

UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BRIEFING ON NONPRESCRIPTIVE
NUCLEAR SAFETY REGULATION

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Tuesday, October 30, 1990

The Commission met in open session,
pursuant to notice, at 10:00 a.m., Kenneth C. Rogers,
Commissioner, presiding.

COMMISSIONERS PRESENT:

KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner
FORREST J. REMICK, Commissioner

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STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

MARTIN MALSCH, Office of the General Counsel

DOCTOR DAVID ROSSIN, President, Rossin and Associates

PROFESSOR MICHAEL GOLAY, Massachusetts Institute of Technology

MARSHALL BREGER, Chairman, Administrative Conference of the United States

DOCTOR ROGER MATTSON, Vice President, Scientech, Inc.

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

10:00 a.m.

COMMISSIONER ROGERS: Good morning, ladies and gentlemen.

Chairman Carr will not be with us today. He's been asked to attend a hearing of the House Subcommittee on Oversight and Investigations of the Committee of Interior and Insular Affairs being conducted this morning in Plymouth, Massachusetts.

COMMISSIONER CURTISS: I'm sure he'd rather be with us.

COMMISSIONER ROGERS: Well, he's representing us.

In the past year or so, the NRC has become increasingly interested in the concept of nonprescriptive regulation. We've come to realize that the prescriptive regulatory approach we've traditionally applied and which appeared to be appropriate during the construction of nuclear power plants has deficiencies when the focus of regulation is on operations. In fact, prescriptive regulation may have unintended negative effects. It may stifle innovation and divert attention from substance to process. It may make it more difficult for a licensee to use an approach optimized to its own culture and

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1 circumstances.

2 Therefore, we've been giving more thought
3 and considering current rulemaking and other
4 regulatory activities to approaches that are less
5 prescriptive. These are being considered in several
6 major Commission initiatives, including the
7 development of regulations for advanced reactor
8 designs and for plant maintenance.

9 As we attempt to do so, we find there is a
10 large gap between a perception that nonprescriptive
11 regulation is good and actually what is involved in
12 implementing it. There appear to be very different
13 concepts of what nonprescriptive regulation means and
14 how it can be applied. There is considerable
15 uncertainty over how the Agency can create regulations
16 that are nonprescriptive, yet still demonstrably
17 provide adequate assurance of safety and appropriate
18 ways for us to track performance and take enforcement
19 actions where necessary.

20 Therefore, we're pleased today to hear a
21 discussion of the concept of nonprescriptive nuclear
22 safety regulation by four distinguished individuals
23 from outside the Agency who can offer us several
24 different perspectives on what the possibilities for
25 nonprescriptive regulation are for the NRC. We will

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1 hear first from Professor Michael Golay of the
2 Massachusetts Institute of Technology who's done
3 considerable work in this area. We'll then hear from
4 Mr. Marshall Breger, Chairman of the Administrative
5 Conference of the United States who has an overview of
6 what is taking place in all the federal regulatory
7 agencies; Doctor David Rossin of Rossin Associates who
8 has worked closely with the licensee committee; and
9 Doctor Roger Mattson, Vice President of Sciencetech,
10 Incorporated, who was formerly an NRC staff member and
11 can therefore comment on this issue from both NRC and
12 external perspectives.

13 Gentlemen, we would like to welcome all of
14 you and to thank you for joining us today. I hope in
15 briefing us you will touch upon the scope of
16 applicability of the nonprescriptive approaches you
17 would like to see the Agency pursue and that you will
18 give us your views of both the benefits and the
19 potential drawbacks of a nonprescriptive approach.

20 Copies of presentation slides used today
21 are available at the entrance to the meeting room.

22 Professor Golay, I believe you're the
23 first on the agenda. Would you please proceed.

24 PROFESSOR GOLAY: Thank you, Mr. Chairman.

25 The things that I want to do today I

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1 believe are familiar to you in part from material
2 which I've submitted previously where at MIT, since
3 about 1983, we've been engaged in research projects
4 focused on the so-called advanced reactors which
5 people hope to use in the next generation of power
6 plants. From that, we have done a lot of thinking
7 about the role of the safety regulation system and
8 effects which it has on the directions which
9 technology can take and how good safety performance
10 can be achieved.

11 As I think you're aware, we also undertook
12 a project with NRC sponsorship during the late 1980s
13 examining one aspect of how nonprescriptive regulation
14 could be pursued. From that we gained enough
15 confidence to suggest that the scope of that kind of
16 investigation should be broadened to see if an
17 alternative practical system could be implemented.
18 What I really want to -- am going to end up suggesting
19 today is that given the time table for the development
20 of the so-called advanced concepts, that it is
21 appropriate for the NRC to undertake some internal
22 action to investigate in a timely way whether a
23 nonprescriptive safety approach could be established
24 for use with these reactors.

25 What I'm going to do is follow the order

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1 of the information packet which I've provided to you.
2 So, I'd like to just ask you to follow along with me.

3 The first point I want to make concerns
4 the question which was raised in introduction, which
5 are the benefits and costs of nonprescriptive
6 regulation. I would say that among the benefits are
7 that it provides, at least potentially, a means of
8 escaping some of the limitations of the current
9 prescriptive approach. In this first page, I've
10 listed here some of them.

11 I would say that probably the most
12 important point is the second one where the current
13 approach has been shown through PRA investigations to
14 produce a non-uniform level of safety and, in fact,
15 one which is substantially uncertain. That is, for
16 example, one of the questions before the Commission
17 today is whether the current fleet of nuclear power
18 plants, in fact, satisfies the safety goal where at
19 the moment it's impossible to provide a definitive
20 answer to that question.

21 So, the overall reason for wanting to
22 undertake an alternative method is the hope that it
23 can provide a means for producing more uniform and
24 higher levels of safety.

25 The fourth item is one which is also very

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1 important and tied to the prescriptive approach to
2 regulation in that we have seen examples with the
3 large number of license holders for nuclear power
4 plant licenses in the U.S. of cases where the full
5 assumption of responsibility for safety has really not
6 been undertaken by license holders, in part because of
7 the very heavy burden of complying with the large
8 number of regulations which issue from the NRC. If we
9 go to performance based or nonprescriptive regulation
10 without detailed guidance from the Commission
11 concerning how to satisfy every single item in detail,
12 suggestions about how to do this, we can expect a
13 clearer transfer of responsibility and authority for
14 actual safety performance.

15 One aspect of the current system which has
16 been very important to us in examining technology
17 improvements is that the current system favors
18 imitation of what's been done before in both
19 technology and in terms of methods and models. As a
20 consequence, it inhibits technological innovation,
21 both with existing plants in terms of making small
22 improvements, and in considering the future
23 technology.

24 Finally, I'd like to really ask a question
25 to yourselves, which is that my observation in dealing

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1 with the Commission and the Commissioners over many
2 years has been that there is a continual stream of
3 detailed questions which have to be resolved at the
4 highest level with the approach to regulation which we
5 have today, with the consequence that the resources
6 for broad policy making are much harder to bring to
7 bear than if we had a system which could segregate
8 some of the detailed questions so that they could be
9 handled at lower levels in the organization.

10 I'd like to turn to the next page and go
11 to the need for nonprescriptive regulation. Here I
12 violated the guidance which I was issued by the staff
13 and there are two pages which are different from what
14 I've given you before and they're before you. The
15 headings are all the same.

16 But one of the main reasons why we feel
17 that nonprescriptive regulation is worthwhile is that
18 in the work that's gone on since the Three Mile Island
19 accident and especially since the Chernobyl accident,
20 a major feature of this work has been to improve the
21 safety of future reactor concepts, especially
22 concerning the mitigation -- both the avoidance and
23 the mitigation of severe accidents. Today we have a
24 void. We have reactor designs which are initially
25 being formulated with the goals which I just mentioned

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1 in mind, yet the hoops that they must jump through in
2 order to obtain regulatory approval are still focused
3 primarily on the DBA level of thinking.

4 So, there's a real mismatch between what
5 these concepts are trying to achieve and the actual
6 challenges which they must satisfy in order to get an
7 operating license. I would argue that the potential
8 for a degradation of safety levels which could be
9 achieved is fairly strong here.

10 The third point on this page which I want
11 to bring attention to is that I think that any action
12 concerning nonprescriptive regulation really has to be
13 dealt with at the level of the Commission.

14 I cite here testimony presented by
15 Commissioner Palladino back in 1985 before the Marilyn
16 Lloyd Committee in which the logical necessity for
17 nonprescriptive regulation and the expectation that it
18 would be used in future reactors was stated and yet--
19 and so, in a sense, there's been this recognition in
20 the Agency for a long time, but it doesn't gel into
21 practice. In dealing with the staff and the
22 Commissioners, I felt basically it requires a mandate
23 from the Commissioners to have a focused effort to see
24 what would be practical in this area, that without
25 that nothing is going to happen.

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1 The bottom line on this figure is that
2 this is really the right time to do it. The agenda is
3 served up by new reactor concepts coming forward, but
4 only the Commission can really take action in this
5 way. So, that creates the reason for considering the
6 question here.

7 I'd like to turn to the next page.

8 What I've tried to do here is to summarize
9 the regulatory situation in which these new reactor
10 concepts are facing which are, if we take the light
11 water reactors, they're being basically designed
12 according to the prescriptive -- the large literature
13 of prescriptive regulation. There is negotiation
14 going on between NRC and EPRI in the context of the
15 requirements document which could perhaps alter what
16 those regulations are. In the severe accident area,
17 as I've mentioned before, there is basically a vacuum.
18 That is, there is not new guidance to the designers
19 concerning how they can improve the designs and also
20 offering any kind of reward for safety improvements.

21 With the non-light water reactors, the
22 situation is even cloudier in that even an existing
23 body of regulation other than that created by Fort St.
24 Vrain and Clinch River really doesn't exist. There
25 have been reviews within the Research Branch really

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1 looking for vulnerabilities and show stoppers with
2 some of the concepts which have been offered, but
3 these are very far from constituting a body of
4 regulation which the designers can use in confidence.
5 In the same fashion the severe accident vacuum exists
6 for these concepts as well.

7 So, this leads to the next page where I
8 wish to make a suggestion, which is that the NRC
9 undertake an internal project to investigate what
10 would be involved in a practical system of
11 nonprescriptive regulation and, as the product of
12 this, to produce proposals to the Commissioners for
13 their consideration. I've outlined what I see as the
14 elements of the project's scope. I'm not going to
15 read them to you. I think that they are things which
16 most of you would create with ten minutes'
17 consideration as well. But it's essentially to create
18 some proposals, try them out, refine them and get
19 external review and present them for consideration.

20 There is one element though that we have
21 found to be very useful in working on questions of
22 this kind, which is what I'm mentioning at the bottom
23 of this page, which is a method of working. That is
24 what we have found in our efforts on related topics at
25 MIT is that working in parallel where in one part of

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1 your effort you worked on a formulation of a general
2 approach and in a second effort you try to apply that
3 general approach as a means of mutual refinement of
4 the two efforts tends to work very well.

5 So, what I would suggest in this case is
6 to try to formulate a general approach to regulation
7 and apply it to one of the advanced reactor concepts
8 which has been proposed. For example, the gas reactor
9 concept has come in with some proposals of their own
10 where that could provide a starting point, if that
11 were desirable. Frankly, I don't think the choice of
12 the reactor concept is all that important, but I do
13 think that this mode of working actually is.

14 COMMISSIONER CURTISS: Before you go on,
15 let me ask you --

16 PROFESSOR GOLAY: Sure.

17 COMMISSIONER CURTISS: -- a question about
18 your first bullet on the adequacy of safety goals. Do
19 you envision there focusing on how the safety goals
20 might be incorporated into a program like this or is
21 the --

22 PROFESSOR GOLAY: Yes.

23 COMMISSIONER CURTISS: -- the use of the
24 terminology "adequacy of safety goals" designed to
25 focus on whether they're internally consistent and

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1 sufficient?

2 PROFESSOR GOLAY: No, no. I view the
3 safety goals as being effectively a vector or a set of
4 elements which express different safety concerns. The
5 question would be are they formulated in a way that
6 forms a good basis as the start of a regulatory
7 system? There may be things that you hadn't thought
8 of that will become revealed as you go into this
9 exercise. So, that's more the spirit in which I'm
10 thinking of it.

11 COMMISSIONER CURTISS: Okay.

12 PROFESSOR GOLAY: However, I would say
13 that the safety goals, the use of the safety goals as
14 the fundamental element in terms of the performance
15 requirements that you would hope to get the reactors
16 regulated under this approach, that they play that
17 role was the basis.

18 COMMISSIONER ROGERS: You would start with
19 them as they presently are stated, at least as --

20 PROFESSOR GOLAY: Yes.

21 COMMISSIONER ROGERS: Not question that,
22 per se, but whether there might be another way of
23 using them or making them more useful for this
24 purpose? Is that --

25 PROFESSOR GOLAY: That's right.

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1 COMMISSIONER ROGERS: Rather than the
2 fundamental numbers or concepts that are --

3 PROFESSOR GOLAY: Exactly. But what we've
4 seen is the safety goals have evolved. The particular
5 codification changes about every three years as people
6 think more about it. So, we would expect more
7 refinement of that kind.

8 Moving to the next page, there's one thing
9 that is built into this approach, which is the use of
10 PRA. So, I'm trying to say something up front about
11 that, which is that, as you can read here, the safety
12 goals are stated in terms of expected risks. So, this
13 implies some means of quantifying expected risk where
14 the standard tool for this is probabilistic risk
15 analysis and there has been some reluctance to try to
16 use probabilistic risk analysis in safety regulation
17 except at some distance from detailed questions. So,
18 I'm going to spend some time trying to focus on that
19 particular concern that people have.

20 I'd like to turn to the next page. In our
21 work for the NRC, one of the things we examined is how
22 you would use PRA in regulation. To get a little bit
23 ahead of the story on this page, the big concern that
24 people have with PRA really comes in two ways. One is
25 that the methods and models used in it are still

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1 evolving. It's not an infantile analytic approach,
2 but it's one which hasn't reached its full maturity.
3 However, the aspect which I think causes greater
4 concern to people is the element of uncertainty, which
5 is recognized as being inherent in probabilistic
6 analyses.

7 The point that I want to make is that you
8 must consider both the result of any such analyses and
9 recognize up front that uncertainty is associated with
10 them and that at some means, I would propose through
11 conservative treatments, has to be also incorporated
12 to deal with uncertainties. You can't pursue the
13 lines which I'm suggesting without recognizing that
14 uncertainty exists and you've got to have some means
15 with safety factors and conservatism in taking them
16 into account.

17 And on this page are listed some aspects
18 of what we see as being necessary elements in use of
19 PRA within the space where it can be used with
20 acceptable accuracy. These are standardized NRC
21 approved models, databases and means of updating these
22 tools, but recognizing that refinement will just be a
23 way of life in both the databases and the models as
24 our knowledge increases.

25 Second, means have to be worked out to

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1 make use of the results from these kinds of analyses,
2 not only for design but for operation and reflecting
3 what we learn through the evolving industry
4 experience. These are all things which I think can be
5 done, but I'm going out that it will be a changing
6 tool which you would expect with an approach which is
7 maturing.

8 On the next page, I want to draw attention
9 to another of the concerns which people sometimes
10 have, particularly using PRA, which is the idea of
11 using rigid decision criteria, either go/no-go kinds
12 of things, for example, on the core damage frequency.
13 The issue has been raised, well, what if you end up
14 with an expected core damage frequency which is
15 1/100th less than a limit as opposed to being 1/100th
16 greater than a limit? Do you suddenly change your
17 answer, which in the face of associated uncertainties
18 is something which people aren't comfortable with?

19 The point that I want to make is that it
20 doesn't have to be that way, that there are judgmental
21 criteria which can be used which have bans for saying
22 yes or no to proposals where further investigation and
23 judgment is required. So, this was one of the things
24 which might reflect back onto the safety goal, for
25 example, or subsidiary goals derived from them.

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1 Now, this is the second page which I've
2 changed from what I've given you and the revised page
3 is there because there's a typographical error in one
4 of the bullets, just a logical error. So, we'll pass
5 onto the next page.

6 What I've done here is to try to give you
7 some examples of how a decision making structure could
8 be formulated. The point here is that the best
9 structure isn't really clear because the issue is how
10 to handle uncertainty. So, I've outlined here three
11 with the expectation that what one would really do
12 would probably result as a blending of these proposals
13 or others based on the experience derived from the
14 investigation which I'm suggesting.

15 One way to do it would be to use
16 probabilistic risk assessment as the basis for
17 formulating a set of deterministic accident sequences
18 to be analyzed, in effect use them as the basis for
19 extension of the design basis accident approach, but
20 always being able to go back to a higher level of
21 standards for insurance of consistency in the
22 formulation of whatever is done, and as a means of
23 always evaluating the marginal effect of any changes
24 which are introduced. So, that would be one extreme,
25 which is basically to use the safety goals and PRA as

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1 the basis for constituting a set of design basis
2 accidents going completely through the severe accident
3 space.

4 For example, EPRI, in their proposal in
5 the requirements document for the passive plants is in
6 effect making this kind of proposal where they're
7 saying that, "For severe accidents, let us take a
8 source term from the reactor coolant system coming
9 into the containment and then let us analyze the
10 containment performance in preventing whatever
11 material comes from the reactor coolant system and
12 getting into the biosphere, but where the source term
13 is a deterministically specified quantity." So, that
14 would be one example that would fit into this
15 particular suggestion.

16 COMMISSIONER ROGERS: Excuse me. Just a
17 point there. It's been my opinion that the
18 deterministic approach to engineering evaluations
19 really in a sense does that intuitively. You start
20 off with a model and then you do a deterministic
21 calculation on that model. Where did you get the
22 model in the first place? Well, it came from some
23 intuitive judgments. But it seems to me is what
24 you're suggesting here that that be a more formalized
25 probabilistic basis for determining the starting

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1 point.

2 PROFESSOR GOLAY: That's right. That's
3 right. And the uncertainty that is, in effect, built
4 into the conservatisms in the cases you deal with is,
5 in fact, exactly the same uncertainty that makes
6 people nervous in using PRA. It's simply we don't
7 confront it quite so explicitly in the current
8 approach.

