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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

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.

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

circumstances.

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

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

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

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

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

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

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

PROFESSOR GOLAY: Thank you, Mr. Chairman.

The things that I want to do today I

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

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

What I'm going to do is follow the order

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

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

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

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

The fourth item is one which is also very

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

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

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

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

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

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

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

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

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

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

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

I'd like to turn to the next page.

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

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

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

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

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

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

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

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

PROFESSOR GOLAY: Sure.

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

PROFESSOR GOLAY: Yes.

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

sufficient?

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

COMMISSIONER CURTISS: Okay.

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

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

PROFESSOR GOLAY: Yes.

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

PROFESSOR GOLAY: That's right.

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

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

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

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

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

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

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

Second, means have to be worked out to

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

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

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

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

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

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

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

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

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

point.

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

COMMISSIONER ROGERS: Absolutely.

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

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

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

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

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

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

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

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

PROFESSOR GOLAY: That's right.

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

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

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

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

PROFESSOR GOLAY: Exactly.

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

PROFESSOR GOLAY: No, that's exactly right.

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

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

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

COMMISSIONER REMICK: I'm not sure I

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

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

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

COMMISSIONER REMICK: Another way I have

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

PROFESSOR GOLAY: Right.

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

PROFESSOR GOLAY: Yes. I would agree with that.

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

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

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

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

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

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

The last thing which is also important is

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

As Chairman of the Administrative

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

statutory mandate.

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

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

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

In short, Chevron makes a difference that works.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Shall we turn now to Doctor David Rossin?

DOCTOR ROSSIN: Thank you, Commissioner.

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

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

Prescriptive regulation, we've heard about these terms today. Prescriptive regulation focuses on a means of accomplishing a desired end and tends to down play the end in itself. Nonprescriptive 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.

Ultimately, sets of words are used to tell the designer and operator what is to be done. We call these prescriptions. Somebody has to write every prescription. In nonprescriptive regulation, it means that the regulator, which would be the NRC in this case, doesn't do it. 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.

Nonprescriptive 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 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.

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

Historically, NRC has been heavily involved in writing prescriptions. The regulatory guides are the most obvious examples. They say that 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, has become 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 changing technology, it does not make sense to be locked into old and outdated equipment.

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

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

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

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

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

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

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

number 6 is about where I am in this presentation.

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

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

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

I believe that over the years NRC has been schizophrenic in its consideration of non-safety factors. On the one hand, it's often 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, and I think it's done this. The purpose of NEPA, as I recall it, was to make sure that these arguments are heard during the licensing process and that the agency granting the license has had the opportunity to hear this input. It doesn't mean that they've got to obey everything that they're told, but to hear the input. And I think this process is maturing gradually.

Because they may be subjective, however, things like no undue risk to any individual or because technical uncertainties may make it too unsure that they're being complied with, such as 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, down to the level of plant functions and systems, to allow him to implement top level objectives in a useful way.

To be useful, these supporting criteria should be consistent with 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.

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

In terms of risk assessment, I would note

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

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

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

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 those prescriptions and any necessary revisions 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.

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

I believe 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, 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 the objectives. Standardization is important for safety certification and regulatory review. Standardization has great potential value for improving reliability and economics. But standardization is not important for the sake of standardization itself. I'll repeat that. Standardization is not important for the sake of standardization itself.

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 initial approved as standardized plants without requiring that the same change be made at other plants. Standardization is needed for safety review and certification of designs, but maintaining strict

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

How can safety be assured if plants are allowed to do different things once they are licensed as standardized plants? The answer is nonprescriptive regulation. What is important is that the functional performance objectives need to 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 procedures and that these changes may differ from plant to plant.

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 today.

The operation of standardized plants offers a logical opportunity to apply nonprescriptive regulation. Once constructed satisfactorily, nonprescriptive 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.

I would comment as an example of the problem that I see, in the past there have been instances in which design changes have not be 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 alternative designs.

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

On the basis of safety, the present body of regulations appears to have been successful. 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 20 years of experience serves

notice that the present approach must be improved upon.

The application of performance-based, nonprescriptive 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.

Thank you.

COMMISSIONER ROGERS: Thank you very much, Doctor Rossin.

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

DOCTOR MATTSON: Thank you, Commissioner.

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

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

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

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

(Slide) If I can have the second slide.

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

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

about what it was that was needed for safety.

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

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

be a way to do this better."

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

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

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

All of these forums of prescriptive

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

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

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

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

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

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

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

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

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

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

the reasons.

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

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

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

Another advantage is the binding record of

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

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

configuration control later in life.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Second, a numerical performance standard

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

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

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

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

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

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

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

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

After TMI there was a move within the NRC

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

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

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

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

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

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

PROFESSOR GOLAY: That's actually my recommendation.

DOCTOR MATTSON: Okay. I misread it.

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

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

designers.

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

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

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

That looks pretty good, but then you stop

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

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

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

over time and from case to case.

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

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

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

COMMISSIONER ROGERS: Well, thank you very much.

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

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

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

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

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

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

MR. BREGER: Thank you.

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

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

COMMISSIONER ROGERS: Thank you again.

MR. BREGER: Thank you.

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

Commissioner Remick?

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

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

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

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

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

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

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

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

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

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

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

COMMISSIONER REMICK: Most certainly.

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

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

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

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

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

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

based to certify the design.

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

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

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

DOCTOR ROSSIN: Let me clarify that.

COMMISSIONER REMICK: Okay.

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

COMMISSIONER REMICK: Okay.

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

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

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

COMMISSIONER REMICK: Do you have any

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

COMMISSIONER REMICK: Very good.

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

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

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

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

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

DOCTOR MATTSON: Think we've done enough

if that?

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

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

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

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

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

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

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

That's all, Mr. Chairman.

COMMISSIONER ROGERS: Commissioner Curtiss?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Dave?

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

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

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

it we're trying to accomplish here.

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

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

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

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

COMMISSIONER ROGERS: Did you mean deterministic or prescriptive?

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

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

COMMISSIONER CURTISS: That's all I have.

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

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

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

the configuration that you're dealing with.

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

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

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

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

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

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

responsibility and to avoid the pitfalls you've mentioned.

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

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

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

Do any of my fellow Commissioners have any other remarks?

We stand adjourned.

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

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON NONPRESCRIPTIVE NUCLEAR SAFETY REGULATION

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: OCTOBER 30, 1990

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

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 — 30 mins
  Massachusetts Institute of Technology
- Mr. Marshall J. Breger — 20 mins
  Chairman
  Administrative Conference of the United States
- Dr. A. David Rossin — 20 mins
  President
  Rossin and Associates
- Dr. Roger Mattson — 20 mins
  Vice President
  Scientech, Inc.

NON-PRESCRIPTIVE REGULATION OF FUTURE NUCLEAR POWER PLANTS

presented before
U.S. NUCLEAR REGULATORY COMMISSION

by

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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 ACCEPTABLE COMPLIANCE IN TERMS OF:

- Design
- Operations
- Evolving Industry Experience

BOTH EXPECTED RISKS AND ASSOCIATED UNCERTAINTIES 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 ACCEPTABLE 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 PROPOSED 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 REFINE

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-PERSCRIPTIVE 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 Unites 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 Fischoff 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 relevent 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.

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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.