

4 DR. APOSTOLAKIS: Do you plan to have one?

5 MR. CHRISTIE: I'm not sure why I would.

6 DR. WALLIS: Because it makes your conclusion more
7 believable.

8 MR. CHRISTIE: Again, we'll talk to you later.

9 DR. APOSTOLAKIS: We'll talk later.

10 MR. CHRISTIE: Okay, so the first place is -- and
11 over the weekend, the comments that you see have been
12 reviewed. The comments that you see are my comments, but
13 they have been reviewed by the other people in the meeting
14 that were vocal enough to get up and speak.

15 They've changed my comments, not substantially,
16 but in many cases, they are people better with words than I
17 am, and so it represents a composite of a lot of people that
18 were there.

19 Okay, let me emphasize, beyond a shadow of a doubt
20 -- and we told everybody in the meeting that the absolute
21 emphasis we saw in the meeting on adding requirements was
22 unacceptable to us, because that's what we saw in the
23 meeting. The framework, and especially the 50.44, just
24 added requirements to us. And if you want to get me mad
25 again, you can make me bring up the examples of why I

1 thought that.

2 But I don't think you want to do this. We did it
3 in one public meeting, and that was bad enough. Two would
4 be a little bit more.

5 But the staff is well aware of what we were
6 thinking. Now, Nick Grantom brought up absolutely that this
7 thing is critical to everything, not just to Option 3.

8 If you look at what's happening to the South Texas
9 Project, what you're seeing there, especially if you look at
10 the request for additional information, that the South Texas
11 people are now responding to, you will see clearly in there
12 that the intent of many of those questions is to preserve
13 the design basis, control to the design basis, and if you
14 identify anything in the PRA that is safety significant in
15 our terminology, then what you will do is, you will control
16 it just like if it were in the design basis space.

17 And that is completely unacceptable to us. If
18 there are no elimination requirements, then why are we doing
19 all this?

20 DR. WALLIS: You see this as an additional
21 requirement then?

22 MR. CHRISTIE: If you will read the request for
23 additional information in South Texas, you will find that
24 there are add-ons, lots of them. And the way that they want
25 to treat the add-ons is that they want to treat them just

1 like the things.

2 Now, we've been assured by the staff, some of the
3 staff, that that is not the intent of those questions, and
4 that we are getting a little bit bent out of shape because
5 we're reading them incorrectly.

6 But when I read the words, just like I read the
7 words in 50.44 last Thursday night, coming from the staff, I
8 read words and I work off of those words. And I know that
9 the staff, especially in Option 2, is really seriously
10 trying to help and not create extra burden for us.

11 But that's not what's coming across. And it
12 didn't come across last Thursday or Friday, either. So,
13 eliminating requirements is very crucial to us. Rick gave a
14 couple of options to the staff, probably in the wrong
15 meeting, as to what we're expecting on the Option 2 part.

16 There's a PRA uncertainty issue, and, ladies and
17 gentlemen, you can read my comments. My comments are the
18 same comments that you heard from Dr. John Garrick when you
19 had the joint ACNW/ACRS meeting.

20 To treat uncertainty, what you do is, you know the
21 factors that lead to the uncertainty, you know the magnitude
22 of the uncertainty, and you know how much impact it has on
23 the decision process.

24 If you know all that, then you can treat and
25 handle uncertainty.

1 CHAIRMAN POWERS: We have colleagues here that
2 have a variety of definitions of uncertainty. And they
3 distinguish between aleatory uncertainty and epistemic
4 uncertainty.

5 When we interrogate them on the epistemic
6 uncertainty, they say, oh, yes, but that also includes the
7 things that you have not modeled.

8 And so how do I know that uncertainty?

9 MR. CHRISTIE: Again, I have been doing risk
10 assessments now for 20 years. Almost every risk assessment
11 I have ever done includes uncertainty. How well we have
12 included that uncertainty and that risk assessment, again,
13 is in the eyes of the beholder.

14 We've spent enough money, we thought, to make the
15 decisions that were necessary to improve the plants and make
16 sure that the plants were working well.

17 I can't answer that. We'd spend days trying to
18 work on that question.

19 DR. SEALE: But it doesn't do us any good to spend
20 our time arguing that it's therefore an inappropriate
21 question to ask.

22 MR. CHRISTIE: Oh, I think the question of what is
23 the uncertainty in your probabilistic risk assessment is one
24 of the key questions that you have to answer, and you do the
25 best job you can to go through the facts, identify the

1 factors, try and quantify the magnitude of the uncertainty,
2 and then see how it hits the -- influences the decision
3 process.

4 But the key is the decision process, not spending
5 millions and millions of dollars reducing uncertainty.

6 Once you get those factors down, if you can, and
7 -- again, it will be in the eyes of the beholder, how well
8 you get it down -- but it's the guys who've got the money
9 that basically have to make the decision.

10 DR. KRESS: But there has to be some guidance then
11 to the decisionmakers on how to use uncertainty in their
12 decisionmaking process.

13 MR. CHRISTIE: Again, I was a participant in the
14 PRA Procedures Guide. We put guidance in there on how to
15 treat uncertainty. If we did a bad job, I haven't heard
16 about it.

17 You know, what we would add to it today, I don't
18 know. Probably we would add some things to it, because
19 we're theoretically 20 years smarter.

20 But if you want to go back and say in the PRA
21 Procedures Guide, let's change the guidance on uncertainty,
22 then, fine, you know, put together another ASME, ANS, and RC
23 program and we can go do it.

24 DR. KRESS: I'm interested in guidance to the NRC
25 staff on how they should use the uncertainty, assuming they

1 had relatively good numbers for it.

2 MR. CHRISTIE: Oh, okay.

3 DR. KRESS: This is a different subject.

4 MR. CHRISTIE: Could be. I'm not sure we --
5 George, I think we did.

6 DR. APOSTOLAKIS: You answered the question.

7 DR. KRESS: You answered it pretty good.

8 DR. APOSTOLAKIS: And we are running out of time.

9 MR. CHRISTIE: Single-failure, hey, we don't need
10 single-failure in this framework document. You know, I
11 mean, we've got PRAs. They do single-failure,
12 double-failure, triple-failure, they do common cause, they
13 do dependent failures, they do anything you want them to do,
14 and they do it better than anything I've ever seen before,
15 and I have done them both.

16 So, to try and add single-failure into some
17 framework for writing regulations today is, to me -- we're
18 wasting our time, in my opinion.

19 The same thing would go for design basis. There
20 are some pieces of the design basis stuff that works, and
21 we'll keep, but let's go to risk-informing 50.44.

22 As you probably know, there is a petition for
23 rulemaking that went into the Federal Register January 12th
24 on 50.44. It completely stripped all the design basis stuff
25 out of the proposed rule.