9 COMMISSIONER ROGERS: Absolutely.

10 PROFESSOR GOLAY: I think that that's
11 really an important point to remember, that is that we
12 have implicit assumptions concerning uncertainty
13 riddled throughout the current approach. There's
14 nothing different in going on nonprescriptive
15 regulation in terms of uncertainty except how explicit
16 you make your treatment.

17 Okay. I'm going to skip over the second
18 illustration and simply go to the third which is more
19 at the other limit, in the interest of time.

20 Another way to do this would be to use PRA
21 as the basic decision tool. That is, do a level 3 PRA
22 and then search through for design vulnerabilities,
23 all the things which would make you doubt the result.
24 I've listed some of the more important factors here,
25 such as vulnerabilities to common mode failures, which

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1 are very hard to analyze, or human failures and, in
2 effect, revise the expected risks on the basis of
3 conservatisms introduced to deal with those
4 uncertainties and then ask does the resulting design
5 satisfy the safety goals with all of those
6 adjustments. Where it doesn't, the applicant would be
7 told where the design is deficient and would be told
8 to go back and do more homework.

9 There's one item that I really want to
10 draw attention here to on the stage 3 where in
11 examining the regulatory systems in other countries,
12 one of the things which we were impressed with was the
13 greater detachment in some cases, not in all, between
14 the regulator and the designer, where in effect the
15 responsibility of coming up with an acceptable fix to
16 a deficiency was really the responsibility of the
17 designer. This idea of having the regulator working
18 together to help him do this was, in fact, something
19 that was not part of the approach. On looking at it,
20 we think that that's actually a very important feature
21 to keep in. I bring it up because I know that this
22 kind of thing has been under discussion with the
23 Commissioners recently.

24 The reason is to make very clear that the
25 responsibility for whatever is proposed is the

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1 responsibility of the designer or the operator. So,
2 there's no, in effect, co-option of the Agency by
3 implicit assumption of the responsibility for the
4 particular avenue which is selected.

5 COMMISSIONER ROGERS: There is a problem
6 though. That is that if the regulator is trying to
7 set these objectives totally independently of what is
8 achievable, what is technically achievable, there can
9 be a disconnect there that what is expected just
10 simply can't ever be arrived at.

11 PROFESSOR GOLAY: That's right.

12 COMMISSIONER ROGERS: State of the art
13 doesn't permit it.

14 PROFESSOR GOLAY: That's right. And this
15 implies, I think, some means of technical appeal which
16 you could see how you could have because that's always
17 a possibility. However, you also have the discipline
18 introduced by the top level performance goals. In
19 effect, the real question is can the design satisfy
20 those goals? That's the kind of argument that has to
21 be offered and it can be offered to more than just one
22 staff member, if the right decision structure isn't
23 set up.

24 COMMISSIONER REMICK: I saw what you said,
25 Mike, in a slightly different way. I thought that

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1 you -- you were not precluding in my mind the
2 opportunity for the designer and the regulator to get
3 together to establish a reasonable performance
4 standard, but when it came to specifically how do you
5 meet that standard, that that be the responsibility of
6 the designer and not the regulator.

7 PROFESSOR GOLAY: Exactly.

8 COMMISSIONER REMICK: I read into your
9 words that viewpoint, but I must admit I was reading
10 into it.

11 PROFESSOR GOLAY: No, that's exactly
12 right.

13 COMMISSIONER REMICK: You would not see
14 anything wrong with them working on a technical basis
15 to establish reasonable performance standards?

16 PROFESSOR GOLAY: That's right. Yes, I
17 agree.

18 On the next page, I've listed a number of
19 practical problems which arise here and I'm sure that
20 this list isn't encyclopedic, it's merely impressively
21 long, which have to be addressed in working out any
22 kind of practical system. I'm not going to read these
23 to you. I think that they're almost all self-
24 explanatory.

25 COMMISSIONER REMICK: I'm not sure I

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1 understood what the third bullet meant. You seem to
2 be questioning the philosophy of defense in depth, but
3 maybe I just misunderstood.

4 PROFESSOR GOLAY: No, no, no. The sense
5 was that if you recognize the need for defense in
6 depth, how do you avoid a situation where the
7 overall -- where you end up with a design where the
8 overall performance goals are met with very heavy
9 reliance on one single design feature. For example,
10 with the gas reactor today, we have that with the
11 reliance on very tough fuel providing it's fabricated
12 to high quality standards.

13 The thing that I think you have to
14 recognize is that defense in depth, the use of
15 containment for example, arises basically as a
16 treatment of uncertainty. That is, because of some of
17 the things that you simply cannot lay away. So, the
18 question that has come up previously in discussions
19 with the staff is, "Well, if you go this way, how do
20 we also make sure that defense in depth is insured?"
21 My answer to it is the way you do it is to say that
22 it's necessary as a means of controlling the
23 implications of uncertainty. But I think that it's
24 something we have to have.

25 COMMISSIONER REMICK: Another way I have

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1 often looked at defense in depth, it does not require
2 absolute perfection in any particular means of defense
3 because you have an alternate in case that one fails,
4 so you don't have to have complete assurance that the
5 one defense system will work because you have a
6 backup.

7 PROFESSOR GOLAY: Right.

8 COMMISSIONER REMICK: That's another way
9 of saying the same thing.

10 PROFESSOR GOLAY: Yes. I would agree with
11 that.

12 Yes, the one bullet that I want to draw
13 your attention to is the third from the bottom. That
14 is how would the NRC oversight for inspection and
15 enforcement change under nonprescriptive regulation.
16 I focus on this because I was struck by a letter from
17 Larry Minnick recently concerning the business of
18 going beyond the level of diminishing returns.

19 One of the problems which I think the
20 Agency has continually had in facing new questions is
21 determination of just how much effort is really called
22 for. I think one of the reasons why this thing keeps
23 coming up is that there isn't a global standard to go
24 to in looking for the marginal effect on safety of a
25 new approach, some new wrinkle in dealing with a

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1 particular issue or the need to formulate a new
2 policy. I think that if we had this nonprescriptive
3 approach in place, we would have a consistent standard
4 to which any new activity could then be judged in
5 terms of.

6 So, I suggest that that's one place that
7 might be relevant in terms of a current concern, but I
8 don't want to dwell on these practical aspects. I
9 think they can all be dealt with, but some require
10 work. And I want to really wrap up because I've taken
11 all my time.

12 On the aspects of the suggested work,
13 which is the next to the last page, I would say that
14 the first thing that I've tried to convey is that the
15 best nonprescriptive approach isn't obvious, that it
16 takes some refinement to really come up with a
17 practical system that you can use and that that's what
18 really ought to be done.

19 The third bullet is that the use of PRA is
20 often resisted because of concern about the
21 uncertainties. As I've said previously, the
22 uncertainties are no different. They're determined by
23 the physics of the problem. It's only a question of
24 how you address them.

25 The last thing which is also important is

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1 that in principle with the nonprescriptive approach it
2 should be possible to refine the regulations as we
3 learn more. One of the things which we have seen in
4 the absence of a global standard to appeal to is that
5 the current system is very hard to refine. We've seen
6 this, for example, in the emergency planning area
7 where there have been demands from the industry to
8 revise the standard for the emergency planning zone.

9 We've seen it, I would suggest, in the
10 impasse that developed over Seabrook and Shoreham
11 where, again without a global risk standard, it was
12 very hard to take some of the objections on some of
13 the outlying accident cases, like evacuating the beach
14 at Seabrook, and put that in a context for decision
15 making. Eventually the Agency did make its decisions,
16 but it was a very hard and expensive process, as I'm
17 sure I don't need to tell any of you.

18 So, finally, I'd like to turn to the last
19 page which is sort of a recapitulation on why I think
20 we ought to undertake the project which I'm
21 suggesting, which is it promises greater and more
22 uniform safety which is fundamentally the goal of the
23 Agency. Hopefully it can do it in a way that doesn't
24 kill the industry, which I would suggest is what's
25 happening today.

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1 One of the mandates of the NRC is not to
2 promote nuclear power, but implicit in the existence
3 of the Agency is also the obligation to provide
4 acceptable safety in a way that doesn't kill the
5 nuclear enterprise. I would suggest that the way it's
6 going today as the outcome of many, many interactions
7 and decisions is effectively to put it into a death
8 spiral. That's, I think, another reason for decisive
9 action.

10 We're in a situation today where there are
11 all kinds of reasons to keep nuclear power available
12 as a vital option for the country. We had today, for
13 example, Japan announcing a new policy to increase
14 their use of nuclear power as a means of dealing with
15 oil concerns and greenhouse concerns.

16 In the U.S. we're having a much harder
17 time formulating similar policies for which I think
18 there would be broad support. I think that we can
19 also get better safety performance by making it clear
20 that the responsibility and authority for producing
21 safety rests with the applicant and this system, I
22 think, will promote that. It should be able to
23 provide swifter and clearer regulatory decisions and
24 it should free the Commissioners up to focus more on
25 the policy level questions rather than on the very

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1 detailed issues which I believe constitutes much of
2 the agenda today.

3 Then finally I would suggest that it would
4 greatly stimulate technological innovation which would
5 also give us a good result.

6 That's as much as I'll take time to say.
7 Thank you.

8 COMMISSIONER ROGERS: Well, thank you very
9 much. I think what we'll do is we'll hold our
10 questions until everyone has had a chance to make a
11 presentation and then we can go at you all and maybe
12 some of you will answer some of our questions as we
13 proceed.

14 Next we'd like to hear from Mr. Marshall
15 Breger.

16 MR. BREGER: Thank you very much, Mr.
17 Chairman, members of the Commission. I'm pleased to
18 be invited to share my thoughts concerning the use of
19 nonprescriptive regulations by federal agencies.

20 Let me take this opportunity to thank the
21 Commission for its continuing support of the
22 Administrative Conference and its activities. Due to
23 the support of this Commission and a number of its
24 sister agencies, the Conference has been able to
25 develop round tables, printed materials and training

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1 programs in the area of alternate dispute resolution.
2 These initiatives are helping reduce costs and delays
3 associated with traditional adversarial proceedings.
4 I'd also like to commend the Commission's
5 representative to the conference, General Counsel
6 William Parler, who is a respected and diligent member
7 of our rulemaking committee.

8 Although I have read Professor Golay's
9 paper on nonprescriptive nuclear safety regulation,
10 the example of loss of off-site power, with interest,
11 I have a disclaimer at the outset. I am here as a
12 rank amateur. I think ignorance was my ticket to be
13 invited. I'm not a technical expert, nor do I profess
14 any keen insight into whether the Commission's
15 experience with regulation of loss of off-site power
16 is typical or atypical of the issues commonly
17 addressed in this Agency.

18 I do note, however, that there is a
19 spirited debate concerning the use of performance
20 standards as a regulatory alternative to prescriptive
21 requirements which has been the subject of numerous
22 *Law Review* articles since the early 1970s when
23 Congress began enacting them as part of the
24 environmental statutes such as the Clean Air Act.

25 As Chairman of the Administrative

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1 Conference of the United States over the last five
2 years, I have seen this issue debated in a number of
3 contexts in a host of agencies and I hope my
4 observations concerning those debates drawn from an
5 administrative law perspective will be useful to you.

6 The Administrative Procedure Act, passed
7 in 1946 as a compromise between New Deal advocates who
8 made belief in the superiority of technical expertise
9 an article of faith, and conservative opponents of
10 administrative government who believed in the
11 superiority of generalized courts of law to provide
12 independent checks on agency experts whose decisions
13 were viewed as partisan advocacy.

14 In that same year, Congress established
15 the Atomic Energy Commission, the first federal agency
16 authorized to engage in research, development and
17 industrial production. The Commission had the best
18 scientific, engineering and management skills. In
19 short, everything the ardent advocate of technical
20 expertise in decision making could wish for. In
21 addition, the AEC had the flexibility provided by the
22 newly enacted APA, Administrative Procedure Act, to
23 promulgate rules and informally resolve disputes.
24 Thirty years later, in the midst of charges that
25 reactor development had pushed aside siting and safety

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1 decisions of immense public importance, the AEC's
2 regulatory authority was separated and given, as you
3 know, to the newly created NRC and here we are.

4 I cite this short historical synopsis to
5 make a point about the first sentence in Professor
6 Golay's article, which states that current U.S.
7 nuclear regulatory system has been criticized as
8 arbitrary, inconsistent and highly legalistic. The
9 unstated inference is that an overly legalized system
10 is somehow inevitably tied to arbitrary and
11 inconsistent regulation. The article further implies
12 that nonprescriptive regulation could provide a
13 technically more acceptable situation.

14 If nuclear regulation is arbitrary and
15 inconsistent, and it may well be, I would submit that
16 it cannot be so because of an overly legalized system
17 in the traditional sense. The English and American
18 common law system may be ponderous, it may be costly,
19 it may be overly reliant on adversarial procedures,
20 but it is not normally criticized for being arbitrary
21 nor capricious. Indeed, all of what I just mentioned,
22 cost, length, adversariness, is designed to prevent
23 capriciousness and arbitrariness.

24 Further, it's unlikely that nuclear
25 regulation is arbitrary and inconsistent because

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1 technical expertise has been given short shrift in the
2 administrative processes the Agency must follow. In
3 fact, one could argue that the history of nuclear
4 regulation demonstrates the fallacy of New Deal
5 thinking concerning the superiority of technical
6 centered decision making over the constitutionally
7 mandated fact-based decision making by general courts
8 of law which are bound by precedent and are therefore
9 not arbitrary or inconsistent, but have their own
10 faults. They're legalistic.

11 I make these observations to establish a
12 context for discussing what Professor Golay calls
13 nonprescriptive regulation or functional goals, or
14 what is termed performance standards in much of the
15 legal literature. These approaches are usually
16 distinguished from decision standards or prescriptive
17 regulations and have become increasingly popular in
18 regulatory contexts.

19 The advantages of performance standards
20 are said to be that they leave regulated entities free
21 to choose or invent "least cost solutions." They are
22 said to foster innovation, produce more flexible
23 results-oriented policy, and to be less damaging to
24 competition in the free market. On the other hand,
25 performance standards are frequently harder to write,

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1 harder to administer and may give competitive
2 advantages to larger and more sophisticated firms who
3 have the capacity to navigate the system.

4 Let me underscore this point. It is often
5 missed. The design flexibility afforded by
6 performance standards may or may not lead to more
7 efficiency and greater technological innovation. I
8 think, in fact, it often does. But there's a
9 correlative. It creates greater challenges to
10 regulatory review and compliance and likely more work
11 for the legal profession. Whether that's a cost or
12 not I leave to you.

13 Evidence for this can be seen in the
14 degree to which performance standards are susceptible
15 to accurate fact-based decision making. Ultimately
16 given the litigious environment in which we live,
17 performance standards will be tested in some form of
18 legal proceeding where the decision maker will have to
19 determine whether the standard has been properly
20 applied. How easy it is to adduce proven compliance
21 will be a major contributor to any analysis of whether
22 a prescriptive or performance standard is the most
23 cost effective or rather was the most cost effective
24 and consistent means of achieving a particular
25 regulatory result.

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1 In evaluating this issue, some
2 misconceptions about how performance standards are
3 treated in an APA adjudicatory proceeding might arise.
4 Professor Golay states that NRC regulations, and I
5 quote, "exist in diverse formats such as the Code of
6 Federal Regulations, the NRC Standard Review Plan, the
7 NRC regulatory guides and branch technical positions."
8 While I have no doubt that your licensees may view all
9 of these sources as regulations in fact, the courts
10 clearly do not and they will not give them the same
11 weight. The Commission may not be happy about that
12 fact.

13 The Administrative Conference has recently
14 completed Recommendation 89-5 concerning which agency
15 interpretation should bind citizens and courts based
16 on a study by former Conference Chairman Robert
17 Anthony. While courts will clearly give deference to
18 Agency interpretations of its mandate, which are
19 codified in its formal regulations following an
20 opportunity for public comment, it is not so obviously
21 bound with respect to other devices used by agencies
22 to set forth its views. The Conference therefore
23 recommends that agencies use notice and comment
24 rulemaking or formal adjudication when they wish to
25 promulgate definitive interpretations of their

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1 statutory mandate.

2 In short, if agencies want their views to
3 be given the deference owed official agency
4 pronouncements, they should act with the requisite for
5 malady owed such positions. As I continue in my
6 discussion, the importance of that may become clearer
7 to the discussion of performance standards.

8 This recommendation was made because of
9 the Supreme Court opinion in 1984 called Chevron USA
10 versus the Natural Resources Defense Council. The
11 court in Chevron gave substantial new directions to
12 review in courts concerning whether to give deference
13 to agency interpretations of their governing statute.
14 Chevron now requires that a court accept an agency's
15 interpretation if it is, one, not contrary to statute
16 or specific statutory intent and, two, is reasonable.

17 In April, the Administrative Conference
18 completed a study, an empirical study of federal
19 administrative law to examine the effects of the
20 Chevron decision on reviewing courts. That study by
21 Peter Shook and Donald Elliot, who is now general
22 counsel at the EPA, finds that the rate of reversal of
23 agency decisions declined but the rate of remand did
24 not. This suggests that Chevron makes it harder for
25 courts to reverse agency decisions for errors of law.

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1 In short, Chevron makes a difference that works.

2 Further, as this Agency well knows, in
3 another case, Vermont Yankee, the Supreme Court ended
4 the meddling by reviewing courts of the development of
5 procedures for rulemaking. The court stated clearly
6 that procedures going beyond requirements of the
7 Administrative Procedure Act and of any particular
8 statute in question could not be required by the
9 courts. The Conferences recognizes that reviewing
10 courts tend to find new ways to reverse or remand
11 cases to agencies when they suspect the agency's
12 record is less adequate than it should be and it
13 should be expected that much less deference will be
14 given to agencies who don't place their
15 interpretations and policies on the record through
16 notice and comment rulemaking or formal adjudication
17 than may have been the case in the past.

18 These recent develops in judicial review
19 are important to the discussion of performance
20 standards because they may affect the conclusions the
21 decision maker reaches concerning whether a
22 performance standard or a prescriptive standard is the
23 most appropriate in a particular case. For example,
24 if you were to decide to require that accident
25 sequences involving loss of off-site power must have a

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1 probability of occurrence of less than one in a
2 million as opposed to requiring two on-site gas
3 turbine generators, you should recognize that one
4 approach gives a reviewing court much more latitude to
5 examine the basis of your decision than the other.

