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ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Subcommittee on Long-Range Plan for the
Nuclear Regulatory Commission

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON LONG-RANGE PLAN

FOR THE NUCLEAR REGULATORY COMMISSION

OPEN MEETING

Room 1167

1717 H Street, N.W.

Washington, D. C.

Thursday, July 11, 1985

The subcommittee met, pursuant to notice, at 6:35 p.m., Max Carbon, Chairman of the Subcommittee presiding.

ACRS MEMBERS PRESENT:

Max Carbon, Chairman

Dade W. Moeller

Forrest Remick

Charles Wylie

Harold Lewis

John McKinley, Designated Federal Employee

PRESENTERS;

Floyd Culler

John Taylor

OTHERS PRESENT;

George Sauter

Jack Berga

PROCEEDINGS

MR. CARBON: The meeting will now reconvene.

This is the continuation of an open meeting of the ACRS Subcommittee on the Long Range Plan for the NRC that recessed July 10th.

I am Max Carbon, Chairman of the Subcommittee.

The other ACRS Members present today are Hal Lewis, Dade Moeller, Forrest Remick, and Charlie Wylie.

The purpose of this meeting is to continue to gather information from a variety of sources regarding the objectives and bases for a long range plan for the Nuclear Regulatory Commission. The topics will be primarily technical issues related to the regulation of nuclear power plants with regard to the public health and safety. It is expected that the plan would cover the period from the present to five to ten years in the future.

John McKinley, on my right, is the assigned ACRS staff member for this meeting.

A transcript of the meeting is being kept and it is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard.

We have received no written statements from members of public. We have received no requests for time to make oral statements from members of the public.

Do any members of the Subcommittee have questions or comments they wish to make about the proposed agenda?

(No response)

Gentlemen, as I said before, we are just very pleased and delighted that you could come this evening.

Since we have already talked a bit about the format this evening, and since you have already said that you would start out by going through our list of issues and then get into general topics later, let me say to the Subcommittee members unless you have any points to bring up at the moment, we will just launch right into it.

MR. CULLER: We are adaptable, too. If you want to start asking questions, that is perfectly fine with us.

MR. CARBON: Sometimes we start it with general comments and then the issue. Since you suggested the other way, we are flexible, and you just take your pick.

MR. CULLER: The way we are going to present this evening -- if presentation is what you should call it -- I would like to make a few comments on goals. Then John is going through the list of technical issues, which will bring up lots of discussion. And, I hope you will interrupt either one of us.

When we talk about the technical issues, I am sure other topics will turn up.

At the end, there are a few thoughts -- one of

which Hal knows about -- that I would like to introduce in the way of organization and purpose for ACRS, different than it is now that may or may not be a good idea, but I think it deserves some discussion in the present context of changing patterns a little bit.

First off, I wish to thank you for the invitation and your great courtesy of adjusting your schedule to ours. We all appreciate the opportunity of being here and discussing with you thoughts. You are as well aware of the state of the industry, of the nuclear industry in the United States as we, probably more so. We see it more than you do from the utility point of view, and I am sure that Warren Owen and many other people have told you the probability of having a new reactor order is essentially zero.

We are finding in economic studies at EPRI that 70 to 80 percent of the new plants coming on still provide the cheapest power other than hydro or geothermal in limited locations in the United States.

The enthusiasm for nuclear power as a potential future economic baseload plant still remains in the industry, and people who have done recent studies show that the cost differential, given proper conditions of management, of regulatory process, speed, that nuclear power would provide the lowest cost power with the exceptions that I have given, in the future maybe by 15 or 20 percent.

Ed Zabroski, who many of you know and Chauncy Star, have been looking at the economic patterns.

We have most of the data from France, and much of it from England, and four great bundles of information on total cost from the utilities, not just architect/engineer costs, somewhat on a privileged basis.

But, we are finding basically that many of the accusations about the process of regulation and to some extent the regulations themselves in at least 20 to 25 percent of the cases in nuclear power have contributed significantly to capital costs, and they certainly contribute to the delay. And it is just almost unequivocal.

So, your attention to what ACRS can do, and what NRC might do in changing these patterns is important.

I think you realize too, and I think this is a double-edged sword, as nearly as we can tell -- and I think the Staff of NRC has determined the same -- that the individual utility's liability with a nuclear plant to losses for damage within the plant are of such magnitude, that the level of safety requirements to protect that investment is probably significantly higher than that required to protect the public health and safety.

Now, you can make that argument it will come around and bite the industry as well as biting the NRC, and we realize it, but there is a basis for some of the little

arguments that I will make in that thought, and I wish to state it.

MR. REMICK: Could I just interrupt a second.

MR. CULLER: Yes.

MR. REMICK: Do you have a feeling that the utilities in general, all 55 nuclear utilities appreciate that point?

MR. CULLER: I would daresay that they do not. And, of course, in safety it has to be all or nothing at all. And that is why I say in part this argument can come around and bite us. It isn't evident from your knowledge, and certainly from ours, that all the utilities act the same way in any particular issue or proceed with the same dispatch or control and understanding.

They all have the same intentions. But there are great levels of understanding that differ from one group to another, and I am sure you are well aware of that.

The second observation that I am sure John will expand on, is an important one. We are also certain, because of utility -- since we are at the development interface, and our development is not lab, it is engineering scale looks, and as you may have heard, and I think John presented to you, the advanced light water program which we have initiated. One of the great inhibitions for getting approval for that program -- and we started three years ago to get our board, our advisory

structure to improve -- is that they did not wish to look at improvements to LWRs, because the improvements might be used as items for required retrofit.

And I guess the sum of this set of diffuse forces, very real, very real, is that the regulatory processes, and to some extent the actual content of the regulations, inhibit improvements in operation, and certainly do not always allow a progression from one safety level to another because of the concern of having costly backfits and such required.

And, there are other tyrannies of the regulatory process. We see it in little things and big things all along, and no more necessarily in nuclear than is now appearing in fossil with acid rain and a lot of other things. There is a tyranny of regulatory processes that essentially squash real advance.

We are very pleased, however, by the endorsement that the Nuclear Regulatory Commission and I think the interest that the ACRS has expressed in the advanced light water program. There is an effective setup to pursue the safety aspects and safety reviews as John's groups begin the studies to improve operability, to improve the inherent safety where possible, and to cut costs and increase lifetime, and move certainly to go in the direction of standardization.