1 It was not relevant to public health risk, and we
2 just stripped it out.

3 DR. WALLIS: It just seems to me, the biggest
4 difficulty to risk-informing 50.44 or any other regulation
5 is that the objective of the regulation is not cast in risk
6 language. So you don't know what goal you have in terms of
7 the language you're trying to use.

8 MR. CHRISTIE: Dr. Wallis, I recommend that you
9 read the petition for rulemaking, and see if we did the job
10 of phrasing it in risk. This is our attempt.

11 DR. WALLIS: You did it?

12 MR. CHRISTIE: Yes, well, myself and a bunch of
13 other people. It come from us, comes from people that have
14 done risk assessment.

15 DR. WALLIS: You don't find in 10 CFR, blah, blah,
16 blah.

17 MR. CHRISTIE: You do find in 10 CFR, some, 50.63
18 station blackout, risk, right; 64 is risk. Oh, yes, it's
19 got elements of risk in 50.63.

20 DR. WALLIS: But it's not quantified.

21 MR. CHRISTIE: No, not quantified numbers, but it
22 has elements of risk to it. So, you know, we've done that,
23 put in the 10 CFR, elements of risk. Have we done it
24 successfully and well? Again, it's in the eyes of the
25 beholder.

1 Big issue in the meeting last Friday -- and you
2 can talk to some other people about it, because I don't like
3 talking about it anymore -- we did simplify the procedures
4 at Arkansas and San Onofre. It was a risk-positive move.

5 It was approved by the Nuclear Regulatory
6 Commission in the safety evaluation report, and if you read
7 the document, you will see that that may not have been true
8 to the people that wrote this document on 50.44, which
9 caused quite a bit of tempest.

10 I would have to say, and I haven't been to all NRC
11 meetings, but the meetings on Thursday and Friday and the
12 workshop were the most contentious meetings I have been in a
13 long time. We had people way past the bounds, myself
14 included, okay? It's one point in time I sat down and shut
15 up because all I was doing was adding to the gasoline, and I
16 will say it to the NRC people that are here today -- I got a
17 letter -- Tom King -- I meant no disrespect to you people or
18 to you national lab people by my silence.

19 DR. APOSTOLAKIS: So where can we find all this
20 information?

21 MR. CHRISTIE: It is in the framework document and
22 in the 10 CFR document, the things that they handed. It
23 came in a package.

24 DR. APOSTOLAKIS: But you are summarizing this
25 contentious meeting?

1 MR. CHRISTIE: Right, I am summarizing some of the
2 issues in the contentious meeting and my words that
3 accompany these slides.

4 DR. APOSTOLAKIS: And you are trying to be fair,
5 presenting both sides?

6 MR. CHRISTIE: I am never fair.

7 DR. APOSTOLAKIS: Okay. But you are very honest.

8 MR. CHRISTIE: I hope so. Okay. It became clear
9 to us that some part of the NRC was to put all plug igniters
10 for the large dry containments. That's already been through
11 the process, the 1509. It shouldn't even enter in at all to
12 any criteria or anything with respect to rewriting 50.44.

13 The hydrogen monitoring issue, again we find no
14 safety reason for hydrogen monitoring in any of the plants,
15 period. Okay? There's a lot of operational concerns for
16 hydrogen monitoring but they are operational concerns and
17 they have nothing to do with what we call adequate
18 protection of public health and safety. They have to do
19 with operational concerns. They are not the primary
20 parameter for any action that we know of taken in the
21 plants.

22 DR. KRESS: You are defining adequate protection
23 in terms of the QHOs in this case?

24 MR. CHRISTIE: No. I am defining adequate
25 protection in terms of is this a primary parameter that I

1 would have to have to guarantee that things work the way
2 they should work, and hydrogen monitoring is not one of
3 them, to the best of our knowledge.

4 We do lots of things in the emergency operating
5 instructions or some people call them emergency operating
6 procedures. We have lots of accident management guidelines,
7 et cetera, et cetera, but it is not a key ingredient that
8 would cause us to do anything different.

9 If Dr. Wallis is correct, if we removed all
10 hydrogen monitoring from the plant, the plants would do the
11 things that they are doing and probably without it -- the
12 same actions would be taken. Okay?

13 The last one is long-term hydrogen. Again, some
14 of the people in this room were involved in San Onofre. It
15 was a concern that was brought up. The Safety Evaluation
16 Report was written for San Onofre on the basis that the
17 hydrogen monitoring and the long-term hydrogen recombiner
18 issues were put to bed except when the SER was issued the
19 recombiners were declared non-safety and hydrogen monitors
20 were not.

21 We still have hydrogen monitors safety-related at
22 San Onofre. In the petition for rulemaking we would no
23 longer have that if that petition for rulemaking were to go
24 through.

25 DR. WALLIS: Well, if you are right that having

1 hydrogen measurements has no effect, then you don't need to
2 be risk-informed to decide you don't need it.

3 MR. CHRISTIE: No, the basis that we got to to
4 decide on what the primary measures were was a risk informed
5 affair. You could not do that decision -- we would not have
6 made the decisions we made, for instance to basically depend
7 on reactor vessel level, thermocouples in the core,
8 radiation monitors around the core, radiation monitors in
9 the containment, pressure and temperature in the
10 containment, et cetera, et cetera, if we hadn't done all the
11 risk assessments and ran that kind of thinking process
12 through well, what is it that we really want to do.

13 For instance, on hydrogen monitoring, we can have
14 sequences where we will completely wipe out the core or put
15 it on the floor and the amount of hydrogen won't be much at
16 all. Your design basis LOCA without any safety injection,
17 for instance, is probably the classic example. We melt the
18 core with no water on it. We won't have any zirc water
19 reaction and we won't have any hydrogen but that core will
20 be on the floor.

21 DR. WALLIS: You'll be making hydrogen from the
22 concrete -- but we are getting into too many details.

23 MR. CHRISTIE: Yes, but when we, by the time we
24 get to hydrogen -- the corium on the floor -- is there
25 anything that the operators haven't done already to retain

1 the containment capability such as the sprays, et cetera, et
2 cetera? Would they do anything different? They have
3 buttoned it up. They have turned on all the active heat
4 removal systems, et cetera, and Adrian -- where is Adrian?

5 DR. APOSTOLAKIS: Yes, Adrian --

6 MR. CHRISTIE: I'm sorry, Adrian, I, as always in
7 these ACRS meetings, I went over.

8 DR. APOSTOLAKIS: Are you finished?

9 MR. CHRISTIE: Yes, I am finished.

10 DR. APOSTOLAKIS: Thank you very much, Bob.

11 MR. HEYMER: My name is Adrian Heymer. I am from
12 NEI. I am a Project Manager. I have been working on and
13 off on risk informed activities at NEI since about 1993 and
14 I guess I first used PRA in the field in about 1977 in a
15 different country at a different time and a different place.