6 On the Vermont Yankee, either requirement
7 implementing your statutory authority may be rather
8 easily promulgated, assuming there is a reasonable
9 technical basis for both through the notice and
10 comment rulemaking procedure. On the Chevron, both
11 rules would be given deference, assuming that they are
12 clear and track the statutory mandate and they would
13 be considered as definitive interpretations of the
14 statutory act's requirements.

15 However, the adjudicatory record necessary
16 to show compliance with the performance standard could
17 be much more difficult to develop than that necessary
18 to show compliance with the prescriptive rule.

19 These observations concerning the possible
20 drawbacks of performance standards apply both to
21 initial licensing and to inspection and enforcement.
22 While they are more difficult for the agency to
23 administer, they provide the regulated entity with the
24 advantage of being able to choose or invent the least
25 cause solution for its particular situation. In this

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1 respect, I'd agree with Professor Golay that such an
2 approach encourages innovation and design
3 simplification and technological development and you
4 have to take that aspect into account in your
5 decisions as well.

6 The Conference has had several occasions
7 to consider alternatives that might assist technical
8 agencies in improving their decisional processes. In
9 1987, as part of its Recommendation 87-10, the
10 Conference encouraged the Occupational Safety and
11 Health Administration to use performance standards
12 whenever they would provide equivalent protection as
13 that provided by design standards, those that
14 prescribe a specific technology or precise procedure
15 for compliance.

16 The Conference added that in deciding
17 which type of approach to use, it should consider
18 whether the standard could be readily understood and
19 monitored and whether it could lower compliance costs.
20 In the preamble to the recommendation, the Conference
21 included an important caveat. The Conference has
22 found no alternative regulatory approach that is
23 always appropriate or better than the traditional
24 presumptively prescriptive regulation. So, while our
25 OSHA investigations encourage performance standards,

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1 we wouldn't say or we couldn't say that one should
2 jettison the traditional mechanisms completely.

3 The OSHA example is similar in many
4 respects to the criticisms made by Professor Golay in
5 his underlying paper. OSHA critics objected to design
6 standards because they could impose greater costs and
7 equally effective alternatives. They required
8 revision every time a technological change took place,
9 they were difficult to apply in varied work machine
10 configurations and they were difficult to understand.
11 Their advantages however were precise expectations for
12 employers, you knew what you had to do; easy
13 compliance monitoring, you either fit in the rule or
14 you didn't fit in the rule; and the ability to ensure
15 that new technologies were implemented.

16 While the Conference supports use of
17 performance standards in appropriate circumstances, I
18 would be remiss if I did not mention the desirability
19 of developing consensus standards, whether they are of
20 the performance or prescriptive variety. You didn't
21 expect me to not mention alternate dispute resolution.
22 As you may know, the Conference has been a strong
23 advocate of alternate dispute resolution techniques
24 and the most obvious example in the standard setting
25 context is negotiated rulemaking. Since the

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1 Commission has already conducted negotiated
2 rulemakings, I will not belabor this point. The
3 Conference encourages the use of that technique in
4 appropriate circumstances, which I hasten to add is
5 not every circumstance for even a large number of
6 situations. In difficult policy areas where consensus
7 is needed and where issues can be defined in an
8 appropriate manner for consensus resolution,
9 negotiated rulemaking is the tool of choice.

10 I might add that the Congress just passed
11 a negotiated rulemaking act which is up before the
12 President to encourage all agencies to explore greater
13 opportunities for negotiated rulemaking. If that is
14 signed by the President, then we will have a new
15 framework for the use of that technique.

16 The Conference has had occasion to
17 consider as well hearing procedures for the resolution
18 of scientific issues. In 1985, the Food and Drug
19 Administration established a unique procedure for the
20 Public Board of Inquiry, PBOI in their alphabetic
21 parlance, to obtain independent scientific review of
22 particular regulatory decisions. The PBOI is one of
23 three alternate informal methods of proceeding that
24 the FDA offers applicants in lieu of formal ALJ type
25 on-the-record proceedings or APA 554 proceedings

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1 similar to that when considering approval of food
2 additives and new drugs.

3 They also are allowed to choose a hearing
4 before an advisory committee similar to the NRC
5 Advisory Committee on Reactor Safeguards or an
6 informal hearing before the Commissioner of FDA which
7 is probably like the informal proceedings now codified
8 in NRC's Rules of Practice.

9 As a result of the Conference's
10 examination of the FDA experience, we concluded in our
11 statement number 11 entitled, "Statement on Hearing
12 Procedures for the Resolution of Scientific Issues,"
13 that agency experimentation with alternate types of
14 hearing procedures for the resolution of scientific
15 issues is justified. I should note that in these FDA
16 examples, the purpose of the procedure was to develop
17 a record to be used in successive stages of the
18 administrative and legal process whether that was a
19 rulemaking or an adjudication. These flexible type
20 formats could be used by the NRC to develop the type
21 of standard, i.e. performance or prescriptive, as well
22 as the technical basis for the standard involved.

23 I would urge that you consider the
24 possibility of some of these flexible formats to
25 assist you in determining whether a particular rule

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1 should be of a performance or a prescriptive variety
2 because I have to underscore that your decisions in
3 these matters will depend as much on the particular
4 scientific context or regulatory context that you're
5 dealing with, the specific rule you want to make, as
6 much as some general miasma, we like performance
7 standards, we like prescriptive standards.

8 I've named these different approaches
9 because practical considerations usually prevent the
10 use of one theoretical model to the exclusion of
11 others. That is to say whatever is in the air, you
12 still have to look at the particular problem at hand.

13 For example, the Consumer Product Safety
14 Commission adopted a performance standard requiring a
15 "sharp points" lab test for toys and toy blocks. This
16 was an easier standard to write and certainly more
17 cost effective than trying to specify myriad design
18 and material options acceptable for toys. That's a
19 performance standard, don't have sharp edges.

20 On the other hand, if a regulator tries to
21 adopt many performance standards in lieu of design
22 standards, the result may be unacceptable confusion.
23 For example, sanitary plumbing must meet structural
24 strength requirements, thermal response requirements,
25 mechanical features, chemical features, including

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1 odorlessness, color stability and stain resistance,
2 biological effects and noise control regulations.
3 Separate performance standards for each factor might
4 make conformance prohibitively complex and expensive.

5 The regulated entity may also find
6 situations where a performance standard is less
7 desirable than a prescriptive one. For example, when
8 OSHA changed its fire safety rule dictating the exact
9 height for mounting fire extinguishers and
10 substituting a performance standard stating that the
11 extinguishers must be "accessible," it opened an
12 Pandora's box. The burden of compliance for the
13 industry became more difficult. Basically whether or
14 not the fire extinguisher was "accessible" became a
15 matter that had to be litigated continuously and more
16 regulation resulted rather than less.

17 My conclusion, after having observed the
18 debate over regulatory philosophy for a number of
19 years, is that while I urge experimentation with
20 performance standards, again I underscore no one
21 solution is a panacea. Regulators have to examine
22 each approach and weigh the cost benefits and
23 associated tradeoffs in specific cases. While
24 performance standards are often easier to write, they
25 are often harder to regulate, i.e. both practically as

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1 in the accessible example with OSHA, and as a matter
2 of legal process.

3 If the time necessary to adjudicate
4 compliance therefore is a major factor, the more
5 prescriptive the requirement the less they will be to
6 adjudicate. If adjudication is not a problem, but the
7 state of technology is rapidly changing and that's
8 your cutting edge issue, the performance requirement
9 may be indicated. Compliance measurement may be
10 controlled, public acceptance may be critical with one
11 approach more easily accepted than another. The ease
12 of writing one standard or the other may be important
13 and indeed dispositive. Each of these consider -- I
14 mean I think again looking back on it the OSHA people
15 would say, "We failed to capture what we wanted when
16 we used the word 'accessible.'" Each of these
17 considerations must be balanced in order to determine
18 how to proceed.

19 One further speculation. While
20 performance standards themselves have historically
21 been promulgated through rulemaking, there was at
22 least some evidence that the common law of the
23 standards, e.g. how they are in fact implemented, will
24 be worked out in compliance hearings and
25 adjudications. To some extent, therefore, performance

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1 standards allow implementation policy to be made in
2 adjudication context and you the Commission will have
3 to struggle how much you like that or don't like that
4 approach.

5 I hope I've been of some small assistance
6 to your deliberations and if at any time the
7 Conference can be of help in more specific ways
8 concerning fairness, efficiency or management of
9 initial processes, please do not hesitate to ask.
10 Thank you very much.

11 COMMISSIONER ROGERS: Thank you very much
12 for a very interesting perspective. It's a little
13 different from a purely technical one.

14 Shall we turn now to Doctor David Rossin?

15 DOCTOR ROSSIN: Thank you, Commissioner.

16 This presentation was based on some work
17 that George Sauter did at NSAC back in the mid-'80s.
18 I left NSAC in '86 to go to DOE. George is now at DOE
19 and this hearing offered us the opportunity to review
20 and rethink some of the work that we did at that time.

21 In an effort to shorten this, I'm going to
22 hope that whoever is running the slides can stick with
23 me. The slides have numbers on them and I'll try and
24 use them. So, if you want to use the first slide, at
25 least I'll know where you're starting.

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1 Prescriptive regulation, we've heard about
2 these terms today. Prescriptive regulation focuses on
3 a means of accomplishing a desired end and tends to
4 down play the end in itself. Nonprescriptive
5 regulation recognizes that there are more ways than
6 one to meet a functional requirement. The appropriate
7 measure is the result, the performance, and not how it
8 is achieved. The how can be studied and emulated, but
9 should not be prescribed.

10 Ultimately, sets of words are used to tell
11 the designer and operator what is to be done. We call
12 these prescriptions. Somebody has to write every
13 prescription. In nonprescriptive regulation, it means
14 that the regulator, which would be the NRC in this
15 case, doesn't do it. The licensee writes the
16 prescription and the NRC reviews it. This is because
17 it is the licensee who is ultimately responsible for
18 safety and performance. The one with the
19 responsibility should be the one who determines how
20 the desired result is to be obtained.

21 Nonprescriptive regulation also means that
22 the licensee can change a prescription subject to the
23 applicable rules and subject to NRC review under those
24 same rules. If another party, either the regulator or
25 a third party, proposes a change, the burden of proof

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1 that is necessary falls on the one that proposes the
2 change. The proposer may make a showing that a change
3 would be cost effective, but that would not be
4 sufficient to mandate the change. The decision to
5 implement remains that of the licensee.

6 This presentation is not offered today as
7 an academic exercise. The ultimate viability of
8 standardization in nuclear plant licensing may hinge
9 on success in implementing concepts suggested in this
10 presentation. I'll return to that point in a few
11 moments.

12 Historically, NRC has been heavily
13 involved in writing prescriptions. The regulatory
14 guides are the most obvious examples. They say that
15 following the guidance will be acceptable and that
16 another approach can also be acceptable but the burden
17 of proof of acceptability of any alternative
18 prescription is on the licensee. The result, though
19 not intended, has become a barrier to innovation and
20 improvement. As the Kemeny Commission noted after
21 TMI, the control and safety systems at that relatively
22 new plant were old. They did not represent state of
23 the art at all. For a complex and changing
24 technology, it does not make sense to be locked into
25 old and outdated equipment.

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1 I'd like to comment there. I agree with a
2 lot of the things that Michael Golay presented. I
3 think our thinking tracks very well in many of these
4 areas. I do think back to the Kemeny Commission's
5 report which focused heavily on the over attention of
6 the nuclear industry on compliance and also an over
7 emphasis on designing for extremely severe accidents
8 and not looking enough at accidents of somewhat higher
9 probability but less consequence. Of course that's
10 what got us into the problem with TMI in a way.

11 Anyhow, I think there has been improvement
12 over the years. I think the trend is turning around.
13 I think there's more attention being paid to what it
14 is we're trying to accomplish in safety and I do
15 believe that the backfit rule has permeated the
16 thinking of the staff and is helping to accomplish
17 this.

18 I'd like to just hark back to one thing
19 that occurred to me during your earlier presentation.
20 That is an example of a regulatory guide that was
21 proposed without much attention to the state of the
22 art. This was the severe accident instrumentation
23 guide that was proposed back in about '77. It said,
24 "Here's what information the plant is going to have to
25 be able to provide in the event of the following type

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1 of accident." The only probably was there wasn't any
2 technology to deliver that. The instrumentation did
3 not exist, it wasn't on the market. In fact, the
4 people didn't know how to do it to meet all the
5 requirements.

6 We argued about that for a couple years.
7 Meanwhile, TMI happened and it would have been very
8 handy to have had instrumentation not to meet that
9 regulatory guide, but to provide post accident
10 instrumentation. The whole industry was sitting
11 around waiting to see what the negotiations would
12 result in.

13 Anyhow, let me turn to the problem, and
14 that is the regulatory structure in the U.S. has been
15 subjected to heavy political pressures and has
16 responded by becoming very rigid and legalistic.
17 There's a widespread recognition throughout the
18 industry that there can be a heavy penalty for
19 attempting to change, to improve or to innovate in any
20 plant that has its license and is operating
21 satisfactorily.

22 The regulation of any technology to assure
23 that it is acceptably safe should have three principal
24 components: risk policy, risk assessment, and risk
25 management. I'll comment briefly on these. My slide

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1 number 6 is about where I am in this presentation.

2 How safe should nuclear power plants be?
3 What is an acceptable level of risk? These questions
4 have been the subject of endless debate and this will
5 keep going. The answers cannot be obtained from
6 technical and scientific principles alone. Rather,
7 the answers should reflect societal value judgments
8 which are indicated by what people are willing to
9 accept. Now, ideally, these judgments should reflect
10 due consideration of all the factors, the benefits,
11 the costs and the risk, and the risk of the
12 alternatives to nuclear power for electrical
13 generation, the need for diverse and reliable sources
14 of electricity.

15 For example, the risks to society from
16 inadequate electrical generating capacity are real and
17 should certainly be considered in setting our top
18 level performance objectives. Professor Golay
19 commented on the situation in Japan, or somebody did,
20 that Japan says, "We're going to have to increase our
21 amount of nuclear power in the future." I live in
22 California now. Los Angeles has said, "We're going to
23 start introducing electric cars out here and we're
24 going to have a goal of introducing a substantial
25 fraction of the vehicles powered by electricity by

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1 2006," I believe. That's all fine unless we end up
2 charging these batteries by running gas turbines day
3 and night in order to charge the things. We're going
4 to be self-defeating in our goal unless we have the
5 technology to do what it is we're trying to do.

6 I believe that over the years NRC has been
7 schizophrenic in its consideration of non-safety
8 factors. On the one hand, it's often stated that its
9 mission is safety only. On the other hand, it has
10 claimed that it is required by the National
11 Environmental Policy Act to consider costs,
12 environmental impacts, energy needs and diversity of
13 supply in its environmental analyses, and I think it's
14 done this. The purpose of NEPA, as I recall it, was
15 to make sure that these arguments are heard during the
16 licensing process and that the agency granting the
17 license has had the opportunity to hear this input.
18 It doesn't mean that they've got to obey everything
19 that they're told, but to hear the input. And I think
20 this process is maturing gradually.

21 Because they may be subjective, however,
22 things like no undue risk to any individual or because
23 technical uncertainties may make it too unsure that
24 they're being complied with, such as no more than a
25 one percent increase in latent cancer risk, statements

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1 of overall levels of acceptable risk are not easy for
2 the regulator to apply. The regulator still needs a
3 set of supporting criteria at lower levels, down to
4 the level of plant functions and systems, to allow him
5 to implement top level objectives in a useful way.

6 To be useful, these supporting criteria
7 should be consistent with top level objectives and the
8 degree of compliance with them should be measurable
9 with reasonable certainty. Given the top level
10 objectives, appropriate lower level criteria can be
11 established through the application of scientific
12 principles. Therefore, their establishment should be
13 done by technically capable persons with input from
14 the regulatory body itself, the regulated and the rest
15 of the technical community.

16 To follow Professor Golay's presentation,
17 I'd make the point here that this is an opportunity to
18 use PRA to test the effectiveness or the validity of
19 the lower level criteria. You set a lower level of
20 criteria to see how a system would look, how it would
21 be designed, and conduct a probabilistic risk
22 assessment and see if you get consist results that say
23 that the criteria you have established makes sense in
24 terms of the results that you get.

25 In terms of risk assessment, I would note

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1 that based on performance, one can evaluate them and
2 ask to see if our top level safety objectives and
3 supporting criteria are being met. We haven't
4 explicitly stated all these, but I think we can say
5 that safety objectives are being made in licensed
6 plants in this country and certainly we have spent an
7 awful lot of time learning from them. That doesn't
8 mean things can't be improved.

9 In the performance based or
10 nonprescriptive regulatory structure we outlined, the
11 NRC would do all the things it does now except
12 prescribing what is to be done. Thus, it would
13 continue to conduct safety analyses, review risk
14 analyses and other submittals by licensees and license
15 applicants, evaluate operating experience and analyze
16 abnormal operating events, identify actual or
17 potential safety issues and carry out plant
18 inspection.

19 Risk management, as we define it, is
20 prescribing of a means to be used to assure that
21 nuclear plants comply with their criteria established
22 for acceptable levels of risk.

23 The NRC role in risk management would be
24 essentially limited to enforcement. However, under
25 its risk assessment authorities, the NRC could review

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1 and evaluate any aspect of the licensee's prescription
2 at any time to test, for example, if assumed component
3 reliabilities were actually being achieved or if
4 prescribed operator training programs were actually
5 being conducted.

6 In summary, under the regulatory concept
7 outlined here, the NRC could carry out all the
8 activities it does now except to prescribe in full or
9 in part how the established safety criteria are to be
10 met. The licensee, who is ultimately responsible for
11 the safe operation of his plant, must be allowed to
12 write those prescriptions and any necessary revisions
13 as best suits his particular circumstances. If the
14 NRC or any other party forces part of the prescription
15 on the licensee, then it should be responsible for any
16 consequences resulting from that part of the
17 prescription being faulty.

18 I would comment on the side that I don't
19 visualize the success of that particular set of
20 circumstances.

21 I believe the critical test which may make
22 or break the future of nuclear power in the U.S. lies
23 before us. That test is whether we can successfully
24 apply the concept of standardization to nuclear plant
25 licensing. For standardization to work, there must be

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1 a viable mechanism for making necessary changes to
2 licensed plants, making improvements, meeting
3 functional requirements with different components and
4 methods. This mechanism must also permit changes at
5 one plant to remain unique or make it easy to
6 implement the same changes at some or all similar
7 plants.