Now, with those introductory comments, we looked at the four general suggestions on goals, primary goals, in your

letter. And we have had quite a bit of discussion.

Obviously the first goal, that of protecting the health and safety from accident and operating -- the first two, one is protecting from accidents, and the others is protecting from operating error and such, protecting health and safety, we think they are obviously the important and prime ones.

But we, I suppose, would word them a little differently. I will not read what is proposed, but I will make them available to you, the primary goals.

Certainly, if the public health and safety must be protected in your words and ours to an acceptable level, the definition of acceptability becomes a primary issue. Safety goals, you are discussing today and many other things.

It is a society value that is decided probably by Congress or an elected body, but certainly ACRS and to a limited extent, NRC, must do the analyses upon which adequacy is based. And I think that maybe one of the more important things now is to decide on what will be used at least for some period of time to define what adequate and acceptable levels of safety might be. It provides an anchor for a while that will help stabilize the licensing and regulatory process.

So, although I put it second, since it is such an important element of the first goal, I think that it deserves real attention.

MR. LEWIS: If I could just interrupt you for a second, you know, of course, that Congress is never going to tell the NRC what level of safety is required.

MR. CULLER: Yes.

MR. LEWIS: And so the only way in which this can happen is if NRC from its own limited perspective, doing its bungling best, proclaims what is meant by adequacy, and sort of challenges the world to object to it.

And in principle, that is what is going on with the safety goals exercise.

MR. CULLER: We realize that.

MR. LEWIS: I don't know whether it will ever terminate

MR. CULLER: If it doesn't, the necessary stability that would revitalize nuclear power in the United States may not occur, because there is a real stability that has to move into place before I think, a single CEO in the United States would be willing to commit to a new reactor.

MR. LEWIS: But the stability, just to pursue the point for one moment, depends not only on the enunciation of a safety goal policy or something resembling it, but it also involves a commitment of the NRC to use it in some way. Because there have been conversations the last couple of days about a safety goal policy being something that you polish and put on the shelf, like we put our trophies on the mantlepiece,

and then go on about normal regulatory practice.

It is going to be extremely difficult to get the degree of stability that you are talking for which will involve both the enunciation of a policy and a commitment of the staff to implement that policy and a commitment of the Commission to somehow do that in the face of the inevitable uncertainties.

And I don't want to be pessimistic, but --

MR. CULLER: I think you are realistic. It will be difficult. But I think somebody at some point in time now must stand up and take the gab. And if not, then I think that the United States basically will not use the nuclear option for quite a long time, until a whole generation of people die and we have lost most of the trained personnel who understand how to put the --

MR. LEWIS: There is no guarantee the next generation will be better than this generation.

MR. CULLER: Well, there is the principle of the hiding hand. If you remember in development economics, the principle of the hiding hand says that you can overpromise and oversell, and run over in costs. And the only thing that saves the project is that the people who come after you are smarter than you are.

And in many respects I think it is true in technological advance.

I think you are right, Hal, and George Sauter and I -- and I think most of you know, George is with us this evening -- and John discussed this in an indirect way last night. What George suggested is that we may face a period in which there is a double track, where we sort of peter out in the old practices and try to change a little bit, but adhering as best possible to a set of safety goals and different procedures for handling as best as possible. And that the changeover may take a long time.

So, the idea of double tracking is one that I had not thought of, but in thinking about it today it makes a little bit of very pragmatic sense to me, and I don't know how to implement that.

One other comment, now, on goals. I don't know exactly what the wording of the Atomic Energy Act of 1954 and the Revisions in the Safety Act were at the time NRC was created, but my memory says there is a second element to protecting against -- there is a second element of responsibility within the NRC and ACRS.

There is also not a promotional activity for nuclear power, but to see that operable systems can operate, and that says that as safety is pursued, we think that there has to be a little bit more balance and that some kind of benefit-risk, including comparisons to risks in other generation modes because nuclear power should not be compared to zero risks.

Every other generation method has its risk, too. What we are saying is there is a balancing off, a balance of some kind that does not go as low as practical or all the way down without considering the cost or the increased cost of electricity.

My last comment is that the importance of the cost of electricity becomes more and more apparent to us. Sam Schurr and our economists were studying basically the catalytic effect of availability of power since about 1900 until now. It is quite evident the work horse in any industrial society is electricity.

There were two periods in the past where the GNP has grown almost directly with the growth of electricty in those periods, but there were different slopes, first the introduction, and second the period of wide application of motors and dispersal of the industry throughout the United States, and we may be at the beginning of a third because of the availability of better measurements, of controls, of being able to deliver energy in five or six different forms at the right place in the right quantity for exactly the right period of time.

There are whole new processes emerging, and we are doing quite a bit of research there. The industrial potential and the jobs in the United States will depend upon our being able to deliver competitively-priced electricity to move these

new techniques into production. So our concentration is coming more and more on costs, and as a consequence, we think that in the overall objectives -- let's call them primary goals -- that are NRC should have some reflection of the importance of balance of safety versus risk, of safety versus economic costs. It has to be made and it should be a goal to look at it.

Those are the primary goals. I listed another set that are more temporal. I call them secondary goals but they could be objectives or five-year planning objectives. One is to stabilize regulation, and that may take 10 or 15 years, but unless it is stabilized, I think the industry won't take off, and as part of this, one must cut the time for construction.

And it is even possible that the NRC should schedule a rigorous schedule -- three years, two years to license -- and figure out what is needed, and that the schedule become a controlling element as during the period of the environmental impact statements when the AEC became responsible for 121 rewrites. They would schedule one every three months -- I'm sorry, one a week, and completion within six months.

The schedules were roughly met, but the importance of the pressure to complete the rewrites was there. I therefore suggest that the whole process of scheduling be taken as a primary function and adhering to schedule within NRC. Obviously, the establishment of safety goals is

important, and with those, once established, and they will probably have some numerical value, the use of hierarchical ranking of importance of safety measures or of incidents that occur in operation of what is important in construction inspection can be illuminated by probabilistic risk analysis -- failure mode and probabilistic risk so that we do not waste a lot of time and a lot of money on issues that are of no consequence.