16 I just want to say a few words to clarify some
17 issues. It may have been a boisterous workshop last week,
18 but I think it was very beneficial and this meeting today
19 has been -- the more you discussed this, the more I learned.
20 I think when you look at the framework and you look at the
21 slide that the NRC put up with the framework, the one that
22 had the defense-in-depth box, I think that is a very good
23 start.

24 I think it may not be perfect but it is a good
25 start from which we can build. I think it is true the

1 industry were confused by some of the statements -- like the
2 defense-in-depth box. We struggled with that a bit.

3 We are sending a document out to get some formal
4 industry feedback and we will be passing that on to the NRC.

5 I think the term "single failure" that is also put
6 in there we also found a little confusing.

7 As to is there a general agreement on the
8 approach, the guidelines and the framework, I am not quite
9 sure what that entails. It seems to be a big box of things
10 to say there is a general agreement on. I think we have got
11 a good starting point. I think the NRC Staff have done a
12 very creditable job in getting to where they have got to
13 today. They have set themselves a very aggressive schedule
14 on 50.44 and they have gone through this process and they
15 have come to the conclusion, very much the same conclusion
16 as the industry reached when it sent a letter to -- and we
17 sent a letter to Chairman Meserve January the 19th, and I
18 can make a copy of that available if you don't have one,
19 which summarized the results of the survey the industry did
20 at the back end of last year on where should we focus our
21 efforts, from the benefits side, on risk informed
22 regulation, the technical aspects.

23 We came up with a conclusion that it is 50.44
24 because we have already done a fair bit of work on that.
25 That is work that went as an example to see how far we can

1 get, set a timeline, reach a decision, and move forward, and
2 the next one, which is a lot more complex, is 50.46, which
3 really -- it's been said here before -- the regulations are
4 like a carpet. They interweave and they are all dependent
5 upon each other, but if you don't look at what you can do
6 with 50.46 first when you look at the other regulations, you
7 tend to get locked back into 50.46.

8 MR. BARTON: What is 50.46, Adrian?

9 MR. HEYMER: The ECCS performance.

10 MR. BARTON: Okay.

11 CHAIRMAN POWERS: Let me ask you a question.
12 Because the plants have been built, so many of them have
13 been built, and they have been built to comply with 50.46,
14 suppose I changed that regulation radically. Would I really
15 have any impact on the industry at all?

16 MR. HEYMER: Yes, I think you do as regards some
17 of the day-to-day activities, as regards to the ability to
18 reassess where you stand as regards -- as it cascades down,
19 perhaps not just from 50.46 but as it cascades down to some
20 of the other regulations.

21 CHAIRMAN POWERS: I think I might concede to you
22 the point on cascading down.

23 MR. HEYMER: Yes.

24 CHAIRMAN POWERS: But the regulation itself I
25 don't think gets you very much.

1 MR. HEYMER: But the issue I am trying to drive at
2 and we are trying to drive at from an industry perspective
3 is that unless you find out what you can do with 50.46, when
4 you go to these other areas and try and determine what you
5 can do with that, you get locked back up into 50.46 -- it's,
6 if you like, a central regulation.

7 CHAIRMAN POWERS: I think that's true. I can
8 imagine it's true. I haven't shown that for myself, but it
9 seems to me that if I were going to do something like that
10 that I would start with the GDCs.

11 MR. HEYMER: Well, you can start there. It's just
12 the fact that the GDCs are -- there's not too much in the
13 GDCs that you have to change. It's in the implementing
14 documents that you would have to change, but they are linked
15 back to 50.46 in itself.

16 CHAIRMAN POWERS: I think the GDCs link back to a
17 good deal more than 50.46.

18 MR. HEYMER: They do, but a lot of what you might
19 want to change or end up changing can be linked into 50.46
20 and it provides what the industry believes is a significant
21 stepping stone to moving on, not only in the other
22 regulations but to reassess the plant and make improvements
23 in the plant.

24 I think once you have sorted 50.46 out, then you
25 have got a clear path to where you need to put your

1 priorities for the other regulations.

2 CHAIRMAN POWERS: Okay. I'll think about that a
3 lot, but I have always kind of looked at 50.46 not so much
4 as having an impact but rather being a demonstration of
5 commitment rather than having any impact simply because
6 plants are already built and already has an ECCS system that
7 obviously meets the requirements of 50.46 and they probably
8 are not going to change that very much. The problem is it's
9 already fixed.

10 Now you may be right -- they back off on a lot of
11 things they maintain about it and there are other things
12 they do that are hooked to it, but it wasn't first on my
13 list.

14 MR. HEYMER: Okay. I think the point has been
15 made fairly forcibly a few moments ago and also in the
16 workshop there are some items that are in the guideline
17 documents and the material that was handed out that we will
18 comment on as an industry and I think that is expected and
19 we will provide those comments.

20 I think it is important not to revisit issues past
21 unless there is really good reason to.

22 I would like to say a word about an additional
23 activity that is being progressed, which I think some people
24 in this room are aware of associated with Generation 4
25 plants, and that is really starting off with a clean sheet

1 of paper and saying where do we go with the regulations.

2 There was a debate at senior levels within the
3 industry on should we try that approach, and the feeling was
4 no, because we want to have, if you like, two sides. We
5 want one side that can benefit existing plants and it was
6 just felt that starting off with a clean sheet of paper,
7 one, it might take us some time to get there, and two, it
8 might be difficult to translate those into the current
9 fleet, but that is going on and I see that as being another
10 activity which helps to improve the regulations and focus on
11 the right stuff.

12 I do think we have made a reasonable start. I
13 think we are impressed with the schedule that the Staff has
14 put down and placed and we hope they keep to that schedule
15 and it is good they have broken down 50.44 and 50.46 into
16 chunks to look at, and that is probably a good thing to do,
17 but we are looking for some good management to drive itself
18 to a conclusion so that we don't continue to evaluate and
19 evaluate and evaluate. There comes a time when you have to
20 draw a line.

21 Finally, we do need a success in risk informed
22 regulation and we would go for a small success rather than a
23 big success. At the workshop I said we would take a field
24 goal over a touchdown, taking the liberty to put it in
25 American football terms, but there --

1 DR. WALLIS: What's a field goal?

2 [Laughter.]

3 MR. HEYMER: There are a lot of skeptics out there
4 on risk informed regulation and I think we need to get a
5 success on the board, and I think the NRC Staff is trying to
6 work towards that.

7 DR. APOSTOLAKIS: So are you implying that there
8 have been no successes yet?

9 MR. HEYMER: I think from where the industry
10 stands at the moment they look at risk informed regulation
11 and they say, well, what is risk informed regulation? Some
12 people think, well, I might consider ISI and IST as a
13 partial success but I think I could go a lot further than
14 what we have done in the past.