8 The key to standardization is an agreement
9 on the purposes and the objectives. Standardization
10 is important for safety certification and regulatory
11 review. Standardization has great potential value for
12 improving reliability and economics. But
13 standardization is not important for the sake of
14 standardization itself. I'll repeat that.
15 Standardization is not important for the sake of
16 standardization itself.

17 The NRC needs to find a way to handle the
18 modifications and continual work projects that must go
19 on in operating plants. The relevant issue here is
20 not standardization per se, but the need for a good
21 mechanism which allows changes to be made at plants
22 initial approved as standardized plants without
23 requiring that the same change be made at other
24 plants. Standardization is needed for safety review
25 and certification of designs, but maintaining strict

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1 standardization for the sake of the concept is neither
2 needed nor appropriate.

3 How can safety be assured if plants are
4 allowed to do different things once they are licensed
5 as standardized plants? The answer is nonprescriptive
6 regulation. What is important is that the functional
7 performance objectives need to be maintained. There
8 may be a variety of ways to assure that they continue
9 to be met even though changes are made in hardware and
10 procedures and that these changes may differ from
11 plant to plant.

12 Where safety considerations dictate that a
13 change must be made in all plants of a class, NRC can
14 mandate it, just as NRC can do today.

15 The operation of standardized plants
16 offers a logical opportunity to apply nonprescriptive
17 regulation. Once constructed satisfactorily,
18 nonprescriptive regulation based on performance
19 criteria can be applied to evaluate both proposed
20 changes and possible requests for conformance based on
21 changes made in other plants licensed under the same
22 standardized plant certification.

23 I would comment as an example of the
24 problem that I see, in the past there have been
25 instances in which design changes have not be approved

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1 even though they still meet the performance criteria
2 required for safety on the argument that the changes
3 would result in a decrease in the margin that
4 previously existed. This approach has resulted in a
5 stifling of design improvements and efficiency
6 initiatives. In standardized plants, there would be a
7 temptation to apply this same policy, regulating on
8 existing margin rather than on meeting actual safety
9 and functional requirements. The proper test should
10 be the ability to meet performance requirements
11 without limit on how they are to be met or what margin
12 may be claimed by previous or alternative designs.

13 I think since TMI there have been both in
14 the NRC and the industry, with INPO and EPRI and NSAC,
15 they've devoted extensive effort to increased
16 understanding of all the aspects of design and
17 operation and in-depth analysis of operating
18 experience.

19 On the basis of safety, the present body
20 of regulations appears to have been successful.
21 However, the fact that no plant has been completed
22 that has been ordered since 1973 is a clear indicator
23 that the balance is not correct. The fact that it is
24 taking the system so many years to review the design
25 of a plant based on 20 years of experience serves

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1 notice that the present approach must be improved
2 upon.

3 The application of performance-based,
4 nonprescriptive regulations can be achieved without
5 legislation, and could go far toward building the
6 necessary understanding to permit new plant orders
7 without compromising the high standards of safety that
8 have distinguished the American nuclear power program.

9 Thank you.

10 COMMISSIONER ROGERS: Thank you very much,
11 Doctor Rossin.

12 I think we'll turn now to Doctor Roger
13 Mattson.

14 DOCTOR MATTSON: Thank you, Commissioner.

15 (Slide) If I could have my slides, I'd
16 start with the first one, please.

17 I guess it's an advantage to be the clean-
18 up hitter here. What I've heard going before me is
19 some views on both sides of the question about whether
20 we should move towards less prescriptive regulation
21 and it kind of fits in with what I had planned to say
22 to you because I'm going to give you some views on
23 both sides.

24 Let me say at the outset that I come down
25 at a bottom line thinking there are some advantages to

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1 nonprescriptive regulation and that we ought to
2 undertake some work to try to realize those
3 advantages. But there also are some advantages to
4 prescriptive regulation. You've heard some of those
5 listed and I'll try to put my spin on those with some
6 of my experiences with prescriptive regulation.

7 (Slide) If I can have the second slide.

8 I think it would help us all to remember
9 how we got to this point. Marty Malsch and I were
10 talking before we started this morning that we
11 remember back in the early days of the AEC, when we
12 first started working in regulation, that all of our
13 requirements were very general and we decided we
14 needed to make them more prescriptive so that we knew
15 how to enforce them and that people knew what we were
16 intending. The call of the day was to be more
17 prescriptive, not less prescriptive.

18 Well, prescriptiveness grew as the
19 industry grew and I've listed some of the reasons on
20 this second slide. We had a number of suppliers to
21 deal with, we had a wide variety of licensees, they
22 had different size, they had different experience,
23 they had different technical abilities and different
24 management abilities and regulating such a diverse
25 industry required us in many instances to be specific

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1 about what it was that was needed for safety.

2 As time went on, technology improved and
3 operating experience accumulated. It was necessary to
4 change regulations, to interpret them differently or
5 to add regulations to address new things that we
6 learned about. Also as time went on, higher levels of
7 safety were required. The societal, political forces
8 in our country decided that higher levels of safety
9 were needed, higher levels of assurance of safety were
10 needed and that led to increased prescriptiveness as
11 to how those levels were to be attained.

12 Then, of course, by the 1980s, after there
13 was already quite a body of prescriptive regulations
14 in place, there were additional information that
15 became available. The TMI accident and all of the
16 specific requirements that flowed from that accident
17 and, of course, the resolution of a large backlog of
18 generic and unresolved safety issues both led to
19 specific changes aimed at special problems and usually
20 problems of a fairly narrow nature. What this
21 resulted in was a patchwork of specific prescriptive
22 requirements that was very costly to backfit, it cost
23 plants under construction, it cost plants in
24 operation. And I think it is that a legacy of the
25 '80s that causes us today to say, "Surely there must

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1 be a way to do this better."

2 Another legacy of the '80s is the growth
3 of safety goals and the acceptance of PRA and perhaps
4 the tools by which we can do better in the future than
5 we've done in the past.

6 (Slide) On slide 3 I've tried to remind
7 us that there are a variety of forms of prescriptive
8 regulation. It's not just in the written requirements
9 like regulatory guides or Appendix K or Appendix R or
10 some of the national standards. You can also get
11 prescriptive regulations by the actions of individual
12 staff members, both reviewers and inspectors. You can
13 get collective decisions from the staff either on
14 specific licenses or on generic issues that are very
15 prescriptive. For example, the TMI action plan was
16 very prescriptive or the station blackout rule or the
17 ATWS rule.

18 You can get actions of licensing boards as
19 they try to arbitrate the resolution of contentions on
20 a specific case that can be very prescriptive and the
21 actions of the Commission itself can be prescriptive,
22 such as Appendix R or the inerting of BWRs, things
23 like that that were actions initiated by and taken by
24 the Commission.

25 All of these forums of prescriptive

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1 regulation are amenable to management by the
2 Commission. We don't need to just do rulemaking to
3 manage prescriptive requirements, that is to put in
4 place through rulemaking some performance standard.
5 You can also manage the kind of prescriptive actions
6 that are taken by the staff individually or
7 collectively or the kinds of actions that are taken by
8 the Commission itself.

9 (Slide) Slide 4 talks about some of the
10 reasons for prescriptive regulation. Maybe we've
11 touched on these all today, so I won't spend a lot of
12 time with them. But often in the licensing process
13 there's a time pressure to not be on the critical path
14 for completion of construction or to not be on the
15 critical path for the resumption of operations. So,
16 in the negotiating that goes on in the granting of a
17 license or the approval to restart a plant, there's
18 pressure to come to resolution and prescriptiveness
19 sometimes flows from that pressure of time.

20 Remember that our licensing process in the
21 United States is an adjudicatory or adversarial
22 process and there are advantages in such a process for
23 being prescriptive about what the agency expects. The
24 less prescriptive you are, the more subject you are to
25 a delay in an adversarial licensing process. More

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1 contentions will be brought against you, more debates
2 will have to occur, in all likelihood, if you are
3 nonprescriptive.

4 I would just give you two examples to show
5 you what I'm talking about. Compare Appendix B on QA,
6 which is quite general, with Appendix K on ECCS, which
7 is quite specific technically. Then think back over
8 your own experience about how much adjudication has
9 gone on in the adversarial licensing process involving
10 Appendix B, especially in the '80s and there was a lot
11 of it. And think back about how much adjudication has
12 gone on about Appendix K since it was issued in the
13 early '70s and the answer is not much since it was
14 issued, but a whole lot before it was issued. That's
15 the simple point I'm trying to make there.

16 There's been prescriptiveness because of
17 the technical complexity of some of the issues that we
18 deal with. You can't be superficial with some of
19 these issues. You have to get down to details. When
20 people get down to details in an adversarial,
21 negotiating type process like our licensing process,
22 then you have to write the details down in order to
23 deal with them. That leads to prescriptiveness.

24 There's also variability among plants and
25 there you see prescriptiveness in the implementation

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1 of NRC requirements. For example, 50.49 on
2 environmental qualifications is quite prescriptive as
3 a rule in and of itself, but it gets even more
4 prescriptive when it's implemented plant by plant.

5 The rising level of safety I've already
6 mentioned, but just let me say that when we regulate
7 as we do in the United States by stating a minimum
8 standard for safety, and then if we raise that
9 minimum, it leads to a kind of incrementalism and
10 incrementalism, I think, leads to being specific and
11 being specific leads to being prescriptive. So,
12 that's another reason for why we've come to this point
13 of being a very prescriptively regulated industry.

14 Another reason that I haven't put on a
15 slide, and I thought about this morning in preparing
16 to talk to you, is that sometimes the industry itself
17 has come to the NRC and begged you to be prescriptive.
18 They do that as individual licensees saying, "Tell me
19 what it takes and I'll do this much and I'll get my
20 license." Or sometimes a vendor will come with a
21 standardized plant, for example, or a standardized
22 component, and want you to do a very prescriptive
23 technical review, approve their component for use in
24 very prescriptively controlled situations so they can
25 go sell it in the marketplace. So, those are some of

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1 the reasons.

2 (Slide) The advantages, on slide 5, I
3 think we've kind of covered those. There's less
4 manipulation in an adversarial process. Appendix K
5 worked, but Appendix B didn't, Appendix K being much
6 more prescriptive. There's less susceptibility to
7 reinterpretation.

8 I ought to pause on that one for a moment.
9 My experience at NRC and since leaving NRC has been
10 that a lot of people in the nuclear industry have been
11 burned by reinterpretation of NRC requirements.
12 Notably the people that had plants under construction
13 at about the time of Three Mile Island when nationally
14 we decided to have a higher level of safety and higher
15 assurances that that level of safety was being met.
16 So, nonprescriptive regulations, like Appendix B and
17 quality assurance and some other regulations, were
18 interpreted differently in the '80s than they had been
19 in the '70s by the NRC, which lead to rising costs and
20 delayed schedules for plants under construction.

21 So, if we go to less prescriptive
22 regulation, we have somehow to guard ourselves against
23 the reinterpretation of those nonprescriptive
24 standards sometime in the future.

25 Another advantage is the binding record of

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1 negotiated settlements. This is a process where the
2 government and the industry have to agree to do
3 something on a plant in order to get it to operate and
4 keep it in operation, sometimes because the issues are
5 complex and because the negotiation takes place at one
6 point in time and implemented over a long period of
7 time. If there's not some binding record of what was
8 agreed upon, the agreement can erode. People can
9 forget what the safety basis was, what the reasons
10 were for the negotiated settlement.

11 That really leads to the last bullet on
12 this slide. Configuration control, we all know, in
13 our nuclear plants has not been what we had hoped it
14 might be. Our safety system functional inspections
15 that NRC performs and that some licensees perform for
16 themselves have shown that the licensing basis has not
17 been well protected in older plants, in some older
18 plants as we had hoped it might be. Part of the
19 reason might be that the older plants were licensed to
20 some very general regulations, Appendix A and Appendix
21 B. They weren't backfit to the standard review plan
22 over the years. They didn't have detailed safety
23 analysis reports. That is, they were
24 nonprescriptively regulated in the early days of the
25 industry. That could contribute to the difficulty of

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1 configuration control later in life.

2 So, I would urge us as we think about
3 nonprescriptive regulation, which I said at the outset
4 I think there are some advantages we should work on,
5 we've got to be careful that we don't throw the baby
6 out with the bath water. There are some things to
7 keep.

8 (Slide) Okay. Slide 6 talks about the
9 advantages in regulating safety function performance.
10 Nobody else has called it that today. I did that on
11 purpose because of some experiences that I've had both
12 at NRC and since leaving the Commission when I did
13 some work for the IAEA. What Professor Golay is
14 talking about is setting some goals for the
15 performance of safety functions -- for example,
16 removal of decay heat -- and then using some modern
17 tools like PRA and safety goals to set the goals and
18 to determine whether you've met the goals for these
19 safety functions.

20 What happens when you do this kind of
21 safety function regulation is you get a better
22 counting for system behavior because you're using
23 system level models, PRA-type models of the plant.
24 You get better understanding of the interdependencies
25 of systems within the plant than you do when you're

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1 narrow and prescriptive and you regulate one component
2 or one system at a time.

3 You get an improved treatment of plant-
4 specific factors because you've by this approach
5 delegated responsibility to implement the approach--
6 that is, to figure out the details -- down to the
7 licensee and the licensee has command of the
8 individual plant factors. You provide for some
9 rationalization of your safety goal. Others have
10 called that the "disaggregation" of a safety goal.
11 That is, you break the overall performance standard
12 for the plant -- that is, the safety goal -- down into
13 its aggregate parts, the safety goals for subsystems
14 or functions, safety functions within the plant. We
15 did that when we solved the ATWS problem for light
16 water reactors and when the Commission put out its
17 rule on anticipated transients without scram. The
18 basis for that rule was a disaggregation of a yet
19 unapproved safety goal.

20 We've already mentioned that this approach
21 puts increased responsibility on licensees. That's
22 good. That causes licensees to be more technically
23 capable and it causes the details to be better
24 handled, but you can't be naive as you go into that
25 placement of greater responsibilities on licensees.

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1 We know from past history that there are some who are
2 good at accepting that responsibility and there are
3 some who are not as good, and you have to find a way
4 to protect yourself and protect the public for the
5 utilities that aren't able or ready to accept that
6 responsibility.

7 Probably the biggest advantage as an
8 engineer that I see in this approach is it provides
9 flexibility for optimization. You can take into
10 account both the power production purposes of the
11 plant along with the safety needs of the plant in
12 deciding what's the best way to design a system or to
13 put in place an administrative procedure or whatever.
14 That is, systems reliability becomes a common currency
15 of both safety and production when we move to this
16 kind of approach.

17 (Slide) On slide 7, I've tied to recall
18 for you, as Professor Golay did in his paper, that
19 there are some places where we've made forays into
20 this field before and I would just mention a couple of
21 them. The aux. feedwater reliability goal that's in
22 the standard review plan of course came out of post-
23 TMI PRA work on PWR aux. feedwater systems, and that
24 goal is a disaggregation of the then still unapproved
25 safety goal. I've said that twice now. You've

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1 approved the safety goal since then. And, some
2 understanding of grid reliability in PWRs across the
3 United States.

4 You may have forgotten, but at the time
5 the ATWS rule was proposed for rulemaking it was the
6 so-called second NRC proposed rule or the Hendrie
7 Rule. Commissioner Hendrie and I think Frank Rowsome,
8 who was on the staff at the time, drafted this rule.
9 I'd read to you a paragraph from the statement of
10 considerations, if you'll bear with me. It's the
11 second paragraph under the so-called Hendrie Rule.

12 It says, "The NRC is exploring the
13 possibility that the regulation of reactor safety may
14 evolve toward regulating the process by which
15 licensees ensure public health and safety and away
16 from licensing the details of plant design and
17 operation. Programs like the reliability assurance
18 program and this proposed rule offer promise of
19 growing into a formal, auditable way the NRC can
20 determine that licensees are doing a satisfactory job
21 of ensuring public health and safety."

22 That's very close to what Professor Golay
23 is recommending in safety function regulation, as I've
24 called it, reliability assurance regulation as Hendrie
25 called it, nonprescriptive regulation as we've titled

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1 it in today's meeting. We all know the Hendrie Rule
2 didn't win in that rulemaking, but out of that
3 rulemaking came a final rule on ATWS and I'll bore you
4 one moment more by reading to you a paragraph from
5 that rule's statement of consideration. There's a
6 page and a quarter on reliability assurance in that
7 statement of considerations.

8 It says, "One of the principal findings,"
9 and this is of the Salem ATWS event, "was the lack of
10 adequate attention being paid to the reliability of
11 the reactor trip system. The Salem Generic Issues
12 Task Force recommended to the Commission that a
13 reliability assurance program be included in the final
14 ATWS rule," and it gives a reference. "While this
15 rule," the one that was finally issued, "does not
16 require such a program, the Commission urges the
17 voluntary development of a reliability assurance
18 program for the reactor trip system."

19 It goes on to list four components of such
20 a reliability assurance program, and if I could I'll
21 read you those four components. They're going to
22 sound familiar in the context of today's discussion.

23 First, an analysis of the challenges to
24 and failure modes of the reactor trip system.

25 Second, a numerical performance standard

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1 for the reactor trip system challenges and the reactor
2 trip system unavailability.

3 Third, a process of evaluating plant-
4 specific and industry-wide operating experience to
5 provide feedback to assess whether the reactor trip
6 system is performing reliably enough.

7 Fourth, procedures within quality
8 assurance programs to assure that the reactor trip
9 system performs satisfactorily in service from a
10 reliability perspective.

11 And that sounds to me very close to a
12 trial application of what Professor Golay has
13 recommended in his paper. What this statement of
14 considerations says, in essence, is the industry will
15 be given some time to take that approach for the
16 reactor trip system, and if it does not the Commission
17 will examine whether rulemaking should be undertaken
18 to develop such an approach for the reactor trip
19 system.

20 On Sizewell-B in the United Kingdom they
21 had a safety goal, if memory serves me, of 10^{-6} for a
22 significant release. They disaggregated that safety
23 goal for safety function performance in the design and
24 regulatory review of Sizewell-B. Your staff has done
25 a review of that process. It's in a NUREG report and

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1 I believe that is an implementation by another country
2 for an advanced PWR design that would be fairly
3 typical of what you would do if you applied this
4 technique to an advanced reactor in the United States.