With the numerical safety goal, I think this hierarchical ranking system by PRA offers a little bit of absolute advantage, but its importance can be exercised even if a numerical -- its practice can be exercised even if a numerical safety goal is not established. The relative position of a failure sequence versus another. If a particular set of valves fail in the secondary system and its probability of interference or carrying to, say, a core damaging condition is 10 to the minus 3, then immediate action should be taken, but if the analysis says the probability of engaging the core is 10 to the minus 5, then nothing should be done for a while and the process should not be interrupted, the completion.

As you know, the French now use this system in construction control as well as operation control. They rank -- if the probability is 10 to the minus 4 for having a serious accident, they let the construction go on. If it's 10

to the minus 3, they fix it right away. Under no circumstances do they stop construction, however. They just reverse schedules.

MR. LEWIS: Could I just explore that for a moment? In one of the NRC Staff documents, there is a similar statement that at 10 to the minus 3, we fix; 10 to the minus 4, we think about it; 10 to the minus 5, we let it go. That sort of thing. But you know, if you start applying these things to individual plants, there is a range of uncertainty, part of which is the differences among the plants, and I wonder whether I should worry as much if one plant out of 100 has a 10 to the minus 3 probability of core melt and the other 99 have 10 to the minus 5. Then I'm still talking about 1000 years before the first core melt in the industry. Why should I worry about that?

I'm only asking this as an instructive question for me.

MR. CULLER: I have not thought about this integrative effect, and I will do so, and we will talk about it sometime. My own feeling is that eventually each of the plants, even during design, will use PRA as a method of deciding what levels of safety to build.

MR. LEWIS: That's right.

MR. CULLER: With the individual plant PRAs, then the measure of what an incident of a delay or a bad QA might

mean in involvement in serious accident would be very real, and I would judge it without thinking about it on that plant alone.

MR. TAYLOR: If I were the chief executive officer responsible for that plant with 10 to the minus 3, I would want to do something about it.

MR. CULLER: That's the way I would react.

MR. LEWIS: I know that's the way everyone comes down.

MR. TAYLOR: Simply because I would say my chances of losing my investment, being brought to the edge of bankruptcy, appear to be 100 times greater, and my associates and I cannot afford that difference. I'm going to do something about it.

MR. CULLER: Or involving a suit.

MR. LEWIS: I'm trying to distinguish probabilities -- this is the wrong forum for this debate, but trying to distinguish probabilities which we fix in our heads by automatically multiplying by 100 for the whole population, and probabilities that we apply to a single plant. If the objective is to not have a core melt for 1000 years or something like that, then you can tolerate a plant or two in 10 to the minus 3.

MR. TAYLOR: But the person who is responsible for that investment can't tolerate it.

MR. LEWIS: Even the chief executive, if you know it's not going to happen for 1000 years, then it's somebody else's watch. I'm not arguing for outliers, but I'm also being told my time is up.

MR. CULLER: I think it's a legitimate question, and I think thinking of it on a more global basis is something I have really never really talked to anybody about. I know what my reaction would be. I would fix it.

MR. TAYLOR: One other comment. Getting that signal, 10 to the minus 3, the next question you have to ask is what caused that 10 to the minus 3, and inevitably you will find something you are going to take care of.

MR. LEWIS: When you say 10 to the minus 4 plus or minus a factor of 10, you are thinking some of those are 10 to the minus 3. For peace, this is the wrong place.

MR. CARBON: In concern for time --

MR. CULLER: I just have two other quick suggestions. I already mentioned scheduling as an issue. I think it is possible within NRC and under the direction, perhaps, of some instructions and questions from ACRS, to increase the level of coordination and oversight if the Licensing Board, Appeals Board and the local site reps who rule; and since I am on advisory committees in almost every one of the involved agencies here, I find that the coordination between agencies, and certainly within NRC,

leaves a lot to be desired.

The lesscns from the licensing boards are not properly taken care of, and I suggest this. No other important secondary goals. I think now if you are willing to let John start off on the technical issues.

MR. CARBON: Fine. Any other questions before we do so?

[No response.]

Fine. Go right ahead if you will, John.

MR. TAYLOR: My assignment is to go over the technical issues which you have proposed and comment on them. The first one is simplification. Simplication is a goal which we have set in our own advanced light-water reactor program as, if anything, a primary goal, so per se, I certainly would support ways in which the NRC could aid and abet and encourage that movement.

I'm somewhat concerned at the way the statement is presented, however, in that it seems to emphasize the NRC in some way engaging in the design process to achieve simplification, or in a very direct sense through regulatory actions affect the design process.

One element of simplification is the regulations themselves, and I would think that that would be a foremost consideration in a simplification program for NRC, that they would evolve ways in which the regulatory requirements were

simplified.

I think we all feel -- and I think this is shared by NRC today, for example -- that the technical specifications which the operators abide by are far too complex to achieve effective operational safety, so I would think that would be a primary emphasis.

MR. CARBON: Excuse me, John. I think the thrust here really is to simplify the regulations, the tech specs, the requirements which NRC imposes, with the thought that that then would allow the designer to do things.

MR. CULLER: Going more in the direction of criteria and standards to be met by the industry?

MR. TAYLOR: My judgment is the designer has to take some steps himself almost independent of the regulations to achieve significant simplification. One very important element in our own efforts is to achieve design features which put substantially less burden on the operator, independent of how the tech specs are written, less burden on him.

MR. CARBON: But this is aimed at fewer requirements, simpler requirements, simpler regulations.

MR. TAYLOR: That's good. Then another point of comment is the goal is stated to improve the safety of existing as well as future plants. Ford has alluded to this in his earlier discussion. We have found our ability to move ahead for future plants has been substantially improved by

separating the work we are doing for future plants from the work we are doing on present plants.

My own judgment is that the present plants are adequately safe. I will make that with a qualification that continued in-depth PRA evaluation will be appropriate to be sure there are not some of those outliers that you mentioned, Hal. In my judgment, if they are found, they should be taken care of. But to set a goal for continued improvement of the existing systems is going to militate against what I think is an essential first step, and that is achieving stability, which Floyd mentioned to you, distinct from moving ahead and saying there are things that can be done to improve the safety for systems that are built in the future.

MR. WYLIE: I agree with what you have said. The original thrust of this as far as existing plants go was that we felt the NRC, and certainly the industry, with the industry's help, should look at what has been imposed on existing plants with the idea of relaxing the requirements where they have been overly complicated, and simplifying the operation of the plants. That was what that was intended to do.