15 If you mention the maintenance rules, executives
16 tend to rise out of their chair very much like other people
17 do on some issues associated with 50.44, and so that is not
18 considered a success from the industry perspective, and
19 there was a flavor -- I don't think it was meant or intended
20 at the workshop -- that was mentioned before about adding
21 on, and it was suggested there is also elimination, and I
22 think that point was taken by the NRC as improving is
23 eliminating as well as improving -- adding on -- if there is
24 need to add on at all.

25 I guess the other point that was made at the

1 workshop and hasn't been brought up here, if you are going
2 to add on, you must be careful not just to add on but you
3 mustn't pile on, and there is a temptation to sometimes do
4 that on voluntary efforts. I think that has been kept in
5 check in the past and it will be in the future.

6 DR. APOSTOLAKIS: You think this is voluntary, eh?

7 [Laughter.]

8 DR. APOSTOLAKIS: This is a personal view. It
9 does not reflect anybody else's view.

10 Mr. Heymer, do you have anything else to say that
11 you think is extremely important?

12 MR. HEYMER: That's it.

13 DR. APOSTOLAKIS: Okay. Thank you very much for
14 coming here. Back to you, Mr. Chairman.

15 CHAIRMAN POWERS: I will recess the committee
16 for -- till ten minutes of the hour and that will conclude
17 the transcription service.

18 [Whereupon, at 3:35 p.m., the transcribed portion
19 of the meeting was concluded.]

REPORTER'S CERTIFICATE

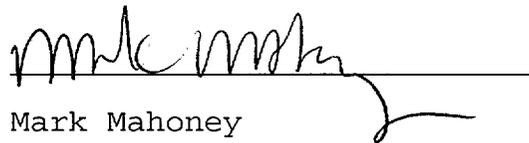
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CASE NUMBER:

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.



Mark Mahoney

Official Reporter

Ann Riley & Associates, Ltd.

ACRS Full Committee Meeting

Risk-Informing the Technical Requirements of 10CFR50

March 1, 2000
Two White Flint, Rockville, MD

Bob Christie

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Framework for Risk-Informed Regulation

General approach

Eliminating requirements

PRA uncertainty

Single failure

Risk-Informing 10CFR50.44

Simplification of procedures

Glow-plug igniters for large dry containments

Hydrogen monitoring

Long term hydrogen

RJC
2/29/00

Comments of Bob Christie, Performance Technology, on document

"Framework for risk-informed regulations"
(handed out in public meeting 2/24/00)

1. It is very unclear what general approach is to be used to evaluate risk-informed regulations. My interpretation is that the proposal is a combination of risk-informed and performance-based approaches that depends on some form of goal allocation.

It appears to me that the proposal starts with the NRC 1986 Safety Goals for the Operation of Nuclear Power Plants: Policy Statement, and tries to allocate goals starting from the Quantitative Health Effects Objectives (QHOs). This is done even though the proposal recognizes that the Quantitative Health Effects Objectives were a measure of how safe is safe enough and not as a measure of adequate protection of public health and safety. Page 14 has the following statements: "The quantitative health objectives are the highest level quantitative goals. The QHOs were originally set as a measure of 'safe enough,' and in that sense they go beyond adequate protection. Given this position of the Commission, there are no risk arguments for setting quantitative goals more stringent than the QHOs."

The process appears to sub divide the QHOs into a Prevent (Core Damage Frequency less than or equal $1E-4$ /year) and a Mitigate (Conditional Early Fatality Probability less than or equal 0.01). See page 10. As I stated in the meeting on February 25, such a sub division violates the statement on page 14 because a core damage frequency less than or equal $1E-4$ /year is more stringent than the QHOs. As I also stated in the meeting, I do not know whether a conditional early fatality probability of 0.01 would be more stringent than the QHOs. It would depend on the nuclear unit.

To summarize my thoughts on the overall approach in the framework document, I would have to say the overall approach is not clear and certainly needs a lot of work. Any approach taken to define regulations for commercial nuclear electric power units must start using the basis of "adequate protection of public health and safety." The Quantitative Health Effects Objectives of the NRC 1986 Safety Goals for Operating Nuclear Power Plants are clearly a useful tool in determining the effectiveness and efficiency of regulations but they can not be used as the basis for regulation because as noted in the framework document, the QHOs go beyond adequate protection.

In 1997 I recommended a "Whole Plant" approach to evaluating the effectiveness and efficiency of NRC regulations in 1997 through the use of pilot plants. The

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approach that was recommended in 1997 would have evaluated the impact of the pilot plants on the health and safety of the public using the parameters of immediate fatalities and latent cancer fatalities as done in the NRC 1986 Safety Goals for the Operation of Nuclear Power Plants. The "Whole Plant" pilot program would have identified performance with respect to these two parameters and considered where the performance was with respect to the QHOs, Emergency Response, Large Early Release Frequency (Release Categories), the Core Damage Frequency (Plant Damage States), system/train conditional probability of success/failure (Top Events), etc. In the Whole Plant pilot studies, there was to be no attempt to subdivide and allocate goals to lower measures but just to know the relationship of the actual performance of equipment and people to the overall impact, from the highest measure to the lowest measure. Plant personnel were to make decisions at the lowest level that was possible and still come up with an effective and efficient decision with respect to the overall impact. I believe the framework document discussed in the meeting last Thursday and Friday could make good use of the approach recommended in 1997.

2. The framework document could be rewritten to have more emphasis on the fact that by eliminating requirements we can have a positive impact on public health risk. Any effort where we can improve the effectiveness and efficiency of regulations by eliminating requirements should be a high priority effort no matter how "small" the improvement. Along these lines, we should have a priority on eliminating requirements that don't have much impact on public health and safety either way, positive or negative.

We should have regulations that focus on the most significant equipment and practices with respect to public health risk. Less significant equipment and practices do not need regulations and NRC oversight. Such less significant equipment and practices are best left to the owners of the nuclear unit who are in the best position to make effective and efficient benefit/cost decisions in this area.

3. There seems to be a attitude in the proposed framework document that there are a lot of uncertainties in Probabilistic Risk Assessment and that we therefore have to take "conservative" measures to make up for the uncertainties. The framework document uses the terminology defense-in-depth for this belief.

There have always been uncertainties in the safety evaluations of nuclear electric generating units. In the past, the deterministic, prescriptive evaluations ignored the uncertainties because the calculations were "conservative." The accident at Three Mile Island 2 in March 1979 demonstrated that the deterministic, prescriptive evaluations which ignored the uncertainties were not as complete as Probabilistic Risk Assessments.

Probabilistic Risk Assessments identify and quantify uncertainties. This is one of the major advantages of PRA. In my opinion, we would do better in the

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framework document to state that the evaluations should identify and quantify the uncertainties. The decision process could then proceed with full recognition of the uncertainties. In my opinion, to claim that there is some defense-in-depth philosophy that will always make "conservative" decisions which will account for the uncertainties in Probabilistic Risk Assessments, is technically flawed.