5 INSAG-3 is a document you've probably
6 seen. It came out of the IAEA. I had the privilege
7 of having some role in that. I'd remind you that in
8 there, in INSAG-3, there's a section on reliability
9 targets under the section on design. And, it was a
10 section that was put there not based on U.S.
11 experience. It was put there at the insistence of the
12 French, the Germans, and the British, because it was
13 their judgement that this kind of regulation was the
14 best way to move in the future. And, without reading
15 it to you, it says to establish reliability targets
16 for safety functions, and I believe that's very
17 similar to what we're doing here or what we're talking
18 about here.

19 Finally, I'd introduce a new thought I
20 think to today's discussion, and that is it isn't only
21 in design that you should consider using
22 nonprescriptive regulation. You can also use
23 nonprescriptive regulation in operational matters, and
24 I'll give you one example where we've done that.

25 After TMI there was a move within the NRC

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1 staff to get fairly prescriptive about occupational
2 exposure regulation. There was a counter move within
3 the industry to say, "We see the problem," that is,
4 occupational exposures are rising year by year and
5 they shouldn't be. They should be reducing year by
6 year. Naval reactors experience showed that that
7 could be done. Industry said, "Don't regulate us
8 prescriptively. In fact, don't even change your
9 regulations. Tell us generally what you want, and
10 that is exposure reduction, and we through INPO will
11 go do that." And we know that there's been some
12 success in that area.

13 And, basically what NRC did was to assure
14 itself that there was an active critical safety review
15 ongoing in plants, and they did that through
16 inspections and through promises by INPO, that there
17 were active ALARA programs, as low as reasonably
18 achievable exposure control programs. And, those the
19 NRC did have a handle on. They could assure that
20 there was such a program. They assured themselves
21 that there was analysis of exposure data and that
22 there were exposure reduction goals set through the
23 INPO process. That safety function is now achieved by
24 nonprescriptive regulation.

25 It's possible, in my mind, looking in from

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1 the outside as you struggle with the problem of
2 maintenance regulation, that there may be an analogue
3 in exposure regulation through nonprescriptive
4 regulation to solve the maintenance problem.

5 (Slide) On slide 8, I've tried to list
6 some prerequisites to moving to some safety function
7 performance type of regulation. We've already
8 mentioned today that you'd have to do some plant-
9 specific PRAs. If you confine your initial efforts in
10 this field to advanced reactors, you're going to get a
11 PRA for those reactors anyhow, so there's not an
12 increment by going this way. It's not an incremental
13 cost.

14 You've got to have some way to credibly
15 maintain the performance data. I believe in Professor
16 Golay's paper he recommended you do it. I don't
17 recommend you do it. I recommend you have somebody
18 else do it for you, like INPO, like NPRDS, and that
19 you have oversight of it. But, if industry is going
20 to use it, then it's got to be their system and
21 they've got to believe in it and they've got to
22 provide data to it.

23 PROFESSOR GOLAY: That's actually my
24 recommendation.

25 DOCTOR MATTSON: Okay. I misread it.

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1 You've got to have a durable consensus on
2 methodology. The last time I think as an industry we
3 looked at the methodology was with some guides that
4 were written in the early '80s with the cooperation of
5 the American Nuclear Society, the AIF then, and the
6 Commission. I think there's probably some change
7 that's occurring in PRA as you go about your
8 individual plant examination program right now. There
9 are some efficiencies, I suspect, that people are
10 beginning to learn about in probabilistic risk
11 assessment, the use of PCs, the use of master plant
12 logic diagrams. Things like that are making PRA
13 technology advanced and I don't know that you need to
14 worry about standardizing methodology right now. I'd
15 probably wait a couple years before I got into that
16 business.

17 You also have to worry -- and I've
18 mentioned this before -- about the ability of
19 licensees to implement the new approach. People are
20 going to have to be trained. You've got to make sure
21 that everybody shares the same attitude and the same
22 philosophy about the move in this direction. Again,
23 if you decide your initial trials are with advanced
24 designs, then the people you'll have to deal with are
25 more limited. You only have the advanced reactor

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1 designers.

2 (Slide) There are a number of interfaces
3 that you have to consider. I've listed those on slide
4 9. I won't spend much time here. You've got to find
5 a way to deal with the qualitative factors, such as
6 management performance and human factors, as you move
7 into this kind of domain. But, you can do it, because
8 you've shown you can do it with exposure control, as
9 low as reasonably achievable occupational exposure.

10 Common sense, the last bullet, means that
11 all of these new analytical high technology ways to
12 regulate you've got to make sure that the bottom line
13 still makes sense.

14 I think the defense in depth discussion
15 that you were having earlier, Commissioner Remick, in
16 looking at advanced reactors where people have
17 encouraged that they be of all passive character in
18 safety systems to reduce the load on operators, I've
19 noticed a tendency to build containments and decay
20 heat removal systems that require the reactor system
21 to go either to high pressure or high temperature and
22 stay there for a long time and to transfer heat out
23 through the containment through some passive means to
24 the environment.

25 That looks pretty good, but then you stop

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1 and you say, "Wait a minute. I'm the Chairman of the
2 Nuclear Regulatory Commission and I want to explain to
3 the governor of state XYZ that I've had an accident at
4 the plant and it's all very passively safe, but it's
5 going to take 30 days for the containment pressure to
6 decay." There's something wrong with a reactor that
7 does that.

8 It's nice to have that passive capability
9 in the background and you might get that out of some
10 of these new approaches, but it would also be nice to
11 have an active system that under most circumstances
12 would rapidly reduce the pressure inside a
13 containment. So, common sense has to be there and
14 defense in depth may be a good way to provide that
15 common sense.

16 (Slide) In summary, on my last slide, I
17 think prescriptive regulation has been necessary. I
18 think it will continue to be necessary in the future
19 for some of the same reasons it was necessary in the
20 past. I don't see you giving away the licensing
21 process that you have today, at least not overnight.
22 There are a lot of people who wouldn't want you to do
23 that. And, that licensing process demands some
24 prescriptive statements of what it is you expect,
25 otherwise it's too susceptible to reinterpretation

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1 over time and from case to case.

2 Nonprescriptive regulation has some
3 supplementary benefits. You've heard some of them
4 described. I hope I've listed some. You shouldn't
5 feel that you have to be static in regulation. This
6 is the Kemeny Commission speaking in '79, as Doctor
7 Rossin has described. They're saying keep up with
8 technology in '79 and there are some aspects of that
9 in this initiative that you're considering. I would
10 encourage you to try it a couple places. I've
11 mentioned one, maintenance, and others have mentioned
12 advanced reactors and those are the two that I
13 intended by this last bullet.

14 On advanced reactors, I think you have a
15 unique opportunity to lay your prescriptive
16 regulations alongside your nonprescriptive analysis
17 and optimization that the designer and the NRC could
18 work on, and then by certifying the plant through
19 rulemaking you can replace the old prescriptive
20 regulations that are not optimized by some new
21 prescriptions that were determined through a
22 nonprescriptive process, but still have the advantages
23 of prescription -- that is, they're durable over time.
24 They're not subject to reinterpretation by you or by
25 the licensee.

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1 And with that, I'll conclude. Thank you.

2 COMMISSIONER ROGERS: Well, thank you very
3 much.

4 I know Mr. Breger has to leave essentially
5 now, but I want to make sure that we thank him very
6 much for being with us and giving us a very
7 interesting perspective that's a little different from
8 the technical one.

9 I wonder, Commissioner Curtiss, if you
10 have perhaps a question?

11 COMMISSIONER CURTISS: I just have a
12 comment, I guess.

13 COMMISSIONER ROGERS: I know Mr. Breger
14 has to move, and that's why I'm --

15 MR. BREGER: I have an appointment on the
16 Hill as well.

17 COMMISSIONER CURTISS: I would, I guess,
18 congratulate you on the work that you've done in the
19 alternate dispute resolution area. I know you've put
20 a lot of effort into that initiative over time. It's
21 not squarely on the subject that we're discussing
22 today, but the contributions that you and ACUS have
23 made in that area have been I think of benefit to us
24 and all agencies.

25 MR. BREGER: Thank you.

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1 COMMISSIONER ROGERS: Well, we thank you
2 very much. We're sorry that you have to leave us,
3 because I think we've got some interesting questions
4 that we'd like to explore, but we'll just have to do
5 it a little bit separately.

6 MR. BREGER: Well, please, if you give any
7 of those to my office or my staff, I'd be happy to try
8 to answer them in detail for you.

9 COMMISSIONER ROGERS: Thank you again.

10 MR. BREGER: Thank you.

11 COMMISSIONER ROGERS: All right. I think
12 now I'd turn to questions. I'm sure we all have some.

13 Commissioner Remick?

14 COMMISSIONER REMICK: First, Professor
15 Golay, unquestionably I'm a believer in performance
16 standards where it makes sense to do so and I did have
17 some questions about some of the concerns I have in
18 implementing it, but Mr. Breger did an outstanding job
19 in great depth and with some examples of expressing
20 those, and then Roger came along and added some, and
21 basically they relate to the fact that we live in an
22 adversarial adjudicatory licensing process. And, as
23 was pointed out particularly by Mr. Breger, I think it
24 is more difficult in that environment to show
25 compliance with performance-based standards than

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1 perhaps prescriptive. I also think that probably
2 applies in our inspection process.

3 For inspectors, prescriptiveness helps
4 them to check-off whether a licensee is meeting -- I
5 don't defend it, but it's an observation, makes it
6 easier. And I think performance-based standard
7 probably requires greater technical capability of
8 inspector staff to be able to put away a licensee is
9 doing something and whether that meets the overall
10 performance standard.

11 And then my fear, as I think Mr. Breger
12 indicated, that this could lead to continuous
13 litigation -- but, he did a thorough job of expressing
14 those limitations or what I express as my concern. I
15 was going to ask you, do you have any reaction to the
16 things that he said or, as I've tried to describe,
17 general concerns?

18 PROFESSOR GOLAY: Well, there is one
19 point, which was referring to the article which I'd
20 circulated with you and the criticisms of the existing
21 systems. I'd mentioned being arbitrary, inconsistent,
22 and legalistic. They do not all flow from the same
23 sets of causes, in my view, and the legalistic side of
24 things will be there no matter what we do, as you've
25 pointed out. Rather, the hope here is that you can

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1 make at least the structure of the questions that you
2 try to ask -- or try to answer, rather, more
3 consistent and with the basis of always appealing to
4 alternative interpretations to a single standard.

5 I guess I don't really know or have a
6 sense of whether this would be better or worse from
7 the point of view of litigation. I do believe that
8 you can take almost any logically-based system and
9 make a mess of it, you know, given enough help from
10 enough people, and from that point of view it might be
11 worthwhile to try it in a smaller example first and
12 make some decisions on that basis.

13 It seems to me that, in a way, the
14 litigious aspect of what we have in our nuclear safety
15 regulation is less a consequence of whether we have a
16 prescriptive or nonprescriptive system than it is a
17 consequence of the fact that many of our social
18 questions tend to get focused on the licensing of
19 nuclear power plants. That is, we have questions
20 which range from should we have a nuclear power
21 program to is the layout of the bolt circle on the
22 pressure vessel the right one.

23 I would probably cast the question
24 differently, asking in effect how can we create
25 alternative forums to resolve the broad social

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1 questions on the acceptability of nuclear power so
2 that the nuclear safety regulation becomes focused
3 much more on just whether the hardware will do what
4 you intend it to do. If you look at the systems in
5 most other countries, they have that kind of
6 separation and I've always felt that that explained a
7 lot of why our procedures are very time-consuming and
8 complicated.

9 DOCTOR ROSSIN: Forrest, could I add
10 something to that?

11 COMMISSIONER REMICK: Most certainly.

12 DOCTOR ROSSIN: I think Marshall Breger
13 pointed out that in general the Supreme Court and
14 where it's been settled at a lower level have
15 supported administrative agencies in their
16 determinations on these issues when the record is a
17 sound one. And, you look at some of the most serious
18 delays in nuclear plants in the case history. When
19 they finally got to the Supreme Court, the Agency and
20 the licensee were upheld in their decision. The only
21 problem was that the years of delay resulted in the
22 economic disasters that have pretty much put nuclear
23 power on the shelf in this country.

24 I can think back all the way to the Bailey
25 case where I think 10 or 11 years went by while that

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1 was litigated. Well, the final decision of the
2 Supreme Court said that the Agency was perfectly in
3 the right in making the decisions it made. By that
4 time, the baby was dead and the issue was gone. And,
5 I don't think this really is a function of
6 prescriptive or nonprescriptive regulation. If
7 somebody wants to take advantage of the system, they
8 may find a way and it may be with a prescriptive rule.
9 It may not. So, I don't think that's a valid argument
10 for not applying nonprescriptive regulation where you
11 can.

12 And, the OSHA example I think is a very
13 important one, because I think it's widely recognized
14 that OSHA is an indication of a lot of our problems of
15 being overly prescriptive in legislation and in rules
16 that were so prescriptive that in general they were
17 overkill in many, many directions. It seems to me
18 that what was missing there was leadership in an
19 agency that told its enforcement people, "Here is what
20 you must do and here's a record and a basis for it,"
21 and that I think would have stood the court test,
22 rather than finding that individual inspectors were
23 fighting with a licensee about whether the thing is
24 this high or that high. That shouldn't have happened.
25 The leadership was missing.

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1 COMMISSIONER REMICK: Well, certainly, I
2 feel that performance standards are worthy of an
3 attempt to use them. There's just no question about
4 that. I found Roger's suggestion that perhaps the
5 certification process is one where we can take
6 existing prescriptive regulations perhaps and put in
7 another format. You have the prescriptive regulations
8 that you want to make sure things meet. That's an
9 interesting thought.

10 DOCTOR MATTSON: By having the
11 certification rulemaking, you draw all of the
12 attention to a national level proceeding where you put
13 on the record all of your PRA basis for the optimized
14 design that you've chosen or that you've decided to
15 license for an advanced plant. And then, once you've
16 been through that process at a national level, then in
17 theory you don't have to go through it again on an
18 individual plant level, but you could still make the
19 outcome of that national level rulemaking be a very
20 prescriptive definition of what you expected to see
21 over the life of that design in terms of the
22 performance of that design. I don't know. The
23 lawyers would have to advise us how to do that, but I
24 would think it would be through some reference to the
25 safety analysis report on which the rulemaking was

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1 based to certify the design.

2 PROFESSOR GOLAY: Let me add two things to
3 build on that, and that is in my proposals I've always
4 suggested that we try this out for new plants, that
5 trying to take an alternative approach and apply it to
6 the existing license I think is just asking for an
7 incredible amount of trouble. And, the idea of doing
8 it on standardized designs I think is really the right
9 way to do it, because this is a more labor-intensive
10 approach. You really have to go in much greater
11 depth. And so, the justification, if you've got a few
12 examples where you're really going to try and do it
13 right, I think makes sense in that way as opposed to
14 taking some operational examples.

15 COMMISSIONER REMICK: One of the example
16 that I think of performance-based -- and I hesitate to
17 use the word "standard." I should say a performance-
18 based goal -- is the safety goal.

19 But, Dave, I noticed on one of your slides
20 you indicated the safety goal as an example of
21 prescriptiveness and that really surprised me because
22 it doesn't say how to do it. It just states a goal
23 from a perspective of public health and doesn't tell
24 you how --

25 DOCTOR ROSSIN: Let me clarify that.

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1 COMMISSIONER REMICK: Okay.

2 DOCTOR ROSSIN: It's very simple. On that
3 one slide I listed a number of topics for discussion
4 and I wanted to discuss and compare. Please ignore
5 that particular slide.

6 COMMISSIONER REMICK: Okay.

7 DOCTOR ROSSIN: It needed a lot more
8 discussion than just the bullets.

9 COMMISSIONER REMICK: Okay. And both in
10 your paper and you mentioned a one percent increase in
11 latent cancer risk and I wasn't clear if you were
12 referring to the safety goal. If that's the case,
13 it's a tenth of a percent increase, but I thought -- I
14 didn't know. The one percent increase in latent
15 cancer risk, both in the paper and you mentioned this
16 morning, I'm not sure what you're referring to
17 specifically.

18 DOCTOR ROSSIN: I was just using that as
19 an example of a thing that could be used, if one-tenth
20 is the right number. But, all I was getting at is
21 that if you use a calculated goal like that, using
22 uncertainties of the kind you have in the linear
23 theory, you're going to get a number, but it's just a
24 number.

25 COMMISSIONER REMICK: Do you have any

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1 reaction to my statement that I think if we had
2 performance-based standards that it would require of
3 our staff, certainly our inspection staff,
4 considerable technical capability to make the
5 judgement of what they saw in the plant, because it
6 would be many different ways of approaching the same
7 performance standard. And, wouldn't it require
8 greater technical capability on their part to make the
9 judgement that that meets that performance standard,
10 versus, if it's very prescriptive, saying yes they
11 meet it or not?

12 DOCTOR ROSSIN: Well, obviously, if it's
13 meeting a simple prescription, you can say yes or no.
14 But, my impression is that the engineering capability
15 of the staff is adequate to do the kinds of things
16 we're talking about. There aren't that many nuances
17 here. I think we're talking about trying to establish
18 criteria and then saying, "Look, I'm trying to do
19 exactly what I've agreed to do. I'm going to do it a
20 slightly different way and I can show you why this way
21 is just as good or better than the way I did before."
22 That should be no problem.

23 I'm scared about rigidity where someone
24 says, "Uh-oh, no. That's no good because it's
25 different from what we did before," or, "I can show

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1 you that I've got a safety margin of 50 percent here
2 and I can see that we can do this much better. The
3 safety margin, we still meet the goal. We meet it by
4 30 percent instead of 50 percent. That should be
5 perfectly good."

6 In fact, one of the examples Roger gave
7 was Appendix K. Appendix K was arrived at by
8 litigation, not by technology, and years later--
9 well, and at the end of that proceeding I think one of
10 the reasons you didn't have a lot of litigation
11 following the decision on Appendix K was, number one,
12 the industry lost and they'd had a belly full of it
13 and they were really not interested in going back and
14 going through this again.