MR. TAYLOR: I think we also feel there are elements discussed later in your issues of conservatism which was decided upon years ago before full knowledge of the phenomenon had been identified, which could be eased, and out of that

easement a better balance could be achieved. Again, operability of the systems, some conservatisms could be achieved on these present plants to be benefit of giving the operator a less complex task to perform and still have full assurance of safety.

That doesn't improve the safety of the system per se, and what I am suggesting is if in a broad sense the industry is in a continued process of changing in the interest of improving safety and so on, we will not get stability, as distinct from letting the present regulations sit in a stable form, being flexible in terms of allowing an individual utility to present a case in which he has the data and the justification to make a change which he believes will satisfy the issue, much like, in fact, we thought the process was evolving in earlier days in setting the General Design Criteria, the various appendices, to provide guidance to the applicant as to what would be satisfactory to meet the regulatory requirements, but also allowing for a case to be presented differently approached, which would also be satisfactory.

We seem to have lost that additional case to be presented and are geared in only on the formally specified requirements. Appendix K, for example, today is being addressed on a case-by-case basis with some plants. My thought is let's not talk about changing Appendix K for the

present plants, but let us be willing to listen to case-by-case justifications of improvement, for whatever reason, and worry about changing Appendix K and other things like that for future plants.

MR. CARBON: I have a kind of basic question. Much of the thrust of this really was in the first clause in the second paragraph, that a likely thrust would be for the Staff to initiate basic system study to review which safety requirements are really important and ease off or eliminate regulations for those that are not, with the thought that in fact perhaps to question whether a lot of unnecessary regulations have been imposed.

Would it be quite helpful and beneficial to existing plants if the Staff did carry out what would be basic systems study to see which ones are really important and try and get rid of a lot of them that are not? That actually reflects up to the last sentence in the first paragraph. It was the belief that perhaps that would lead to added safety, whether that was your goal or not.

But I guess you are saying that you are not particularly interested in seeing that done.

MR. TAYLOR: For the present systems. And the reason for that is that what is badly needed in this industry is the stabilization of the regulatory process --

MR. CARBON: Even if it means fewer -- even it it

meant removal of some regulations?

MR. TAYLOR: I suggested a case-by-case evaluation could be made because certain utilities can achieve benefits from some simplifications and easements, but if you do it on a broad basis, that means your requirements are changing. Every utility will have to move.

Now, if those requirements are primarily of the kind that make it easier for the operator to operate the plant, I am sure it is fundamentally acceptable, but many of them will reflect themselves in the need to change equipment, to change many procedures, and change itself has its element of cost, confusion, inadequate training to keep up with it, and so on.

My own judgment is it is best to see if we cannot stabilize with the present systems on the judgment that they are adequately safe, still scrutinizing to look for those outliers and taking action there and concentrate on the improvements for the future systems.

MR. WYLIE: One effort has already been started, and that is to simplify the tech spec.

MR. TAYLOR: That one certainly has great merit because it bears principally on operator failure. If you can define it with that distinction, I find it a lot easier to agree.

MR. LEWIS: For the others, there is some position you don't want to change the laws, you just want to get more

lenient judges?

MR. TAYLOR: Don't want to change the laws. Would like to see the flexibility that we believe was built into the system originally. You have got a prescription. If it is met to the letter, it is satisfactory. If it is not met to the letter and you can justify technically a different approach to achieve the basic safety, then allowance for that is provided, not that the safety be reduced. No way am I suggesting that.

Now, what we have learned heavily in the industrial side I mentioned earlier, that the risk of the loss of the plant investment puts a higher demand on keeping away from severe accidents, which is a fundamental safety issue on the utilities and the public risk itself.

MR. LEWIS: You think all utilities are aware of that at this point?

MR. TAYLOR: I will just echo what Floyd says. In an industry with as many people, variegated background, experience, there are very perceptions of any given generalization.

MR. REMICK: I guess I am still a little bit confused, John, on where you draw the line. You favor the tech spec change. I certainly do. You don't Appendix K. Yet to me, Appendix K is very specific, very proscriptive, and it seems to me if you consider it on a case-by-case basis, it is going to be pretty tough and you are sure subject to people

litigating it because it is fairly proscriptive and they can say you are not meeting it.

MR. TAYLOR: What you are gaining, as I see it, is a stable statement of regulation.

MR. REMICK: That I can understand. You want to stabilize rather than add confusion. That I can appreciate. I don't know how we pick out things. That is okay.

Source term. I assume you would favor relaxing source term, and tech specs you would.

MR. TAYLOR: Certainly.

MR. REMICK: There are certain things you would like to see reviewed, but others not touched, and I'm not sure how we know where --

MR. TAYLOR: The source term work we are doing is being done -- at least from our own viewpoint -- with two primary objectives. One is long term. It is the true understanding of the public risk associated with severe accident. If it could be accomplished and was shown to involve a lower level of risk, that would be a tremendous step forward, in our judgment, in this industry.

The second is short term, and it is to make more reasonable the emergency requirements. Would not affect the plant. Some people may wish to use the source term to make changes on a plant. My own judgment is that I would not pursue that. Simply use that information to get a more

balanced and reasonable emergency planning regime for nuclear plants.

MR. REMICK: I still don't know what you are suggesting of what ones that we look at to see if there should be changes and what ones we should best leave alone because of stability. It seems like it is not clear.

MR. TAYLOR: Think of $100 billion power generator the utility is trying to run, and I am suggesting that we stabilize requirements which would cause him to have to change that plant.

MR. REMICK: I see. It might be changing existing plants.

MR. CARBON: Your top priority is stability above all else.

MR. TAYLOR: That's right.

MR. CARBON: Then simplification is great if it doesn't affect stability.

MR. TAYLOR: One thing that has influenced me in this judgment comes from our recent experience in this advanced light-water reactor program. When we proposed it, we were rejected by our utility advisory committee who must pass on all our programs. They rejected it for several reasons, but a dominant reason was we have no idea what regulations we have to build a new plant to, so why should we waste our money trying to design one?

In response to that, we undertook a program of working with NRC to develop a methodology of closure of open safety issues, taking a few specific cases to go into in depth in terms of closure, to have a methodology and then specific cases where the issues could be or would be closed. That program has been amazingly successful, from my viewpoint. We did develop a methodology. We found some 650 issues that were open, many of them trivial, but nevertheless open, and we got agreement from the Staff that using this methodology, we could close over 500.