The only way to handle uncertainties is to know what factors account for the uncertainties, how large are the uncertainties, and how much impact the uncertainties have on the decision process. Probabilistic Risk Assessment enables decision makers to quantitatively balance competing criteria and make a decision in the context of the overall process. Probabilistic Risk Assessment is the best tool to evaluate public health and safety. One of the reasons that this is true is that Probabilistic Risk Assessment addresses uncertainties.

4. Just as Probabilistic Risk Assessment addresses uncertainties, it also addresses the number of failures that lead to top events. This can be single failures, double failures, triple failures, etc. These failures can be combinations of equipment failures and failures by humans. Probabilistic Risk Assessment also addresses dependent failures (support system failures, common cause failures, etc.). Probabilistic Risk Assessment can also evaluate the timing of sequences of failures/successes through such techniques as recovery actions or phased approaches. All of these failures/successes can be addressed in the Probabilistic Risk Assessment and the relative importance of each failure/success evaluated.

There should be no attempt to bring over the "single-failure" requirements from design basis accident analysis. In my opinion, any effort devoted to the use or modification of the "single-failure" requirements from design basis accident analysis in this task to risk-inform the regulations will detract from the overall effort.

In the past, redundancy and diversity requirements and the application of the "single-failure" rule served the nuclear plants well but they were an "overkill" in some areas and an "underkill" in other areas. It is time to move on to better techniques.

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Comments of Bob Christie, Performance Technology, on document

"Risk-Informing 10CFR50.44"
(handed out in public meeting 2/24/00)

1. The argument in the San Onofre submittal of September 10, 1998, that the simplification of the Emergency Operating Instructions, achieved by the removal of instructions for hydrogen recombiners and purge-repressurization systems would, by itself, increase safety by removing a distraction from more critical operator actions was made with deliberate consideration of all the all relevant material at San Onofre by qualified personnel. The NRC Safety Evaluation Report written for the submittal concurred that the changes in the submittal were risk beneficial. There should be no statement in the document handed out in the meeting that this argument is questionable.

The safety significance of the safety increase (risk reduction) from the simplification of the Emergency Operating Instructions due to elimination of hydrogen control requirements will vary from nuclear unit to nuclear unit. In the case of San Onofre, the safety significant was qualitatively evaluated by personnel at the plant. As a single stand alone item at San Onofre, in the overall context of adequate protection of public health and safety, the simplification is probably of "small" safety significance. However, as an indication of the ability of personnel at San Onofre to strive for continuous improvement in all aspects of plant operation, the safety significance is high.

The nuclear industry should not be in the position of ignoring changes to the NRC regulations that might have a positive impact on adequate protection of public health and safety just because the change has "small" safety significance. If the nuclear industry is to survive and prosper in an economically deregulated electric power industry, any regulation that distracts plant personnel from items of safety importance at the nuclear unit must be changed. NRC personnel and nuclear plant personnel must become accustomed to the process of "continuous improvement."

2. There should be no regulation with a requirement for large dry containments to withstand a hydrogen burn from an amount of hydrogen equivalent to that generated from a metal/water reaction involving 75% of the cladding surrounding the active fuel region. This is the requirement for "glow-plug igniters." This requirement has been evaluated for large dry containments per 10CFR50.109 and found to not meet the criteria necessary to impose the requirement.

The NRC Safety Evaluation Report for the San Onofre submittal of September 10, 1998, contains the following statement: "Although hydrogen igniter systems

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would provide added confidence that containment integrity can be maintained during hydrogen burns, Generic Issue (GI) - 121, 'Hydrogen Control for PWR (Pressurized Water Reactor) Dry Containments,' found that hydrogen combustion was not a significant threat to dry containments and concluded there was no basis for new generic hydrogen control measures (i. E., igniters).

If the staff of the Nuclear Regulatory Commission have specific concerns with any nuclear unit with respect to combustible gas control and wish to impose any new requirements, they should follow the directions contained in 10CFR50.109.

3. In my opinion, any existing regulations for hydrogen monitoring inside containment for the Mark I and Mark II BWRs should be deleted. These nuclear units have their containments inerted. To the best of my knowledge, there are no actions to be taken by the operators during severe accidents that would impact the course of the severe accident and which depend on knowing the hydrogen concentration inside the containment. Hydrogen concentration inside containment is, at best, of secondary importance with respect to the parameters that allow the operators to take appropriate action during severe accidents. Other parameters are used to instruct the operators what actions to take during severe accidents.

The existing regulations for hydrogen monitoring inside containment for large dry containments should be deleted. There are no glow-plug igniters to activate. The existing capability of the containments allows the containment to withstand hydrogen burns. The existing systems to mix the containment atmosphere and the existing systems to remove heat from the containment do not depend on the operators knowing the hydrogen concentration. To the best of my knowledge, there are no actions to be taken by the operators during severe accidents that would impact the course of the severe accident and which depend on knowing the hydrogen concentration inside the containment. Hydrogen concentration inside containment is, at best, of secondary importance with respect to the parameters that allow the operators to take appropriate action during severe accidents. Other parameters are used to instruct the operators what actions to take during severe accidents.

Without the existing regulations for hydrogen monitoring inside containment, the owners of the nuclear units will have the option of keeping and maintaining the existing hydrogen monitoring equipment, replacing the existing hydrogen monitoring equipment with more state of the art digital equipment, leaving the existing equipment in place, after proper precautions are taken, but not maintaining the equipment, or removing the existing equipment. The decision as to what course of action to pursue is with the owners of the nuclear unit who are in the best position to determine the benefit/costs of the options available. The existing hydrogen monitoring equipment has no impact on adequate protection of public health and safety. Decisions as to what to do with the existing hydrogen monitoring system is an operational decision, not a safety-related decision.

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4. The argument is made in the document that hydrogen monitoring and hydrogen recombiners could have some impact on long term hydrogen control in large dry containments following damage to the reactor core. Such equipment was used in the long term following the accident at Three Mile Island 2 in 1979.

Again, these concerns are operational concerns which have no impact on adequate protection of public health and safety. Decisions as to what to do with existing hydrogen monitoring systems, hydrogen recombiners, and hydrogen purge systems once the existing regulations are changed to make this equipment non-safety-related are best left up to the owners of the nuclear units.