15 Back in the mid-'80s at NSAC we went back
16 to Appendix K and we looked at the margins that were
17 there based on the safety basis for Appendix K. I
18 mean, it says in the rule, "Here's what we set out to
19 do." Now, you looked at the numbers with the kinds of
20 computer capability we had and the experimental
21 evidence and the operating experience that we'd
22 accumulated over the previous seven or eight years
23 since the rule and saw that the limiting temperatures
24 were maybe 200 or 300 or 400 degrees more stringent
25 than they needed to be to accomplish all the safety

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1 goals or all the safety bases that were in there.
2 Appendix K is too rigid to change without rulemaking
3 again.

4 If it said do it so that it meets the
5 rules, then I think any competent regulatory
6 engineering staff could review what you did and see
7 that with NRC approved codes and everything else the
8 requirements are met, and frankly this has made a
9 difference of a substantial amount in terms of core
10 performance throughout the United States and
11 throughout the rest of the world where they adopted
12 out standards just because it was easier to do it.

13 I think that a tremendous price has been
14 paid, but as a result of that litigation it was so
15 contentious and so extended and so brutal that nobody
16 really was in the mood to contest it for quite some
17 time.

18 DOCTOR MATTSON: Commissioner Remick,
19 could I go back to your question about whether you
20 need more capability in the inspection staff?

21 It seems to me that you would implement
22 nonprescriptive regulation like you do prescriptive
23 regulation, with a 50.59, Part 50.59 process. You
24 depend on that implementation of that process by the
25 licensee the same way you do today. My experience

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1 with implementation of 50.59 is that it takes quite a
2 lot of technical skill by licensees today to know when
3 they have an unreviewed safety question.

4 Many licensees are required to run their
5 own analysis codes. Some of them are very
6 sophisticated codes. The licensees that choose not to
7 do that themselves, there are NSSS suppliers or others
8 that supply those analysis capabilities for them.
9 And, the fact that you're moving to a more
10 analytically dependent form of regulation I wouldn't
11 think would be particularly troublesome. I think that
12 licensees can provide that kind of skill today. They
13 could provide it in the future. That's why I
14 mentioned training. They may not have all of the
15 skills today that would be required by that different
16 kind of analysis that we're talking about.

17 Then, I think NRC would need two kinds of
18 inspectors: one to make sure that the process, the
19 50.59 process, the review of -- the determination of
20 unreviewed safety questions, that kind of thing, was
21 being followed, that is somebody to make sure the
22 records were there, that the organizations were in
23 place, that there was paperwork to show that the
24 organizations were reviewing the right questions using
25 the right codes; then, there might have to be another

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1 level of inspector who knew how to do that kind of
2 analysis himself, that would on a less frequent basis
3 make sure that the right technology was being applied
4 by licensees in reviewing changes to their plants.

5 COMMISSIONER REMICK: Very good.

6 I appreciate your mini history of the
7 development of prescriptive regulations in the AEC and
8 the NRC, and certainly agree. You basically said it
9 was inevitable that we became more prescriptive,
10 because we were very general, and for many reasons you
11 gave they became more prescriptive. Some of the
12 reasons were that new applicants weren't familiar with
13 what the AEC or NRC intended by their general
14 regulations, and you also mentioned that there were
15 later developments in technology or methods like PRA.

16 I wonder, then, if you drew a curve of
17 amount of prescriptiveness in regulations versus time,
18 if it wouldn't increase with time. But, should it
19 decrease at some point, then, as people -- more people
20 know what it is the Agency intended by its general
21 regulations and we develop new tools like PRA,
22 statements of safety goals and so forth? If that
23 curve should bend over with time, should it -- or,
24 should it always increase? Should it level off? Have
25 you given any thought to that?

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1 DOCTOR MATTSON: Yes. I had one idea of
2 that that I was going to mention, but I left it out
3 and I'm reminded of it now.

4 I think high energy line-break is a little
5 bit that way, the decision in the early '70s to go
6 with arbitrary pipe breaks and then to describe
7 exactly where those pipe breaks are going to be. And
8 then, the plants became very rigid over the '70s and
9 industry put its heads together and came up with a--
10 or helped NRC come up with a technical basis for
11 allowing credit for leak before break and saying that
12 there are ways to protect against this that are
13 preferable to the prescriptive way that was developed
14 in Reg Guide 1.46 and some letters that went out in
15 connection with that in the early '70s prescribing
16 exactly how to do this with every kind of pipe in the
17 plant. Instead, an equivalent level of protection
18 taking into account the bad effects of rigidity came
19 into being in the '80s and the Commission amended its
20 rules to take account for that, so in a sense that's
21 moving back from the overly-prescriptive, based on
22 lessons learned.

23 COMMISSIONER REMICK: Do you think we've
24 done enough of that?

25 DOCTOR MATTSON: Think we've done enough

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1 if that?

2 COMMISSIONER REMICK: Enough of that type
3 of thing, that example you gave that we've --

4 DOCTOR MATTSON: Oh, no. I am convinced
5 that, if you apply this technique to advanced
6 reactors, you will find places in your current
7 regulations that you will want to waive through
8 rulemaking because this approach shows you better ways
9 to design those plants. No question that this will
10 show you more systematically, more uniformly, in a
11 more optimal way how to build plants than the old
12 approach. It has to, because the old approach grew up
13 piece by piece through many different Commissions,
14 through many different members of the staff over a
15 long period of time and it's a patchwork.

16 DOCTOR ROSSIN: I can support that
17 strongly. I was deeply involved with that whole
18 process at EPRI throughout the early '80s. There is a
19 point where I think -- and I think targets of
20 opportunity like this are there and good work can be
21 done that can move this in that direction. It's not
22 an across the board thing. It's selective and should
23 be applied where it makes sense.

24 I think one of the things that could be
25 done better and could have been done better in that

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1 case and I think will be done better in the future is
2 that as examples like this come up I think the
3 Commission can adopt much less rigid ways of
4 implementing these improvements and changes. It seems
5 to me that that was a very good example, but the
6 amount of analysis that had to be done in order to get
7 back to a reasonable level where everybody knew they
8 had to be was extremely huge, took an awful lot of
9 time and probably could have been done in a much more
10 streamlined way.

11 I think the negotiations between the
12 industry and the Commission over that period of time
13 moved in the right direction, but it was very hard I
14 believe for the Commission to exercise the flexibility
15 that really they could have exercised as long as they
16 were very clear on what they were doing and documented
17 the basis on why they were doing it. I think we could
18 have moved ahead much faster.

19 COMMISSIONER REMICK: I would thank all
20 four of the speakers for a very interesting and
21 informative -- I know you've all spent a considerable
22 amount of time giving thought to this and it's been
23 very helpful with the different insights that you've
24 provided.

25 That's all, Mr. Chairman.

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1 COMMISSIONER ROGERS: Commissioner
2 Curtiss?

3 COMMISSIONER CURTISS: I guess I have a
4 lot of questions, but I'm not going to ask them all
5 since it's after lunchtime.

6 Roger, let me just ask you one question.
7 You talked about the potential for using an approach
8 like this in the maintenance area. I wonder if you
9 could embellish on what you see as a nonprescriptive-
10 based approach to maintenance along the lines of what
11 you envision?

12 DOCTOR MATTSON: Let me try. I have a
13 fairly simplistic view of it, so you'll have to
14 forgive me for being somewhat distant from it. Maybe
15 it will help.

16 You want better assurance that plants are
17 maintained in the state that you licensed them and
18 that you feel comfortable about them. The industry
19 seems not to want you to meddle in their business any
20 more than you already do. It seems to me that you
21 could speak to the process by which maintenance is
22 provided in nuclear plants and speak to the
23 performance you expect out of maintenance in keeping a
24 plant in the condition that you understood it to be
25 when you licensed it without getting into the details.

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1 And, to me, that's a form of nonprescriptive
2 regulation.

3 I think that's the same thing that the
4 Commission did when it decided not to get prescriptive
5 about occupational exposure. It just said, "We want
6 to see exposures go down, individually, collectively,
7 across the industry and at individual plants." I
8 believe you've got some record to show that they have
9 gone down.

10 COMMISSIONER ROGERS: You've got a
11 measurable number that you can point to, a
12 quantitative result, and with maintenance that's part
13 of the big problem.

14 DOCTOR MATTSON: Okay. I understand that,
15 and that's one of the reasons I brought reliability
16 assurance to the table again today, because an element
17 of a reliability assurance program is maintenance.
18 There's also quality assurance. There's also
19 replacement of parts or whatever, housekeeping,
20 whatever goes into assuring the reliability of an
21 already built system.

22 Maybe the way to go at maintenance is
23 along with some other things, quality assurance during
24 operations, maintenance, housekeeping. A lot of the
25 ex-Naval officers that show up on the Commission seem

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1 to have a strong interest in housekeeping. All of
2 those things go into making up a reliability assurance
3 program and maybe you want to go back and revisit that
4 idea and say all of these things are aimed at making
5 certain systems be of high reliability, the scram
6 system for example, and we have an interest in the way
7 scram systems and certain other safety systems are
8 maintained and the only way we know to measure that is
9 through some reliability, some performance standard
10 for those systems. Help us develop what constitutes a
11 reasonable performance standard for your plant.

12 The Hendrie Rule said let the plants
13 themselves develop the performance standard, NRC only
14 look at the methods that they were using to develop
15 the standard, because it will vary design by design--
16 that is, the performance system for the scram system.
17 And you could, through that door, influence not only
18 maintenance but also housekeeping and quality
19 assurance and replacement of parts and surveillance
20 testing and a variety of things that go into a
21 reliability assurance program.

22 PROFESSOR GOLAY: You know, I think one of
23 the problems that you get into with, say, if we take
24 the maintenance or scram reliability thing is that in
25 a lot of these things there's judgement required. And

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1 one approach that could be suggested is, well, let's
2 do what seems reasonable to try and push people
3 through their voluntary efforts acting in their own
4 self interests to do things which would give a good
5 result and I've always felt that one of the reasons
6 why you need a formal process or the kind that we're
7 talking about today is that it is in fact difficult
8 for the Commission to act with discretion where
9 there's judgement involved because of the spectrum of
10 licensees involved. You always have to worry about
11 those who won't perform in a reasonable way, even
12 though the majority may do so. And so, overall, I
13 think that would be one good reason for trying to get
14 some experience with a more formal functionally-
15 oriented approach.

16 Well, that's as much as I'll say about
17 that.

18 COMMISSIONER CURTISS: Well, I guess the
19 concept that you've articulated here, I thought
20 Marshall Breger and, Roger, you did a good job of
21 summarizing some of the advantages and disadvantages.
22 We'll all go back to our office now and we've got
23 specific initiatives sitting on our desk and it's a
24 question about how do we come up with a performance-
25 based approach to fitness for duty or fuel assemblies

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1 that get hung-up on the top or on the bottom of
2 reactor internals or day to day problems. I do, I
3 think, share a number of the desires that you all have
4 articulated.

5 I guess I look at the issue with I guess a
6 healthy dose of skepticism in terms of the
7 disadvantages. It does seem to me that the kinds of
8 problems that you get into that Mr. Breger identified,
9 the additional time that it will take to develop the
10 approach, the additional detail that the record is
11 going to have to be developed in and, third, the
12 particular point that we've discussed in the context
13 of the regulatory impact, the extent to which the
14 approach lends itself to interpretation. We spent two
15 hours here two weeks ago talking about what a problem
16 it is that our regulations are interpreted in such a
17 diverse range of ways by the inspectors and by the
18 regions and so forth, and the licensees are looking at
19 least in a lot of respects for some clear and uniform
20 answer to regulatory questions.

21 I do happen to believe that the approach,
22 Doctor Mattson, that you've suggested on maintenance
23 is one that deserves a careful look. It's in that
24 area, perhaps, as we have in training, found that
25 it's -- my own personal view here -- difficult to

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1 prescribe an approach that would work for everybody in
2 the maintenance area. You go to plants where the
3 maintenance program seems to work because you've got
4 people who pass down the maintenance program from year
5 to year and from decade to decade. You go to other
6 plants where it works because it's got a lot of
7 procedure and a lot of paper and everybody follows the
8 procedure and the paperwork.

9 Stepping back, though, and asking
10 ourselves what is it about maintenance that we would
11 like to ensure, I guess, and maybe oversimplifying it
12 beyond what you said, you'd like to see the system
13 perform when called upon. We can all sit down and
14 identify the various systems at a given plant that are
15 key systems -- RHR and HPSI and go down the list--
16 and I suspect every plant in this country could sit
17 down with our people and identify the key systems that
18 are important to that plant.

19 I guess the question is whether you can
20 establish some sort of performance-based results-
21 oriented reliability goal that you'd like to see those
22 systems meet and it's for that reason that we've asked
23 the staff to take a look at that very question. Can
24 you develop a regulatory framework around that
25 principle, results oriented, as opposed to what we've

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1 sort of loosely referred to here as a prescriptive
2 type approach. I do think this has some merit.

3 Dave?

4 DOCTOR ROSSIN: Jim, you said you were
5 going to look at something and see how to apply it.
6 First, the question is, is this a case where it should
7 apply? A couple of the examples you gave are, and a
8 couple of the examples I would say, no, you don't
9 apply it there.

10 You know, the Commission has been arguing
11 among themselves about a maintenance rule for about
12 seven or eight years now, I mean the current wave of
13 argument about maintenance rule. And, meanwhile, the
14 industry is maintaining plants. They've got to do it.
15 It would seem to me that we may be reaching a point
16 here with the maintenance rule where a lot of things
17 are in place now.

18 I think one of the things that the
19 industry over the years has been concerned about is a
20 rule coming in and undoing something that they've
21 worked very hard to make work in their own
22 circumstances, and that's why this may be a very good
23 example of where details and prescriptive stuff coming
24 from the Commission would be counter-productive at
25 this point. You've got to really ask yourself what is

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1 it we're trying to accomplish here.

2 PROFESSOR GOLAY: Let me go to one other
3 thing, and that is another thing that is going to be
4 on your table that you just can't avoid is severe
5 accidents, because right now the policies in place are
6 so much in disjunction with what people think they
7 can achieve technologically and the kinds of arguments
8 that are going to be offered to you on advanced
9 reactors that I think you're unavoidably going to have
10 to be forming some sort of policy, a new severe
11 accident policy, and it's the heart of safety. You
12 know, if you look at how the public is threatened by
13 nuclear power reactors, it's through severe accidents.
14 And so, I think that you're basically not going to be
15 able to avoid this question of what's the right, the
16 logically correct way to approach nuclear safety.

17 In this discussion, we've got into a
18 spirit of saying, "Well, if we go to nonprescriptive
19 regulation, we throw out all of the beneficial aspects
20 of deterministic criteria," and I think it's important
21 not to accept that thinking because in truth you're
22 going to have to have a large component of
23 deterministic standards because uncertainty is an
24 important aspect of the question. And so, first, I'd
25 like to make sure that that clarification is accepted.

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1 The second is I want to build on Mr.
2 Breger's point, which is that when he compared these
3 different examples the main argument that came down on
4 the prescriptive approach was -- were essentially
5 arguments of expediency in terms of decision-making,
6 timeliness, clarity in a detailed way. And his most
7 telling point I thought was that when you end up in a
8 situation where you have a plethora of issues which
9 are linked to one another and must be handled in this
10 way, that's when the deterministic approach collapses.
11 And that's what we've got with nuclear power, and
12 that's the reason, a fundamental reason why I think we
13 really ought to explore this and see what we can do to
14 make it work.

15 The important point, though, is that only
16 the NRC can change itself.

17 COMMISSIONER ROGERS: Did you mean
18 deterministic or prescriptive?

19 PROFESSOR GOLAY: See, the prescriptive
20 approach we have has been deterministic wholly, but
21 the two are not synonymous. That is, telling people
22 what you expect from a particular system out of
23 context and doing this many times over and over is
24 what I would call the prescriptive approach, doing it
25 in fine detail, as opposed to starting from a global

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1 performance goal and then trying to work that down
2 into a set of decision rules that people can use,
3 which is the fundamental goal here.

4 COMMISSIONER CURTISS: That's all I have.

5 COMMISSIONER ROGERS: Well, I've got a
6 long list too, but I think I've run out of time. So,
7 I'm going to just ask one question because I know the
8 Chairman had an interest in it.

9 What do you see as the impact of these
10 ideas on standardization? I think Professor Golay and
11 Doctor Rossin might both respond to that. I think you
12 may have different -- you've said some things about
13 different aspects of it. For example, how does one
14 maintain a program of configuration control in the
15 absence of some prescriptions?

16 DOCTOR ROSSIN: Well, I think we agree--
17 at least as far as I know, Michael, we agree -- that,
18 in answer to that question, I think it's very obvious.
19 Configuration control means configuration control. It
20 does not mean don't change anything or don't fix
21 anything, don't replace anything and don't make things
22 work. It goes back to what it is you're trying to do.
23 You're trying to run plants safely, and configuration
24 control means you keep a record of everything you do
25 so that you know what you've got out there. You know

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1 the configuration that you're dealing with.

2 There is no reason to confuse
3 configuration control with a standardized plant that
4 can't be modified and changed. Standardization is in
5 order to certify the safety of a design. Once that
6 design is certified, if it's built, you're going to
7 have to operate it. You're going to have to maintain
8 it. You're going to have to modify it and change it.
9 Every nuclear plant in the country probably has 100
10 mods going on right now and there's no way that that's
11 going to change if we're going to have nuclear power,
12 and that has to be understood going in.

13 PROFESSOR GOLAY: Let me add to that. I
14 think, if anything, this approach would be more
15 agreeable to standardization and maintenance of a good
16 database. As Dave pointed out, the essential thing is
17 to have a record, and for the kinds of analyses which
18 we're talking about you have to have a much more
19 thorough record. And implicit in using this approach
20 is over the plant life refining your analysis as you
21 learn more about your plant and as the database from
22 experience changes, so in fact I think it would be an
23 inherent aspect of it.

24 We have found with utilities -- Northeast
25 Utilities is a good example -- where they have gone to

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1 PRA basis for their safety management and their
2 negotiation with the Agency that they have reported
3 that one of the big benefits of doing that is they
4 have a much better understanding of the nature of
5 their plant and the things which they think should be
6 done. That's part of why I make my suggestion to
7 focus on the standardized plants as the primary target
8 or the first target here.

9 COMMISSIONER ROGERS: Well, I'd like to
10 thank you all for coming today and providing the
11 Commission with this informative briefing. I know you
12 all took time from busy schedules and that some of you
13 also traveled a considerable distance to join us and
14 we appreciate your willingness to assist us as we
15 begin to consider this potentially important departure
16 from our traditional way of doing business.