Now, it is 550 of those issues for future systems. When we got three-quarters of the way through that program, that rigid attitude on the part of our advisories began to melt visibly. They said: you know, maybe there is a chance that we can know what we are going to have to design and license a plant in the future to, and subsequently we got approval of that. That's the dominant thing in their minds.

MR. SAUTER: Can I take a shot at responding to your question, Forrest? I think you have to think in terms of at least two kinds of stability. For new plants, I think you think in terms of stability of the requirments, stability of the regulatory process. Perhaps simplifying the regulations and the regulatory procedures would be a way to approach that.

Also, I think in terms of the present plants, you have to think about the stability on somewhat of an individual

plant basis. If you design and are operating a plant according to one set of requirements, now somebody comes along and, in an attempt to stabilize and simplify the requirements, presents you with another set, which means you now have to do things differently than you have done before, that's an unstable situation used in that plant.

MR. LEWIS: You are right, that's a different issue. That's the backfit issue.

MR. SAUTER: I think in terms of stability, we are talking about both of these issues.

MR. LEWIS: I think we shouldn't. I think we should keep them separate. I think that's what you are saying.

MR. SAUTER: I think what I hear John saying, and I agree with it if you are attempting to set up a different set of requirements, a simpler, more stable set of requirements for new plants, which in turn then get applied to some of the present plants and it means they have to do things differently, that's an unstable situation for them.

So I think if you are going to do that, you at least have to offer the present plants some kind of grandfather. Either you can choose to go with these new ones or you can choose to stay --

MR. REMICK: Isn't there some risk of that in the tech spec thing that out of that might come some plants are going to have to do something slightly different? I don't

know.

MR. TAYLOR: Yes.

MR. REMICK: And tech specs, hopefully everybody will benefit, but out of it I can see some plants just might have tech specs that don't meet the new thinking. They are going to kind of have to have backfit procedures reporting or something like that.

MR. SAUTER: I don't think there is any system that can guarantee somebody isn't going to have to do some changes. The name of the game is to try to minimize putting somebody at jeopardy: that I have gone out of my way to comply with this set of requirements, and now you are laying something else on me.

MR. REMICK: I was trying to say what do you people think are good things that should be done and other things that should not be done.

MR. CULLER: You have raised a good question, and I think, again, it is one of those that deserves some closer attention. Certainly the simplification of operating requirements and the back away of some of the margins and all would make it easier to operate.

MR. TAYLOR: Let's take another example, seismic requirements. We have identified, and others have, too, a substantial number of what we judge to be overconservatisms in piping design to meet seismic adequacy. I am not proposing a

change in the basic approach that regulates the seismic issue at this juncture. On the other hand, people have approached the Commission and said in this instance, with this new knowledge, I can meet the safety requirements and I won't have to put the snubber or this pipe support in, and that, to some extent, has been accepted. I see nothing wrong with that approach as distinct from saying, hey, we are going to have a whole new set of seismic requirements for the present systems, most of which have already been built, and in order to make a change to "improve" that, would entail substantial cost and change.

MR. LEWIS: You know, John, in the case -- I don't want to dwell on the seismic one. The argument, as I understand it and even believe in it, is that removing the snubbers will make the plant safer. It is not just a matter of relaxing a regulatory requirement; it is that the overstiffening has produced a degree of vulnerability that was absolutely unnecessary. It was just a mistake.

MR. TAYLOR: I don't think that we have reached the stage that we can truly quantify that we are making it safer or not. There may be some --

MR. LEWIS: I think you can. This debate we should have in another forum, but I think that fact can be quantified in a number of ways, but let me just turn to another question.

MR. TAYLOR: I have heard the arguments, namely, if

you don't have as many obstructions in the pathways for equipment maintenance and surveillance and so on, you are going to make the plant safer by some elimination. That is qualitative judgment. It may well be true, and with time, it could reflect itself in a future set of design requirements.

MR. LEWIS: Again, I do think that the evidence is quite clear that flexibility of piping makes it more resistant to damage than rigidity.

MR. TAYLOR: Rigidity is coming, as you well know, from pipe whip considerations, from blowdown considerations, and there is a delicate balance that has to be --

MR. LEWIS: Let's conduct this technical debate at another time. But another thing that troubles me a little bit -- and I think it is clearing up a little bit now, but there has been some confusion about stability of regulation of existing plants and stability of the regulatory process. I think I heard you say, John -- I really want to be sure that I did -- that you would like to see future plants licensed according to existing regulatory practice, even though we know more, just because that is something that we know now.

MR. TAYLOR: I didn't say that. I said just the opposite. I said we should separate this issue of changing, even improving regulation with concentrating those improvements on the future plants, just as we are trying to do that in our own work, and we should be very leery about

changing for present plants.

MR. LEWIS: Let me then just reemphasize my inability to understand because, in terms of what the utility executives are talking about, nobody wants to, I am told, order a plant now because he has no idea what the regulatory requirements will be on new plants. The only way he can know -- there are two ways he can know. One is that NRC can formulate absolutely out of the whole cloth a set of regulatory requirements for future plants based on the fact that we really do know a lot more now than we did when the existing set was developed.

The other possibility is they can say, fellows, you know, even though we know more, we are not going to take it into account, and this is the set you are going to have to design to. That would give you stability but at the price of using --

MR. TAYLOR: That I have not asked for, Hal. In fact, in our work with NRC on our advanced plant, they have agreed to some changes in Appendix K for "future plants." For future plants. And we have elicited that agreement. We wanted it. And that is just one small example of what we hope will occur as we go.

MR. LEWIS: The concern that came up here was that if you do establish new requirements for future plants, somebody will want to make them retroactive to existing

plants.

MR. SAUTER: Let me give an example. Suppose out of whole cloth for new future plants, we could construct a set of regulatory criteria which were performance oriented some way or another as opposed to the present proscriptive one. That might be quite satisfactory and, I think, perhaps a better way to go for future plants. But if in doing that they were then en masse applied to the present plants, I could see where that would result in some major backfits.

On the other hand, perhaps the way to go in order to get the price of getting that better system for future plants would be, as Floyd mentioned, to run temporarily a two-track system of proscriptive set of regulations for present plants and a performance-oriented set for new plants.

MR. LEWIS: There is plenty of regulatory experience with grandfathering things that are licensed under regulations.

MR. CULLER: I think that is what we are basically saying.

MR. SAUTER: We need a grandfathering.