Risk-Informing the Technical Requirements in 10 CFR 50

Presented to

Advisory Committee on Reactor Safeguards

March 1, 2000

Outline

- Status report on:
 - ▶ Scope, approach and progress in study to risk-inform 10CFR50 technical requirements
 - ▶ Results of public workshop on 2/24-2/25/00
 - ▶ Future plans

 - No letter requested from ACRS at this time
-

Background

- SECY-99-264
 - ▶ Plan and schedule
 - Feb 3, 2000 SRM
 - ▶ Approved plan
 - Workshop
-

Page 3

Scope

- Adding or modifying provisions to Part 50 allowing staff to approve risk-informed alternatives to current requirements, including
 - ▶ Revising specific requirements to reflect risk-informed considerations (regulations, regulatory guides, standard review plans)
 - ▶ Adding new requirements or expanding current requirements to address risk-significant issues not currently covered
 - ▶ Deleting unnecessary or ineffective regulations
 - Not covering Fire Protection or EP
 - Focus on requirements that have the most significant potential for improving safety and efficiency and reducing unnecessary burden
 - Focus on revising technical requirements (regulations, regulatory guides, standard review plan)
 - Retain design basis concept (i.e., risk-informed design basis)
-

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Approach Involves Two Phases:

- Phase 1: Identify and prioritize candidate design basis accidents (DBAs) and regulations (including their associated regulatory guides and standard review plans) for risk-informing, and identify proposed changes to requirements
- Phase 2: For proposed changes that are approved by the Commission, develop detailed technical basis and proceed with rulemaking

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Current Phase 1 Activities Include:

- Development of a framework for risk-informing regulations (including guidelines for defense-in-depth and safety margins)
- Selection of candidate regulations and DBAs
- Trial implementation: Risk-informing 10 CFR 50.44
- Trial implementation: Risk-informing special treatment requirements

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Framework for Risk-Informing 10CFR50

Framework Development:

- Maintain *goal* of “Protect Public Health and Safety”
- Develop an *approach* that builds upon defense-in-depth philosophy
- Implement *strategies* of defense-in-depth that maintain concept of prevention and mitigation and that are consistent with the safety goals and with the cornerstones
- Implement *regulations* that are risk-informed to ensure the strategies are met
- Define *tactics* for carrying out the strategies and defining the requirements in the regulations

Therefore,

⇔ *Need working definition for “defense-in-depth”* ⇔

Defense-in-Depth

- **Commission:** *“Defense-in-depth is an element of the NRC’s Safety Philosophy that employs successive compensatory measure to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility. The defense-in-depth philosophy ensures that safety will not be wholly dependent on any single element of the design, construction, maintenance, or operation of a nuclear facility.”*
 - **ACRS: May 19, 1999 Letter to the Commission**
 - ▶ **Current view (structuralist)**
 - Defense-in-depth embodied in the structure of the regulations and facility designs
 - Requirements based on repeating the question, “what if this barrier fails?”
 - ▶ **Risk-based views (rationalist)**
 - Base regulations on risk information, with defense-in-depth employed only where necessary to compensate for uncertainty or incompleteness in knowledge
 - ▶ **Recommendation: Use a structuralist view at a high level and a rationalist view for implementation , that is:**
 - Maintain defense-in-depth principles
 - Use risk information to assess the effectiveness of defense-in-depth layers
-

Defense-in-Depth: working definition

- *The application of multiple measures to prevent or mitigate accidents using the following four strategies to protect the public:*

Preventive

- (1) limit the frequency of accident initiating events
- (2) limit the probability of core damage given accident initiation

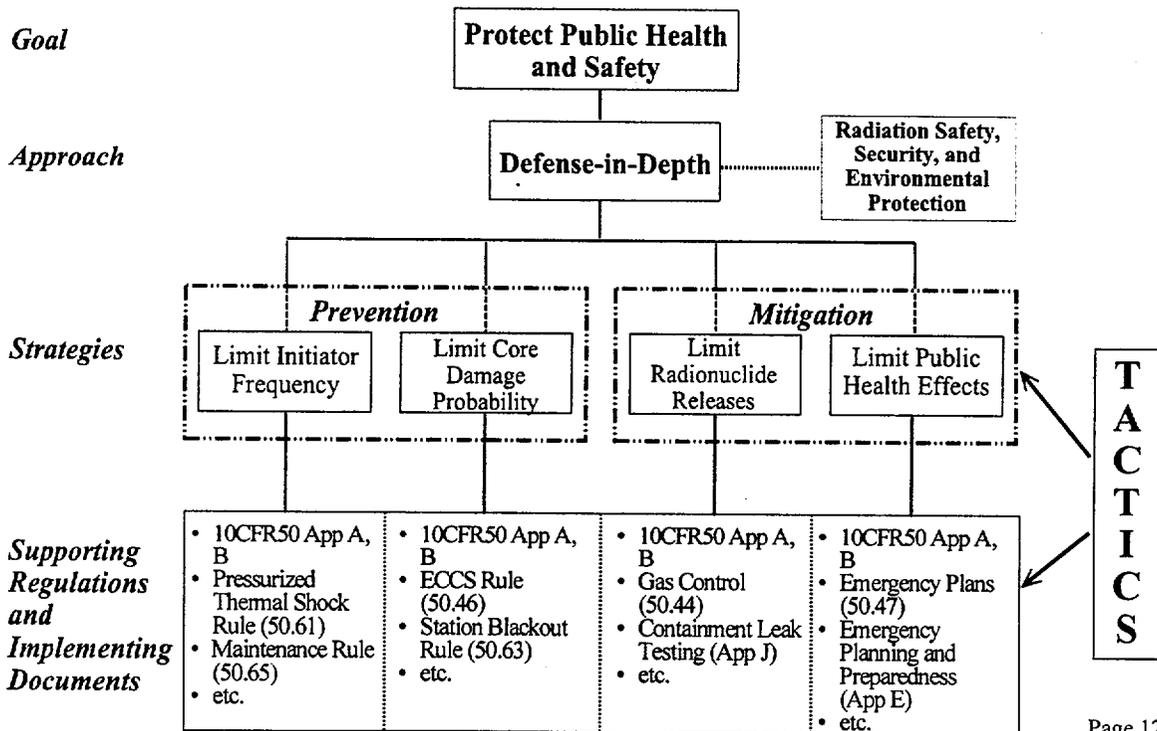
Mitigative

- (3) limit radionuclide releases during core damage accidents
 - (4) limit public health effects due to core damage accidents
-

Defense-in-Depth Implementation Principles

- Contains deterministic and probabilistic elements
- Retain single failure criteria concept
 - ▶ Apply to active and passive components?
- Degree of defense-in-depth will be dependent upon degree of uncertainty
- Preserve a reasonable balance between the four strategies
- Maintain high integrity of barriers
- Maintain good engineering practices
- Maintain emergency planning

Framework:



Use of Tactics

Tactics are tools embodied in regulations that enable meeting the defense-in-depth strategies