17 You've given us considerable food for
18 thought. We must now digest what you've given us
19 about different approaches to nonprescriptive
20 regulation and the areas of applicability of each and
21 about legal, institutional, and other considerations.
22 We must assess both the potential benefits and
23 possible drawbacks you've identified. Our challenge
24 will be to select the most appropriate type of
25 regulation for different areas of Agency

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1 responsibility and to avoid the pitfalls you've
2 mentioned.

3 We're particularly interested in examining
4 the potential use of nonprescriptive regulation for
5 the advanced reactor designs and for maintenance, so
6 we'll be giving strong consideration to the design
7 approaches that might be appropriate in the former
8 case and to performance measures that might be
9 suitable in the later case.

10 In the longer-term, we may want to
11 consider other areas as possible candidates for
12 nonprescriptive regulation and even perhaps consider
13 converting some of our existing prescriptive
14 regulations to a less prescriptive form. Prescriptive
15 regulation may remain necessary in some areas, while
16 different types or degrees of nonprescriptive
17 regulation may be appropriate in other areas. We'll
18 have to address not only what is best in each case,
19 but how a body of regulations that may incorporate
20 different degrees and types of prescriptiveness can
21 work effectively as a whole.

22 Thank you again for your help in getting
23 us started on this process.

24 Do any of my fellow Commissioners have any
25 other remarks?

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1 We stand adjourned.

2 (Whereupon, at 12:22 p.m., the above-
3 entitled matter was concluded.)

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CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting
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TITLE OF MEETING: BRIEFING ON NONPRESCRIPTIVE NUCLEAR SAFETY
REGULATION

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: OCTOBER 30, 1990

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10/30/90

SCHEDULING NOTES

Title: Briefing on Nonprescriptive Nuclear Safety Regulation

Scheduled: 10:00 a.m., Tuesday, October 30, 1990 (OPEN)

Duration: Approx 1-1/2 hrs

Participants:	- Professor Michael W. Golay Massachusetts Institute of Technology	30 mins
	- Mr. Marshall J. Breger Chairman Administrative Conference of the United States	20 mins
	- Dr. A. David Rossin President Rossin and Associates	20 mins
	- Dr. Roger Mattson Vice President Sciencetech, Inc.	20 mins

NON-PRESCRIPTIVE REGULATION OF FUTURE NUCLEAR POWER PLANTS

presented before
U.S. NUCLEAR REGULATORY COMMISSION

by

Professor Michael W. Golay

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30 October 1990

LIMITATIONS OF CURRENT NRC REGULATORY APPROACH

- **IS HIGHLY PRESCRIPTIVE, OFTEN PRESUMING THE NATURE OF PLANT FEATURES**
- **PRODUCES NON-UNIFORM SAFETY RESULTS**
- **PRODUCES UNCERTAIN LEVELS OF SAFETY**
- **INHIBITS ASSUMPTION OF FULL RESPONSIBILITY FOR SAFETY BY LICENSE HOLDER**
- **FAILS TO ENCOURAGE SAFETY IMPROVEMENTS**
- **INHIBITS TECHNOLOGICAL INNOVATION**
- **FAVORS REPLICATION OF EXISTING TECHNOLOGIES AND ANALYTICAL APPROACHES**
- **BOMBARDS NRC COMMISSIONERS WITH BURDEN OF DETAILED DECISION-MAKING, THEREBY INHIBITING TIMELY FORMULATION POLICY**

NEED FOR NON-PRESCRIPTIVE REGULATION

**PRESCRIPTIVE, DBA-BASED, REGULATION WAS USED IN THE PAST
FOR LWRS, HTGRS AND LMRS**

**NON-PRESCRIPTIVE REGULATION LONG RECOGNIZED BY NRC AS
LOGICALLY ESSENTIAL FOR NEW REACTORS, e.g., 1985 TESTIMONY
OF COMMISSIONER PALLADINO BEFORE HOUSE ENERGY R&D
SUBCOMMITTEE OF SCIENCE COMMITTEE**

**LITTLE PROGRESS TOWARD NON-PRESCRIPTIVE REGULATION
ACHIEVED TO-DATE**

**THE CHANCE OF A GENERATION TO RATIONALIZE NUCLEAR SAFETY
REGULATION WILL BE MISSED IF NRC REMAINS PASSIVE**

REGULATORY SITUATION OF NEW REACTORS

NEW LWRs (EVOLUTIONARY AND PASSIVE):

- **BEING DESIGNED IN ACCORDANCE WITH EXISTING REGULATIONS**
- **MAYBE WILL ENCOUNTER NEW REGULATIONS FOLLOWING NRC-EPRI NEGOTIATIONS**
- **FACING REGULATORY VACUUM REGARDING SEVERE ACCIDENTS**

NEW HTGRs AND LMRs:

- **PRELIMINARY CONCEPT REVIEWS FINISHED**
- **MOST RELEVANT PRECEDENT AVAILABLE IS FROM:**
FT. ST. VRAIN
CLINCH RIVER
- **FACING REGULATORY VACUUM REGARDING SEVERE ACCIDENTS**

RECOMMENDED ACTION

ESTABLISH AN INTERNAL NRC PROJECT TO FORMULATE A METHOD FOR NON-PRESCRIPTIVE REGULATION (USE EXTERNAL HELP AND REVIEW, AS NEEDED) FOR PROPOSAL TO COMMISSIONERS

PROJECT SCOPE

- ADEQUACY OF SAFETY GOALS
- REGULATORY REVIEW APPROACHES AND DECISION CRITERIA
- DECISION TOOLS
 - MODELS AND DATA
 - MEANS FOR REVISION
 - METHODS FOR VERIFYING COMPLIANCE THROUGHOUT PLANT LIFE
- PROPOSALS TO COMMISSIONERS
- PROJECT REVIEW

METHOD OF WORK, PARALLEL EFFORTS MUTUALLY REFINING EACH OTHER FOR:

- FORMULATIONS OF GENERAL APPROACHES
- APPLICATION TO A SPECIFIC POWER PLANT EXAMPLE

BASIS OF NON-PRESCRIPTIVE REGULATION: NRC SAFETY GOALS, INCLUDING FUTURE AMENDMENTS

THE SAFETY GOALS ARE STATED IN TERMS OF EXPECTED RISKS.

**THUS, SOME USE OF PROBABILISTIC RISK ASSESSMENT (PRA)
IN NON-PRESCRIPTIVE REGULATION IS IMPLIED.**

**SAFETY GOALS CAN GUIDE FORMULATION OF RISK ACCEPTANCE
CRITERIA.**

NECESSARY FEATURES FOR PRACTICAL PROBABILISTIC RISK ASSESSMENT (PRA) USE

STANDARDIZED, NRC-APPROVED:

- Data Bases
- Models
- Means of Refining Data Bases and Models

**STANDARDIZED METHODS FOR ASSESSING ACCEPT-
ABLE COMPLIANCE IN TERMS OF:**

- Design
- Operations
- Evolving Industry Experience

**BOTH EXPECTED RISKS AND ASSOCIATED UNCER-
TAINITIES MUST BE ADDRESSED WHEN USING PRA**

ALTERNATIVE ACCEPTANCE CRITERIA

RISK ACCEPTANCE CRITERIA COULD BE STATED IN VARIOUS
WAYS, e.g., MEAN, MEDIAN OR CONFIDENCE-LEVEL BASED

DECISION CRITERIA NEED NOT BE RIGID, e.g.,

RIGID CRITERION:

EXPECTED RISK \geq LIMIT \Rightarrow REJECTION

EXPENDED RISK $<$ LIMIT \Rightarrow ACCEPTANCE

FLEXIBLE CRITERION (USES A BAND OF POTENTIALLY ACCEPT-
ABLE PERFORMANCE):

EXPECTED RISK $>$ UPPER LIMIT \Rightarrow REJECTION

EXPECTED RISK $<$ LOWER LIMIT \Rightarrow REJECTION

EXPECTED RISK BETWEEN UPPER AND LOWER LIMITS \Rightarrow
FURTHER INVESTIGATION AND JUDGMENT

EXAMPLES OF ALTERNATIVE METHODS OF REGULATORY IMPLEMENTATION

I. PROBABILISTICALLY-BASED DETERMINISTIC EVALUATION OF SAFETY:

STAGE 1 – PERFORMANCE OF LEVEL 3 PRA

**STAGE 2 – EXAMINATION OF PRA RESULTS FOR DESIGN
VULNERABILITIES**

**STAGE 3 – USE OF STAGE 2 RESULTS IN TERMS OF SAFETY
GOALS TO IDENTIFY A SET OF DETERMINISTIC
TRANSIENTS, DBAS AND SEVERE ACCIDENTS FOR
DESIGN SAFETY ASSESSMENT, BIASING ASSUMED
ACCIDENT FREQUENCIES TO ACCOUNT FOR
UNCERTAINTIES**

**STAGE 4 – ANALYSIS OF PLANT PERFORMANCE IN TERMS OF
STAGE 4 RESULTS**

**STAGE 5 – IDENTIFICATION OF AREAS WHERE PLANT IS
DEFICIENT (WITHOUT GIVING GUIDANCE
REGARDING HOW TO FIX THE DEFICIENCY)**

EXAMPLES OF ALTERNATIVE METHODS OF REGULATORY IMPLEMENTATION

II. COMBINED PROBABILISTIC AND DETERMINISTIC EVALUATION OF SAFETY:

**STAGE 1 – PRA-BASED RISK ANALYSIS WITHIN RANGE OF
CASES WHERE ACCEPTABLE ACCURACY CAN BE
OBTAINED (e.g., LEVEL 1 PRA)**

**STAGE 2 – DETERMINISTIC ANALYSES OF A SET OF
CONSERVATIVELY-FORMULATED ACCIDENT
SITUATIONS AND EXPECTED FREQUENCIES,
EXTENDING BEYOND THOSE ADDRESSED AT
STAGE 1 (TRANSIENTS, DBAS AND SEVERE
ACCIDENTS)**

**STAGE 3 – COMPARISON OF COMBINED RESULTS TO SAFETY
GOALS**

**STAGE 4 – IDENTIFICATION OF AREAS OF DEFICIENCY
(WITHOUT GIVING GUIDANCE REGARDING HOW
TO FIX THE DEFICIENCY)**

EXAMPLES OF ALTERNATIVE METHODS OF REGULATORY IMPLEMENTATION

III. PRA-BASED REGULATION OF SAFETY:

**STAGE 1 – PRA-BASED SCREENING OF ACCIDENT
SEQUENCES AND CONSEQUENCES WITH RESPECT
TO SAFETY GOALS**

**STAGE 2 – EXAMINATION OF DESIGN VULNERABILITIES, e.g.,
OMITTED ACCIDENT SEQUENCES
VULNERABILITIES (e.g., COMMON MODE,
HUMAN FAILURES)
OPTIMISTIC DATA & MODELING ASSUMPTIONS**

**STAGE 3 – IDENTIFICATION OF AREAS WHERE THE PRO-
POSED PLANT IS DEFICIENT (WITHOUT GIVING
GUIDANCE REGARDING HOW TO FIX THE
DEFICIENCY)**

IMPORTANT QUESTIONS CONCERNING THE PRACTICAL IMPLEMENTATION OF NON-PRESCRIPTIVE REGULATION

- How will non-prescriptive regulation blend use of deterministic and probabilistic regulatory criteria in different areas of decision making and enforcement?
- How will the NRC's traditional approach to the regulation of design, construction and operational aspects of a plant be changed?
- What is the rationale for "defense-in-depth" and how is it to be implemented and maintained?
- What other deterministic consideration (such as redundancy and diversity) shall be maintained?
- Where is non-prescriptive regulation consistent, or not consistent, with current NRC policies on standardization, backfitting, severe accidents, safety goals?
- What industry acceptance/preference exists for non-prescriptive regulation?
- How will NRC oversight of inspection and enforcement change under non-prescriptive regulation?
- What documentation will a license applicant submit for review?
- How does the proposed framework improve safety and why?

ASPECTS OF SUGGESTED WORK

- **THE BEST NON-PRESCRIPTIVE REGULATORY APPROACH IS NOT OBVIOUS**
- **AN INVESTIGATION OF ALTERNATIVE APPROACHES APPLIED REALISTICALLY IS NEEDED TO IDENTIFY BENEFICIAL REFINEMENTS**
- **USE OF PRA IS OFTEN RESISTED BECAUSE SOME RESULTS ARE SIGNIFICANTLY UNCERTAIN**
- **THE UNCERTAINTY REVEALED THROUGH PRA IS NOT DIFFERENT FROM THAT INHERENT IN THE CURRENT REGULATORY APPROACH**
- **NON-PRESCRIPTIVE REGULATIONS AND IMPLEMENTATION CAN BE REFINED AS KNOWLEDGE IMPROVES**
- **THE CURRENT REGULATORY APPROACH IS DIFFICULT TO REFINES**

POTENTIAL BENEFITS OF NON-PRESCRIPTIVE REGULATION (APPLIED TO NEW POWER STATIONS)

- **GREATER, MORE UNIFORM SAFETY**
- **SAFETY RESPONSIBILITY AND AUTHORITY RESTING WITH
LICENSEE**
- **SWIFTER, CLEARER, MORE CONSISTENT REGULATORY
DECISIONS**
- **INCREASED ABILITY OF NRC COMMISSIONERS TO PROVIDE
POLICY GUIDANCE**
- **GREATER TECHNOLOGICAL INNOVATION**

1 PERFORMANCE-BASED REGULATION

A. DAVID ROSSIN

BEFORE THE

U. S. NUCLEAR REGULATORY COMMISSION

TUESDAY, OCTOBER 30, 1990

2 PRESCRIPTIVE REGULATION

FOCUS ON MEANS

PRESCRIPTIONS ON HOW THINGS ARE DONE

3 NON-PRESCRIPTIVE REGULATION

FOCUS ON ENDS

PRESCRIPTIONS STILL NEEDED

4 EXAMPLES OF "PRESCRIPTIONS"

SAFETY GOAL

DESIGN CRITERIA

PERFORMANCE OBJECTIVES

SYSTEM FUNCTIONAL REQUIREMENTS

COMPONENT PERFORMANCE REQUIREMENTS

5 SOMEONE HAS TO WRITE EACH PRESCRIPTION

PRESCRIPTIVE: NRC WRITES

NON-PRESCRIPTIVE: LICENSEE WRITES

6 NO ACCIDENTS OR ZERO RISK AS A GOAL

"YEARNING"

MAY BE UNATTAINABLE IN PRACTICE

OPEN-ENDED

UNDERSTOOD THAT ATTAINMENT
CANNOT BE MEASURED IN ADVANCE

7 TOP-LEVEL OBJECTIVES

SOCIETAL VALUE JUDGMENT

BENEFIT/COST/RISK BALANCE

ALTERNATIVE TECHNOLOGIES

RISK OF BEING WITHOUT ADEQUATE ENERGY

8 AN ACCIDENT DOES NOT INDICT THE TECHNOLOGY

SERIOUS ACCIDENT NOT "ACCEPTABLE"

LOW PROBABILITY EVENTS DO HAPPEN

**9 LOW PROBABILITY EVENTS ARE TOLERABLE
UNLESS THEY HAPPEN**

10 TOP-LEVEL SAFETY OBJECTIVES

SET BY NRC

OPEN PROCESS WITH PUBLIC COMMENT

11 LOWER-LEVEL CRITERIA TO IMPLEMENT TOP-LEVEL OBJECTIVES

SET BY NRC AND LICENSEE

GUIDANCE, NOT REQUIREMENTS

12 CHANGES TO PRESCRIPTIONS BY LICENSEE

BURDEN OF PROOF THAT REVISED PRESCRIPTION
WILL MEET SAFETY OBJECTIVES AND/OR
FUNCTIONAL PERFORMANCE OBJECTIVES

13 CHANGES SOUGHT BY NRC OR OTHER PARTY

BURDEN OF PROOF ON PROPOSER
TO SHOW THAT CHANGES ARE NECESSARY

14 RISK POLICY
RISK ASSESSMENT
RISK MANAGEMENT

15 ROLE OF NRC

EVERYTHING IT DOES NOW EXCEPT PRESCRIBE

16 APPLICATION TO STANDARDIZATION

PERFORMANCE-BASED REGULATION OFFERS A
VIABLE WAY TO MAKE NECESSARY CHANGES
TO LICENSED STANDARDIZED PLANTS

17 STANDARDIZATION:

IMPORTANT FOR SAFETY CERTIFICATION AND LICENSING

18 STANDARDIZATION:

POTENTIAL VALUE FOR IMPROVING RELIABILITY AND ECONOMICS

19 STANDARDIZATION:

NOT IMPORTANT FOR THE SAKE OF
STANDARDIZATION ITSELF

20 ONCE LICENSED:

IMPORTANT THAT PLANT MEET OBJECTIVES
NOT THAT IT REMAIN "STANDARD"

21 ASSURANCE OF SAFETY FOR STANDARDIZED PLANTS

NON-PRESCRIPTIVE, PERFORMANCE-BASED REGULATION

22 PERFORMANCE-BASED REGULATION

EVALUATE THE PERFORMANCE
OF LICENSED NUCLEAR POWER PLANTS

PERFORMANCE-BASED REGULATION WOULD
NOT COMPROMISE SAFETY, AND COULD
FACILITATE PERFORMANCE IMPROVEMENTS

23 ADVANTAGES OF PERFORMANCE-BASED REGULATION

STABILITY

FLEXIBILITY

DEFINES A REGULATORY END POINT

BETTER DEFINITION OF ROLES

24 DEALING WITH UNCERTAINTY

USE LOWER-LEVEL CRITERIA

**MEETING TOP-LEVEL OBJECTIVE
WITH REASONABLE CONFIDENCE,
NOT ABSOLUTE CERTAINTY**

25 UNCERTAINTY

UNCERTAINTY MEANS LACK OF DETAILED KNOWLEDGE,

NOT NECESSARILY INCREASED RISK

26 FURTHER EVALUATION OF NON-PRESCRIPTIVE REGULATION

POTENTIAL BENEFITS OF IMPLEMENTATION

OBSTACLES AND LIMITATIONS

DEVELOP OUTLINE OF IMPLEMENTATION STRATEGY

27 DETAILED DEVELOPMENT OF NON-PRESCRIPTIVE REGULATION

ESTABLISHING LOWER-LEVEL CRITERIA

ACCEPTABLE TESTS BASED ON "REASONABLE CONFIDENCE"