MR. CULLER: Not exactly grandfathering, but a very careful preservation of a stability for the existing plants. If there are real challenges to safety, then changes have to occur, or if there are great simplifications in operations or such, maybe that should occur. But the new plant criteria

certainly should not be retrofitted onto the old, and that is basically what I think John was saying.

Forrest, you asked a question, and we will talk some about it. If we have a better, finer differentiation with an existing plant study, we will try to write it up and send it to you because it is a good question.

MR. CARBON: Let me interrupt and urge moving on.

MR. TAYLOR: My own judgment, we have a substantial defense-in-depth. We will certainly in the future systems examine an issue. I don't think it needs extensive reexamination for present plants. Transition from deterministic to probabilistic regulation, here again we are faced with the same dichotomy.

I think in the future there would be great merit in moving toward more probabilistic regulation approach. I don't see giving up deterministic regulation fully incidentally in that process, but more of a balance, more of a utilization of probabilistic assessment in the regulatory arena for the future.

However, again, for the present systems, I suggest that the work that is done now to use PRA as an evaluative tool separate from the regulatory process itself is valid, and it has already shown itself to be valuable, particularly in finding those outlyers. Beyond that I don't think I would go.

Any comments?

(No response.)

That's covering Number 2 a lot faster than Number 1.

MR. CULLER: That's known as "front-end interest."

MR. TAYLOR: Quality assurance. I think that is a job the industry has got to take care of. In many respects, the quality assurance specific plans and standards which have been established have been established by the industry in one form or another, and the difficulties that have occurred have been the inability to in very real detail follow through on what was established. So it's up to the industry to square that away, as I see that, and I don't see how a regulator can.

Where it seems to be, of course, of greater difficulty is in the area of construction, and I think a very major revision is going to be required. It presumably will primarily have a benefit for the future because it will require major revision.

MR. LEWIS: It's not only in construction, John. We just came up from having heard of a trip on a plant that was generated by somebody using a voltmeter on the ampmeter scale, and this is the same plant that did the same thing a couple of months ago by somebody using a voltmeter on an ampmeter scale. Why does it happen twice in a row? Quality control on people is just as important as on --

MR. TAYLOR: Oh, yes. I mentioned construction because that was a big visible problem for the industry

entailing enormous costs. But you're right, it exists in every element of work for these operating plants. Maintenance is a very important one.

MR. LEWIS: I can't understand how a plant management could let a major event like the first one occur and then not take steps to make sure -- somebody pumped a different system this time, but by the same process. It seems to have been overlooked. I don't understand it. And that's an issue of quality control.

MR. TAYLOR: But who is going to fix that? It's up to the industry. And when I say "industry," I am not saying just the individual utility. We have a very big program today in maintenance technology where we are trying to describe the maintenance processes effectively. We've set up a maintenance equipment application center in Charlotte to bring people in to train them on systematic preventive maintenance processes, inspection and so on.

INPO is very active, of course, in establishing and following standards and maintenance. NUMARC has become extremely active. Those activities are going to be the ones that solve this problem if it's going to be solved. I can't see how a regulator can, in fact, solve the problem.

MR. LEWIS: I can't either, and that's why I think the responsibility, I agree with you, is on the industry.

I was very dismayed by this particular experience in

which apparently nothing happened between the two repetitions of exactly the same state. That responsibility was at the plant. We will hear more about it. I don't want to play that one here. But that's really not the sort of thing that is resolved by a large program to quantify the best way to do maintenance. It's resolved by attention to very simple things.

MR. TAYLOR: I am not suggesting that our program is a total solution. I am saying the solution takes the individual utility and centralized activities of this nature to be fully effective.

MR. CARBON: Is it your belief that on the construction side, where we have had these bits of QA problems showing up way late in the game, that industry will be able to handle the problem, that they will effectively take care of it?

MR. TAYLOR: My judgment is that we can essentially go back -- what I have suggested -- and a little bit of this work has started now; it's going to take so long it's certainly not going to bear very much on the present plants -- a project which I call "TRACE," to look at the QA and construction difficulties that exist and trace them back to the setting of the standards in that particular train and reexamine those standards establishing their technical justification, make them unambiguous so an inspector who

cannot be expected to have the full knowledge isn't put in a position of judgment as to what is correct, and make sure they're practical in terms of construction and installation capability.

You know, there is a myriad of such standards in the wwhole setup which will have to be changed. So my thought is that that process slowly, carefully, systematically has to be reexamined and reestablished for the future.

Now, having done that, the thought which has been very much promulgated of having the regulator in some sense sign off at various stages in construction rather than waiting until you're already done, will have to be reintroduced into the picture, for obvious reasons.

If there is a problem, it should be identified early in the game. As you well know, the industry is strongly in the terms of future simplified regulation for one-step license. Such an arrangement is only practical if a very thorough checklist is established which, in effect, assures the regulator that what he was promised would be built has been built, and that can be used to apprise the regulator as you go that you're building the plant the way you said you would.

MR. CULLER: My answer to your problem, and a little bit to Hal's, is I suspect if the industry doesn't do it, it won't get done.

MR. CARBON: I would agree with that.

MR. CULLER: As a consequence, the enforcement of the responsibility I think the industry takes to heart. Now, exactly how it gets done and how rapidly is always a question with 55 groups involved. Nonetheless, I know that it's taken seriously, and they are looking at ways of keeping real-time track of all the inspections, so at the end of the day they can say, "This was inspected, and here it is on the scope. I know that it was done." I believe there is real effort being made among the leaders, and the leaders will, one way or another, through INPO and other things force a more uniform approach.

There are other techniques, some that the Japanese use. They set up one team to do the same thing around all of their circuits, and it's conceivable that these collective opportunities for the industry to act together, set up a quality control system and group that does work for every one of the utilities may be one of the solutions.

I don't believe it will be long in coming, but there will always be mistakes like you had, and some of the answers to that kind of a mistake is you make such a technique of jamming in two electrodes into an instrument, a nonnecessary inspection.

MR. LEWIS: You give a guy voltmeters instead of multimeters is one simple solution.

MR. CULLER: There are simple solutions to keep repetitive mistakes from occurring.

MR. LEWIS: There is a problem with even a team going around doing the same thing, because if that team makes a mistake, it can make a lot of mistakes.