- There are numerous tactics that can be employed
- An optimum set, as opposed to a complete set, is desired
- Many tactics are applicable to more than one of the defense-in-depth strategies
- Current regulations employ most of the tactics to be considered, though not always in an optimal way
- Generally, tactics are employed to:
 - ▶ Improve the reliability/availability of SSCs (or reduce uncertainties)
 - ▶ Improve the likelihood that the success criteria will be met (improved confidence)
- One of the most important tactics is the use of *safety margins* to provide confidence in the regulations that are produced

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Examples of Tactics and Related Regulatory Documents

- | | |
|-----------------------------|------------------------|
| ■ Safety Margin | Embedded in many regs |
| ■ Single Failure Criteria | Pt. 50 App A |
| ■ Redundancy | GDC 34, 35, 41, 44, 55 |
| ■ Diversity | GDC 17, 55 |
| ■ Emergency Planning Drills | 50.47 |

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Safety Margin

- A measure of the conservatism employed in a design or process to assure a high degree of confidence that it will work to perform a needed function
 - Regulatory Requirements and Guidance
 - ▶ Acceptance Criteria (often qualitative)
 - ▶ Acceptance Methods for Demonstrating Compliance
-

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Safety Margin: Implementation

- Preserve key function goals, e.g.,
 - ▶ Prevent clad failure for AOOs
 - ▶ Prevent core melting and containment failure for DBAs
 - Apply safety margin to acceptance criteria and use best-estimate code calculations
 - Use quantitative approach for safety margin when possible (e.g., 95th percentile acceptance criteria based on best-estimate code calculations).
-

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Quantitative Goals for Risk-Informing Regulatory Requirements

Quantitative Health Objectives (QHOs)

Early Fatality Safety Goal
 $\leq 5E-7/\text{year}$

Latent Cancer Fatality Goal
 $\leq 2E-6/\text{year}$

(1) Prevention-Mitigation Assessment: Consider the Strategies in Pairs

Prevent	Mitigate
Core Damage Frequency $\leq 10^{-7}/\text{year}$	Conditional Probability of Individual Fatality $\leq 10^{-2}$

(2) Initiator-Defense Assessment: Consider the Strategies Individually (Preferred)

	Limit the Frequency of Accident Initiating Events (Initiators)	Limit the Probability of Core Damage Given Accident Initiation	Limit Radionuclide Release During Core Damage Accidents	Limit Public Health Effects Due to Core Damage Accidents
	Initiator Frequency	Conditional Core Damage Probability	Conditional Early Containment Failure Probability	Conditional Individual Fatality Probability
Anticipated Initiators	$\leq 1/\text{year}$	$\leq 10^{-4}$	$\leq 10^{-1}$	$\leq 10^{-1}$
Infrequent Initiators	$\leq 10^{-2}/\text{year}$	$\leq 10^{-2}$	$\leq 10^{-1}$	$\leq 10^{-1}$
Rare Initiators	$\leq 10^{-3}/\text{year}$	≤ 1	≤ 1	$\leq 10^{-1}$

Notes: The product across each row gives $\leq 10^{-6}/\text{year}$. Responding systems and procedures are not designed for rare events.

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Key Implementation Issues

- Application of single failure criterion
 - ▶ Active component
 - ▶ Passive components
 - ▶ Prevention versus mitigation
 - ▶ Reliability cutoff
- Application of quantitative goals
 - ▶ Initiating events
 - ▶ Accident scenarios
 - ▶ DBA
 - ▶ Consideration of LPSD and external event risk
 - ▶ Long term containment failure
 - ▶ Use of 10% of goals as guidelines for individual events/scenarios
- Implementation of risk-informed requirements
 - ▶ New requirement that would pass the backfit test would be mandatory
 - ▶ All other changes voluntary
 - ▶ Selective implementation, unless changes are related
- Consideration of uncertainties
- Consistent implementation of safety margin
- Other considerations
 - ▶ Worker protection
 - ▶ Relation to Option 2 scope

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Screening, Selection and Prioritization of Candidate Regulations (Requirements) and Design Basis Accidents

Selection Criteria for Candidate Regulations and DBAs

- Risk (safety) importance of regulation
 - ▶ Frequency of initiating events
 - ▶ CDF and LERF for event scenarios
 - ▶ Risk contribution of systems, structures or components
 - Regulation poses unnecessary burden to NRC or licensee relative to its risk significance
 - ▶ Methods, assumptions or acceptance criteria have excessive conservatism (e.g., excess safety margin)
-

Individual Criteria for Prioritizing Candidate Regulations

- Potential for improving safety; example:
 - ▶ High priority because substantial improvement is anticipated due to risk significance of the requirement and the large number of plants affected
- Complexity of the regulation; example:
 - ▶ High priority because minor change needed and no other related regulations impacted (i.e., easy to implement)
- Resources required for risk-informing the regulation; example:
 - ▶ High priority because small resources needed (both short and long term) and because of the large number of plants affected
- Potential for reducing licensee and NRC unnecessary burden; example:
 - ▶ High priority because implementation will significantly reduce unnecessary burden

Prioritization of Candidate Regulations -- Example

Candidate Requirements	Safety Significance of Regulation	Complexity of Potential Change	Resources Required to Implement	Unnecessary Burden Reduction	PRIORITY (preliminary)
	<i>High - HIGH</i>	<i>Small - HIGH</i>	<i>Small - HIGH</i>	<i>Large - HIGH</i>	HIGH
				<i>Small - LOW</i>	HIGH
			<i>Large - LOW</i>	<i>Large - HIGH</i>	HIGH
		<i>Large - LOW</i>	<i>Small - HIGH</i>	<i>Small - LOW</i>	HIGH/LOW
				<i>Large - HIGH</i>	HIGH
			<i>Large - LOW</i>	<i>Small - LOW</i>	HIGH/LOW
	<i>Low - LOW</i>	<i>Small - HIGH</i>	<i>Small - HIGH</i>	<i>Large - HIGH</i>	HIGH
				<i>Small - LOW</i>	LOW
			<i>Large - LOW</i>	<i>Large - HIGH</i>	HIGH/LOW
		<i>Large - LOW</i>	<i>Small - HIGH</i>	<i>Small - LOW</i>	LOW
				<i>Large - HIGH</i>	HIGH
			<i>Large - LOW</i>	<i>Small - LOW</i>	LOW
		<i>Large - HIGH</i>	HIGH/LOW		
		<i>Small - LOW</i>	LOW		

Preliminary Results

- High priority DBAs
 - ▶ Spectrum of pipe-breaks (50.46)
 - ▶ Rod-ejection accident (PWR)
 - ▶ Rod-drop accident (BWR)
 - ▶ ATWS power oscillations (BWR)
 - High priority 50.44 and 50.46
 - Other “prime candidates” from NEI survey
 - ▶ Codes and standards (50.55a)
 - ▶ Environmental and dynamic effects design bases (Appendix A, GDC 4)
 - ▶ Environmental qualification of electrical equipment (50.49)
 - ▶ Control room ventilation (Appendix A, GDC 19)
 - ▶ Electric power systems (Appendix A, GDC 17)
-