"REASONABLE CONFIDENCE" AS A BASIS FOR COMPLIANCE

INCORPORATING DEFENSE-IN-DEPTH

DETAILING NRC ENFORCEMENT ROLE

TRIAL APPLICATIONS

NONPRESCRIPTIVE NUCLEAR SAFETY REGULATIONS

PRESENTATION TO:

U. S. NUCLEAR REGULATORY COMMISSION

**ROGER J. MATTSON
SCIENTECH, INC.**

OCTOBER 30, 1990

DEVELOPMENT OF PRESCRIPTIVE REGULATION

- **1960s: EARLY AEC REQUIREMENTS WERE VERY GENERAL**
- **1970s: PRESCRIPTIVENESS GREW AS INDUSTRY GREW**
 - **VARIED SUPPLIERS AND LICENSEES**
 - **IMPROVED TECHNOLOGY AND EXPERIENCE**
 - **HIGHER LEVELS OF SAFETY**
- **1980s: RESPONSE TO TMI AND USI RESOLUTIONS**

FORMS OF PRESCRIPTIVE REGULATION

- **WRITTEN REQUIREMENTS**
- **ACTIONS OF INDIVIDUAL STAFF MEMBERS**
- **ACTIONS OF THE STAFF**
- **ACTIONS OF LICENSING BOARDS**
- **ACTIONS OF THE COMMISSION**

REASONS FOR PRESCRIPTIVE REGULATION

- **TIME PRESSURES**
- **ADVERSARIAL LICENSING PROCESS**
- **TECHNICAL COMPLEXITY OF ISSUES**
- **VARIABILITY AMONG PLANTS**
- **RISING LEVEL OF SAFETY**

ADVANTAGES OF PRESCRIPTIVE REGULATION

- **LESS MANIPULATION IN ADVERSARIAL PROCESS**
- **LESS SUSCEPTIBLE TO REINTERPRETATION**
- **BINDING RECORD OF NEGOTIATED SETTLEMENTS**
- **FIRM BASIS FOR CONFIGURATION CONTROL**

ADVANTAGES IN REGULATING SAFETY FUNCTION PERFORMANCE

- **BETTER ACCOUNTING OF SYSTEM BEHAVIOR**
- **IMPROVED TREATMENT OF PLANT SPECIFIC FACTORS**
- **PERMITS RATIONALIZATION OF OVERALL SAFETY GOAL**
- **PLACES INCREASED RESPONSIBILITY ON LICENSEES**
- **PROVIDES FLEXIBILITY FOR OPTIMIZATION**

EXPERIENCE IN REGULATING SAFETY FUNCTION PERFORMANCE

- **AFW RELIABILITY GOAL IN STANDARD REVIEW PLAN**
- **HENDRIE RULE PROPOSED FOR ATWS**
- **SCRAM SYSTEM RELIABILITY ASSURANCE PROGRAM**
- **SIZEWELL-B DESIGN IN UNITED KINGDOM**
- **INSAG-3 SAFETY PRINCIPLES OF IAEA**
- **RADIATION PROTECTION PROGRAMS FOR LICENSED NPPs**

PREREQUISITES TO REGULATING SAFETY FUNCTION PERFORMANCE

- **PLANT-SPECIFIC PRAs FOR SYSTEM PERFORMANCE**
- **CREDIBLE MAINTENANCE OF PERFORMANCE DATA**
- **DURABLE CONSENSUS ON ACCEPTABLE
METHODOLOGY**
- **ABILITY OF LICENSEES TO IMPLEMENT NEW APPROACH**

REGULATORY INTERFACES TO CONSIDER

- **POWER PRODUCTION RELIABILITY**
- **MANAGEMENT PERFORMANCE**
- **HUMAN FACTORS**
- **EXISTING LICENSING BASIS**
- **COMMON SENSE**

SUMMARY

- **PRESCRIPTIVE REGULATION HAS BEEN NECESSARY**
- **NONPRESCRIPTIVE REGULATION HAS SUPPLEMENTARY BENEFITS**
- **AS SAFETY EXPERIENCE EVOLVES, SO SHOULD REGULATION**
- **TRY USING SAFETY FUNCTION APPROACH IN ADVANCED REACTOR DESIGN AND OPERATIONAL PERFORMANCE REGULATION**

PERFORMANCE-BASED REGULATION

A. DAVID ROSSIN AND GEORGE D. SAUTER

BEFORE THE

U. S. NUCLEAR REGULATORY COMMISSION

**TUESDAY, OCTOBER 30, 1990
10:00 AM**

PERFORMANCE-BASED REGULATION

A. DAVID ROSSIN AND GEORGE D. SAUTER

BEFORE THE

U. S. NUCLEAR REGULATORY COMMISSION

TUESDAY, OCTOBER 30, 1990
10:00 AM

WHAT DO WE MEAN BY NON-PRESCRIPTIVE REGULATION?

Nuclear safety philosophy in the United States has evolved through statements of safety policy, ACRS letters, rulemakings, regulatory guides and design safety standard review plans. Attempts have been made to set a safety goal based on probabilistic risk assessment. Ultimately, sets of words are used to tell the designer and operator what is to be done. These are prescriptions.

Prescriptive regulation focuses on a means of accomplishing a desired end, and tends to downplay the end itself. This discourages improvement and innovation. A better approach is non-prescriptive or performance-based regulation, which focuses on attainment of the desired ends.

Non-prescriptive regulation recognizes that there are more ways than one to meet a functional requirement. The appropriate measure is the result: the performance, and not how it is achieved. The "how" can be studied and emulated, but should not be prescribed. Performance-based regulation recognizes that there can be more than one way or one set of means capable of achieving the desired end.

Somebody has to write every prescription. Non-prescriptive regulation means that the regulator (the NRC in this case) does not; the licensee writes the prescription and the NRC reviews it. This is because it is the licensee who is ultimately responsible for safety and performance. The one with the responsibility should be the one who determines how the desired result is to be obtained.

Changes can be made today under mechanisms like Sec. 50.59E. The concern is that the need for flexibility and innovation is growing, but the atmosphere, communication and degree of mutual understanding are all becoming more rigid.

Non-prescriptive regulation also means that the licensee can change a prescription, subject to the applicable rules, and subject to NRC review under those same rules. If another party, either the regulator or a third party, proposes a change, the burden of proof that it is necessary falls on the one that proposes the change. The proposer may make a showing that a change would be cost-effective, but that would not be sufficient to mandate the change. The decision to implement remains that of the licensee.

The fundamental objective, and the ultimate test of the success of regulatory policy, is the attainment of desired levels of safety and performance, not whether everyone follows a predetermined set of prescriptions for attaining them.

This presentation is not offered as an academic exercise. The ultimate viability of standardization in nuclear plant licensing may hinge on success in implementing concepts suggested in this presentation.

Historically, NRC has been heavily involved in writing prescriptions. The Regulatory Guides are the most obvious example: they say that the following the guidance will be acceptable, and that another approach can also be acceptable, but the burden of proof of acceptability of any alternative prescription is on the licensee.

The result, though not intended, is a barrier to innovation and improvement. As the Kemeny Commission noted after TMI, the control and safety systems at that relatively new plant were old. They did not represent "state of the art" at all. For a complex and challenging technology, it does not make sense to be locked into old and outdated equipment.

Then what is the problem? The regulatory structure in the US has been subjected to heavy political pressures, and has responded by becoming very rigid and legalistic. There is a widespread recognition throughout the industry that there can be a heavy penalty for attempting to change, improve or innovate in any plant that has its license and is operating satisfactorily.

SAFETY GOALS

Nuclear power plants, and for that matter, most major engineering efforts, are designed and operated with the goal that no serious accident will occur. That is a proper design goal, but people are not infallible, practical judgments must be made, and ultimately it must be recognized that the world is not risk-free. Some degree of risk must be accepted. However, that does not give either the designer or the regulator a clear and simple basis for safety design.

Setting a goal to strive for, such as no serious accidents or zero public risk, is laudable, as long as everyone realizes that they are goals, or "yearnings", as Dr. Baruch Fischhoff calls them.

For example, "There should be no accidents at nuclear power plants" expresses a desire for zero risk, something that cannot be achieved. Likewise, "The risk of offsite health or environmental impacts from the operation of nuclear power plants should be made as low as possible" is an open-ended objective. It is not quantitative or measurable, so compliance cannot be demonstrated.

Such safety goals or yearnings are not in themselves useful as regulatory standards or criteria. To be useful, regulatory objectives must address measurable and achievable levels of plant design and operation, so that compliance (or lack of compliance) with them can be demonstrated, although perhaps with some uncertainty. They are criteria for acceptable performance, and recognize that, as with any human endeavor, there will always be some non-zero level of projected risk from the operation of nuclear power plants.

Decisions must be made in the design and operation of the plants about where to draw the line beyond which further steps to reduce the projected risk are not feasible or even desirable from a societal point of view. Once drawn, this non-zero risk line can be translated into acceptable, useful regulatory objectives through cost/risk/benefit considerations, engineering judgment, or just plain common sense.

Progress in improving the regulation of nuclear plants will be seriously impeded, if not stopped, unless everyone concerned recognizes that zero projected risk is not a practical regulatory objective. Neither is every accident or mistake a disaster, a failure of management or a breakdown of the quality assurance program, or an indictment of the technology, implying that only something new and different will be acceptable in the future.

If an accident does happen, it does not mean that the accident is acceptable. In fact, it is not. Every effort must then be made to determine why it happened and what can be done to prevent it or anything related to it from happening again.

But by the same token, if an accident happens, does that mean that the technology itself, or its regulatory safety structure has been a failure, and should therefore be abandoned? This is neither a foregone conclusion nor an absurdity.

The premise has to be that a low-probability event can happen. This recognizes the basic fact that there is no such thing as a risk-free world, or a risk-free energy technology. In recognizing this, it still does not mean that one accepts a

serious accident as inevitable. Rather, it means that society can accept a technology even with a non-zero probability that a serious accident can occur.

THE CONCEPT: RISK POLICY, RISK ASSESSMENT, RISK MANAGEMENT

The regulation of any technology to assure that it is acceptably safe should have three principal components: risk policy, risk assessment, and risk management.

Risk Policy

"How safe should nuclear power plants be? What is an acceptable level of risk?" These questions have been the subject of endless debate. The answers cannot be obtained from technical or scientific principles. Rather, the answers should reflect societal value judgments, which are indicated by what people are willing to accept.

Ideally, these public judgments should reflect due consideration of factors such as the appropriate balance of the benefits, costs, and risks of nuclear power; the costs and risks of the alternatives to nuclear power for electrical generation; and the need for diverse, reliable sources of electricity.

For example, the risks to society from inadequate electrical generating capacity are real, and should certainly be considered in setting top-level performance objectives.

In theory, since risk policy should reflect societal value judgments about the right balance of benefits, costs and risks, all interested persons should have a voice in the setting of overall levels for acceptable risk. This would require a high level of individual education, information and interest, which has not been seen in our society. In practice, the NRC will have to play a lead role in stimulating discussion, publishing proposals for public comment, and issuing criteria, just as it has done in establishing its current safety policies.

However, to date the NRC has been schizophrenic in its consideration of non-safety factor. On one hand, it has stated that its mission is safety only; on the other hand, it has claimed that it is required by the National Environmental Policy Act to consider costs, environmental impacts, energy needs, and diversity of supply in its environmental analyses.

Because they may be subjective (e.g., no undue risk to any individual) or because technical uncertainties may make it too unsure they are being complied with (e.g., no more than a one percent increase in latent cancer risk), statements of overall levels of acceptable risk are not easy for the regulator to apply. The regulator still needs a set of supporting criteria

at lower levels (e.g. down to the level of plant functions and systems) to allow him to implement the top-level objectives in a useful way.

To be useful, these supporting criteria should be consistent with the top-level objectives, and the degree of compliance with them should be measurable with reasonable certainty. Given the top-level objectives, appropriate lower level criteria can be established through the application of scientific principles. Therefore, their establishment should be done by technically capable persons with input from the regulatory body itself, the regulated and the rest of the technical community. In this case, the NRC would take the lead role.

Risk Assessment

How safe are nuclear power plants now? Is this sufficient, based on a comparison with established top-level safety objectives and supporting criteria? If not, what degrees of improvement are needed, and in what areas of plant design and operation? Providing answers to these questions would be the predominant activity of the NRC in the future, both in design review of new plants and in continuing evaluation of operating experience with current plants. The process would involve participation of the licensees and opportunity for input from the public.

But there is another question: "How are any needed degrees of improvement to be achieved?" This is the province of the licensee, not the regulator, and not the public. The NRC role would not include prescribing what modifications in plant design, construction, and operation were to be made. That would fall within the risk management component (described below).

In carrying out its risk assessment responsibilities, the NRC would do all the things it does now except prescribing what is to be done. It would continue, for example, to conduct safety analyses, review risk analyses and other submittals by licensees and license applicants, evaluate operating experience, analyze abnormal operating events, identify actual or potential safety issues, and carry out plant inspections.

Risk Management

This component addresses questions such as, "How are the plants to be designed, constructed, operated, and managed so that the established safety criteria are complied with? If needed degrees of improvement are identified, how are they to be achieved?" In short, risk management as defined here is the prescribing of the means to be used to assure that the nuclear plants comply with the criteria established for acceptable levels of risk.

Each plant licensee is ultimately responsible for the safe operation of his plant, and it is he who bears the primary burden of poor risk management or the benefits of good risk management (although the public, particularly those nearby the plant, may have a large stake as well). Accordingly, each should be allowed to prescribe how his plant is to meet the established safety criteria. The prescription will include such things as plant design, operating procedures, personnel training, and safety analyses, as well as the assumptions on which any of these are based (e.g., component reliability, human factors, external event occurrence frequencies). It is possible, of course, that a licensee could simplify his prescription by opting for a previously approved standardized plant design or set of operating procedures. It may be to his advantage to join with other plants and industry groups to take advantage of joint research and to adapt or even adopt things that have already demonstrated success.

The NRC role in risk management would be essentially limited to enforcement. However, under its risk assessment authorities, the NRC could review and evaluate any aspect of the licensee's prescription at any time to test, for example, if assumed component reliabilities were actually being achieved or if prescribed operator training programs were actually being conducted.

In summary, under the regulatory concept outlined here, the NRC could carry out all the activities it does now except to prescribe, in full or in part, how the established safety criteria are to be met. The licensee, who is ultimately responsible for the safe operation of his plant, must be allowed to write that prescription, and any necessary revisions of it, as best suits his particular circumstances. If the NRC, or any other party, forces part of the prescription on the licensee, then it should be responsible for any consequences resulting from that part of the prescription being faulty.

STANDARDIZATION

The critical test, which may make or break the future of nuclear power in the U.S., lies before us. That test is whether we can successfully apply the concept of standardization to nuclear plant licensing. For standardization to work, there must be a viable mechanism for making necessary changes to licensed plants, making improvements, and meeting functional requirements with different components and methods. This mechanism must also permit changes at one plant to remain unique or make it easy to implement the same changes at some or all similar plants.

The key to standardization is an agreement on the purposes and objectives:

* Standardization is important for safety certification and regulatory review.

* Standardization has great potential value for improving reliability and economics.

* Standardization is NOT important for the sake of standardization itself.

The standardized plants of the future are the opportunity for application of non-prescriptive regulation to a real issue where a break is needed. The NRC needs to find a way to handle the modifications and continual work projects that must go on in operating plants.

The relevant issue here is not standardization, per se, but the need for a good mechanism which allows changes to be made at plants initially approved as standardized plants without requiring that the same change be made at the other plants of the same standardized family.

Standardization is needed and proper for safety review and certification of designs. But maintaining strict standardization for the sake of the concept of standardization is neither needed nor appropriate.

It is evident that every plant will have to be maintained. While it is important to have assurance that safety is maintained, it is legitimate to recognize that every component does not need to remain the same throughout the plant operating lifetime.

How can safety be assured if plants are allowed to do different things once they are licensed as standardized plants? The answer is non-prescriptive regulation. What is important is that the functional performance objectives be maintained. There may be a variety of ways to assure that they continue to be met, even though changes are made in hardware and in procedures, and that these changes may differ from plant to plant.

Assuring that the performance-based objectives are met gives assurance of safety. Changes can be made under 50.59E, or based on submittal of proposals if the 50.59E criteria are not applicable.

Where safety considerations dictate that a change must be made in all plants of a class, NRC can mandate it, just as NRC can do now.

Operation of standardized plants offers a logical opportunity to apply non-prescriptive regulation. Standardized designs can be approved and plants can be licensed under this method. Once constructed satisfactorily, non-prescriptive regulation based on performance criteria can be applied to evaluate both proposed

Operation of standardized plants offers a logical opportunity to apply non-prescriptive regulation. Standardized designs can be approved and plants can be licensed under this method. Once constructed satisfactorily, non-prescriptive regulation based on performance criteria can be applied to evaluate both proposed changes and possible requests for conformance based on changes made in other plants licensed under the same standardized plant certification.

In the past there have been instances in which design changes have not been approved even though they still meet the performance criteria required for safety, on the argument that the changes would result in a decrease in the margin that previously existed. This approach has resulted in a stifling of design improvements and efficiency initiatives. In standardized plants, there would be a temptation to apply this same policy: regulating on existing margin rather than on meeting actual safety and functional requirements. The proper test should be the ability to meet performance requirements, without limit on how they are to be met or what margin may be claimed by previous or alternate designs.

CONCLUSION

Particularly since the Three Mile Island accident, both the NRC and the nuclear industry, with INPO, EPRI, and NSAC, have devoted extensive effort to increased understanding all aspects of design and operation, and to in-depth analysis of operating experience. Can we judge how well the present body of regulations is performing?

Certainly on the basis of safety, they appear to have been a success. However, the fact that no plant has been completed that has been ordered since 1973 is a clear indicator that the balance is not correct. The fact that it is taking the system so many years to review the design of a plant based on twenty years of experience serves notice that the present approach must be improved upon.

The application of performance-based, non-prescriptive regulations can be achieved without legislation, and could go far toward building the necessary understanding to permit new plant orders, without compromising the high standards of safety that have distinguished the American nuclear power program.