MR. CULLER: I am sorry. You know about party circles and the business of audit. There has to be an audit. The teams can't run unaudited. I think a hierarchical auditing from an industry group or whatever is being done is necessary in an audit by the NRC on what the industry is maintaining is a necessary part of it to check on the quality all the time.

But going in and doing it as part of a government agency is not going to provide a solution any more than the solution which the industry itself can provide.

MR. TAYLOR: If our goal was to end up with perfect performance, we wouldn't need defense-in-depth. I think we need defense-in-depth so we can tolerate imperfect performance at times, no matter how marvelous our system will be, mistakes will be made.

And I don't condone repetitive mistakes, particularly of the nature you described, Hal.

MR. LEWIS: I agree with most of what you have said, John. My concern is really at a much more elementary level. It really is true that if in our laboratories once a year at

the beginning of the year some student will measure a voltage with an ampmeter and pop it, and then it won't happen again. It really won't happen again. And I am disturbed about it happening twice -- major events at the same plant. And, in fact, the last guy did it to both sides of the system. He ran from one to the other and did them both.

MR. CULLER: Was it the same man who did it thet second time?

MR. LEWIS: No. The first event was some time ago. This last event, the guy did it twice within the space of a couple of minutes.

MR. CULLER: Maybe he's still learning his first lesson.

MR. MOELLER: You mentioned QA being decided by the industry. To what degree does the NRC paper trail help or hinder the QA of industry?

MR. TAYLOR: I wish I could say that we don't need a paper trail, because true quality doesn't come from the paper. True quality comes from the people who do their job, who set the requirements in the first place.

My biggest experience in the past has been with QA systems that have passed gloriously all the audits, and the requirements haven't been right. So you know they are doing their thing to the wrong requirements and we don't have the quality we want, and they have to dig below the paper to go

after real quality.

But I can't conceive of a regulatory process that does not involve paper. We are stuck with it.

MR. CULLER: It has to have tracking.

MR. TAYLOR: Therefore, that paper should all out requirements which are unambiguous and practical to achieve, because the regulator must check against those requirements rigorously. You can't give excerptions just routinely.

MR. REMICK: I don't disagree with anything you've said about if we're going to have an effective improvement in QA, industry has to be involved in making changes. But aren't there also some regulatory changes that have to be considered? For example, you talked about, I think, the need for hold points or certification points. Isn't there a need to go along with some changes on the regulatory side?

MR. TAYLOR: Very much so.

MR. CULLER: I think we failed to say something. What we think needs to be encouraged in the industry-regulatory interface is that the growing cooperative effort -- supplementary, complementary -- needs to be encouraged, with more and more being pushed toward the industry because they have the hands-on control.

But there are certain criteria that have to be met by the industry, and there must be a strong audit function, paper trails and other things like this. There must be a way

of checking because you could not, or NRC could not, discharge its responsibility without having some way of checking that the performance is adequate.

But I do think that there are rather strong moves being made slowly within the industry that I think should be encouraged. They are loosening up a little bit and making INPO records available for looking at and things like this. And as a consequence, with the ice beginning to break, I think it's asking the industry to increase its responsibility to some of the routine checks and monitoring, and actual execution, particularly in quality control, has a very good chance of working.

I don't think it should be prescribed exactly, but to continue to urge that the industry pick up more and more and then to back the regulator out of the actual execution and to allow the audit function and check function to come more and more into play.

John, we might better go on because all the questions are fun to talk about, but I realize you have had 12 hours already.

MR. TAYLOR: Number 4 is unquantified conservatism. And we discussed that to some extent already. Strong feeling that these conservatisms should be quantified. I think through the NRC safety research program, our program, suppliers programs, have generated a tremendous amount of

quantitative data to permit this to be done in a logical, effective way, and apply it in the regulation for future plants.

I repeat myself again. For present plants, my own thought would be: use that knowledge in terms of case-by-case circumstances as distinct from making major changes in the regulatory prescriptions.

Any questions on that?

(No response.)

MR. TAYLOR: 5 is appropriate level of safety. And now we are into that important issue of safety goal which Floyd has mentioned. I, too, would support his comment that an important part of the stabilization process, in spite of the hard difficulties of establishing it, is the safety goal that is measurable and can be used to say, along with the appropriate cost-benefit evaluations, that there is no need to make this improvement on this plant at this time.

MR. CULLER: I have a comment here, I suppose, maybe two. One is an observation and one is a comment.

First off, the whole issue of informing the public of logical levels of safety needs to have a champion, and I don't know whether it is the NRC who is supposed to develop intelligible and knowledgeable statements about what levels of safety are required or not, but somewhere within the matrix of thinking, somebody has to be a public interpreter, and it

can't be done --

MR. CARBON: Excuse me. Let me just interject. If isn't NRC, could you suggest who it might be?

MR. CULLER: We have talked a lot about this, and one element -- and that's the comment Iam going to make, I suppose, a thought -- Chauncey Star, as you know, sort of gurued risk in a formal sense, and he's still doing it. We talked for three years about the desirability of having a data analysis function where there are risks to radiation and risks to toxics and other things like that. That takes this horrible mess of data, somewhat as we did 30 years ago with the cross-section data, and cleaned up the background.

And we've been talking with both Stanford and Harvard and their medical and engineering groups about setting up a comparative risk center, basically where the data are analyzed with care, and then the risks due to radiation as compared to the risks due to smoking, sort of what Lord Walter Marshall has proposed, the index, an understandable index, of "a puff on Sunday" -- a puff on Sunday is worth about a hundredth of a millirem as far as causing cancer deaths -- and to begin to develop a feeling in each regulation that it has passed what the relative hazard that this regulation specifies in terms of risks that are understood.

Now, such a comparative risk center has to be absolutely clean as a hound's tooth. It can have no position

on policy or anything else.

And we have been discussing with the Stanford group for almost two years the possibility of doing this. And there is real interest. And Kennedy himself is now involved.

One element of increasing public understanding is to understand risk in a comparative sense in real terms. People cannot understand 10 to the -5 or 10 to the -6. I have talked to my wife about this all of her life, and she says, "It doesn't mean anything more to me now 40 years later than it did when you first started talking." And that's the truth.

As a consequence, I think we have to improve the means of communication. Nonetheless, I think maybe the NRC is the only group in position to take on this educational program, either that or the ACRS itself. I was going to comment on that at the end. It's conceivable that your role may be able to interpret what the NRC is saying to one form or another, and that's not so easy to do, but nonetheless, it may be helpful.