50.44 Preliminary Results

50.44: “Standards for Combustible Gas Control System in Light Water Cooled Reactors”

- Selected as a trial regulation for piloting the process of risk-informing Part 50
 - Promulgated to provide a means for the control of hydrogen gas that could evolve following a LOCA DBA and reduce the risk of a hydrogen deflagration or detonation that could threaten containment
 - Identified by licensees as a regulation containing non-risk significant requirements that pose unnecessary burden
 - Basis for staff’s approval of SONG’s exemption request, not plant-specific; application on a wider, generic bases
-

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50.44: Relationship to Framework

- Framework seeks to both *prevent* core damage accidents, and *mitigate* the public impact should a core damage accident occur
 - Rule promotes the mitigative strategy of “*containing fission products released in core damage accidents*”
 - ➔ regulation supports the strategy concerned with fission product containment by reducing the conditional probability of cotainment failure from hydrogen combustion
 - Rule fits framework by evolution, not by design:
 - Original rule emphasized mitigation of LOCA phenomena
 - Revisions focused on mitigation of degraded core accident phenomena
 - Assess rule to:
 - Eliminate any non-risk significant elements
 - Add missing risk-significant elements
 - Simplify to more effectively meet objective
-

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50.44: Technical Requirements

50.44 Requirement	Containment Type		
	Mark I and II	Mark III and Ice Cond	Large Dry
▪ Measure hydrogen concentration in containment	X	X	X
▪ Insure a mixed containment atmosphere	X	X	X
▪ Control combustible gas following LOCA (5% clad metal/water or 0.00023 in)	X	X	X
▪ Add high point vents	X	X	X
▪ Inert containment	X		
▪ Hydrogen control system to handle 75% clad metal/water reaction		X	

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50.44 -- Preliminary Evaluation

- Review requirements
 - Identify licensee implementation
 - Evaluate safety significance
 - Identify options for consideration and evaluation
-

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50.44 -- Preliminary Evaluation (Cont'd)

- **Measure H2 in Containment:** safety grade instrumentation for H2 and O2 measurement
 - ▶ H2 measurement capability has safety value for tracking and managing an accident
 - ▶ Some relaxation of the STR imposed on the equipment used
 - ▶ Allow "grab" sampling, determine where safety grade imposed and allow commercial grade instrumentation
- **Ensure Well Mixed Containment Atmosphere:** atmospheric mixing systems (fan coolers, sprays, air return fans, etc.)
 - ▶ Keeping a well mixed containment atmosphere without hydrogen stratification important to safety
 - ▶ Systems used for mixing are generally used for other functions
 - ▶ No changes proposed
- **Add High Point Vents:** high point vents in RCS
 - ▶ Assuring that adequate core cooling is not precluded due to H2 accumulation in the reactor coolant system has a high safety significance
 - ▶ High point vents are in place
 - ▶ No changes proposed

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50.44 -- Preliminary Evaluation (Cont'd)

- **Control Combustible Gas Concentrations in Containment**
Following a LOCA: safety grade H2/O2 recombiners, and safety grade H2 vent and purge systems
 - ▶ The safety significance, in terms of CDF and LERF, of control systems designed to deal with slowly evolving H2 subsequent to a LOCA appears to be quite low
 - ▶ These systems are not able to deal with the rapid H2 generation which could occur during a severe accident
 - ▶ The burden of maintaining as safety systems appears unnecessary from a risk-informed perspective
 - ▶ The ability to control more slowly evolving combustible gases may be desirable in the later stages of a core damage accident
 - ▶ Control could be achieved by adapting equipment currently in place for post LOCA H2 control or by using new equipment instead
 - ▶ Unlikely that the equipment would need to be safety grade

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50.44 -- Preliminary Evaluation (Cont'd)

Control Combustible Gas Concentrations in Containment Following a LOCA

- ▶ Remove internal recombiners from operation
 - ▶ Remove internal recombiners from operation, and make provisions for portable external recombiners
 - ▶ Retain internal recombiners but drop safety grade classification
 - ▶ Remove internal recombiners from operation and replace with passive autocatalytic recombiners (PARs)
 - ▶ Remove internal recombiners from operation and rely on igniters for long term H₂ control (for Mark IIIs and Ice condenser containments only)
-
- ▶ No change for H₂ vent and purge system
 - ▶ Remove H₂ vent and purge system from operation
 - ▶ Retain H₂ vent and purge system but drop safety grade classification
 - ▶ Remove H₂ vent and purge system from operation, but identify other possible vent and purge system (such as for containment pressure control) for H₂ control
-

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50.44 -- Preliminary Evaluation (Mark I and II)

- ***Inert Containment Atmosphere:*** inerting system, containment atmospheric dilution (CAD) system
 - ▶ The safety significance of an inerted containment atmosphere in the smaller BWR containments is generally acknowledged to be high
 - ▶ No changes proposed
-

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50.44 -- Preliminary Evaluation (Mark III and Ice Condensers)

- ***H2 control system to handle 75% clad metal/water reaction:*** AC powered igniter system
 - ▶ The safety significance of the existing H2 igniter systems is considered to be high
 - ▶ Greater emphasis on defense-in-depth and the uncertainties in PRAs could provide a rationale for maintaining all or some igniter operability during station blackout (SBO) accident sequences for one or both of these containment types
 - ▶ Ensure availability of all existing igniters during SBO
 - ▶ Ensure availability of a reduced set of existing igniters during SBO
-

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50.44 -- Current Status

- Accelerate schedule to evaluate different risk-informed options for the various technical requirements
 - Recommend to Commission (March 2000) to move forward on an expedited basis
 - Develop recommendations for a risk-informed 50.44 for Commission approval June 2000
-

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Workshop Summary

Stakeholder Feedback Received

- General agreement with approach and guidelines
- Approach also needs to consider
 - ▶ Consistency with plant oversight process
 - ▶ Impact on workers
 - ▶ Option 2 scope should be a key factor in deciding what a risk-informed part 50 should address
- Need to ensure good communication with owner's groups and industry programs
- Do not prohibit looking at emergency planning in the future
- Move ahead, on an expedited basis, with changes to 50.44
- Option 3 role with respect to "special treatment" rules needs clarification

Future Activities

Future Activities Include:

- Prepare status report, including any policy issues, to Commission (March 2000)
 - Public meeting (April/May) on 50.44
 - Recommendations to Commission on 50.44 (~June 2000)
 - Consider stakeholder feedback, completion of review to identify candidate regulations and DBAs and develop preliminary recommendations, beyond 50.44 (August 2000)
 - Hold additional public workshop (September 2000)
 - Meet with ACRS (October)
 - Provide final recommendations to Commission (December 2000)
-