MR. REMICK: Somebody has to be able to understand our letters.

(Laughter.)

MR. CULLER: You have to be able to understand us.

MR. REMICK: We can't write a letter that people understand.

MR. CULLER: It's true. It's difficult in this

arcane language that we have.

Now, go ahead, John.

MR. CARBON: Excuse me. Could I ask a question back here? We keep using the words "safety goals," but we really don't mean that, do we? What I mean is this afternoon someone commented, for example, that FAA, I guess, has safety goals which are two or three orders of magnitude better than they can achieve.

MR. LEWIS: I don't think that was true. He did say it. I don't think it's true.

MR. CULLER: I don't think that's true. We looked at that.

MR. CARBON: What we really mean, isn't it how safe is safe enough rather than safety goals?

MR. CULLER: Yes.

MR. TAYLOR: In fact, what was very impressive to me about reading of the aviation safety goal is that they originally formulated it and had it, in fact, in an amendment in their regulatory framework, and realized as they attempted to put it in practice, they were not able to measure achievement. And they changed it so they not only could achieve the goal, but they can measure their ability to achieve it. And that's what we must have.

MR. LEWIS: But the measure of their success is that most airplane accidents nowadays are caused by pilot error,

and that means they've done a good job on the mechanics.

MR. TAYLOR: Yes. And they still have more to do with the pilot.

MR. LEWIS: But there will always be --

MR. TAYLOR: Automation of nuclear power plant operation. Our own trust here is not to seek out increased automation, either for present systems or for future, but to attempt to utilize modern computer technology, graphics, ability to give substantially greater aid to the operator, diagnostic aid, quickly provided.

Let him make the decision, let him be in charge of the plant, but give him substantially more effective information with which he can act.

MR. CULLER: Let me expand a bit on that. One of the areas that we decided to get into with both feet three years ago was artificial intelligence. And we've had some of the best guys in the nuclear division on it for a while.

We had our first application seminar for a lot of things about three weeks ago, and I swear to God I was impressed with what has come out. There are devices being proposed that will do such things that will assure you that the reactor is shut down when it says it is shut down, and there is no device now available that will do that.

MR. LEWIS: Don't count on those either.

MR. CULLER: Well, I don't either, but the chances

of our providing information enough to the operator so that he knows what to look for under circumstances, I truly think that what John is saying, this business of providing the operator with quick information through artificial intelligence is going to be a great assist.

You may expand, but I was truly impressed with what has been done in two years.

MR. LEWIS: We must talk about that at some other time.

MR. CULLER: Why don't you come up --

MR. TAYLOR: Floyd is talking about a lot of things that are in the laboratory and not the plants.

MR. LEWIS: My experience is the promises are magnificent.

MR. TAYLOR: The issue with utilizing these techniques in the plants that are advanced, of artificial intelligence, is that they're not familiar and they're not really trustd by the operator and he is very leery, therefore, of utilizing.

So one of our frontrunner programs for initial application is a shutdown analyzer. It doesn't operate when the plant is running; it is utilizable after he has had an inadvertent scram to give him a more in-depth diagnosis and, hopefully, faster, of what caused that scram.

We've gotten explicit desire from the utilities for

this because of the Salem affair, where the operator wasn't quick enough to understand that he had lost redundancy in the few earlier versions of that particular incident. The utility ends up with a tremendous fine and terribly bad publicity. They're still worried, does the operator have that extra subtle capability to see through some of these seemingly simple events? We think an AI system, an expert system, would be a substantial aid to him.

MR. LEWIS: We will talk about that, but not on Max's time.

MR. CULLER: Come up and talk with us about that.

MR. TAYLOR: If we can get the operator to use that in a situation where, if he takes action or not it's not going to hurt the plant, then get confidence in it, then we can talk about putting something to help when he's running the plant.

MR. CULLER: I have a personal opinion, too, about automation. I favor the general policy of not forcing the operator to make a quick decision under stressful conditions. And I like the British and French automation, automatic control for half an hour. It gives the operator time to collect data and think about what happens before he has to start reacting. He can override the system. The reactor has an automatic control for approximately half an hour.

MR. TAYLOR: My own version of that is we have in the present system that type of automation, and in future

systems we would make it that that type of actuation is not needed as fast itself, let alone operator action on top of it, that the operators can, in fact, be more leisurely, along the lines that Floyd has mentioned. But this again would be for future systems.

MR. LEWIS: This is a very important issue, of course.

MR. CULLER: We understand that. I think John and I agree pretty much, and we have both said about the same thing. I don't think we would automate a reactor for operation. Incidentally, the high-flux isotopes reactor during shutdown on the high flux and startup because it goes through a period of very limited temperature override, has an automated takeup and shutdown. The power density of the high-flux isotope reactor is very high and the period is very short. So when we built it in 1963, we automated. We run it on the computer. We can override it in an instant, but the computer takes it up and brings it down.

MR. REMICK: It's not quite what we're talking about. But something I remember from a recent trip to Japan. At the Fukushima site, their Unit 4 at the Daini site is going to have a new control room, somewhat like nuclear but different. The Japanese version. They have voice recognition so the operator can stand there and ask reactor pressure, reactor level and so forth, a nice digitized female Japanese

voice comes back and tells him what it is. He can ask for equivalent of SPDS. He can just ask the page he wants. He doesn't have to punch any numbers if he wants to see another page.

MR. CULLER: This is the kind of thing John is talking about, operator aid.

MR. TAYLOR: The control center on the mirror machine in Livermore, if you've seen it, has nothing but touch types which is there is not a switch or a lever in the whole damn control room.

MR. REMICK: You can just point to CDT --

MR. TAYLOR: They have to touch it. But that's all. It's beautifully laid out in color.

MR. REMICK: There is a whole series of infrared and the person just points. You don't have to touch it, just put your finger close.

MR. LEWIS: That's not automation.

MR. TAYLOR: No. That's my point. I don't know whether we want to go above where we are in automation per se.

Safety research, I strongly feel that NRC should maintain a major role in safety research. Being in the research side of the business, you can take that as you wish, too.

But we feel that that provides NRC with the independence of technical judgment that is essential to make

it a credible agency, and I would strongly support it. I am actually somewhat concerned that every time a budget cut is taken at NRC today it tends to be taken out of the research program.

MR. CULLER: Hal, we went back and reviewed the UGAVE(?) Report to a limited extent.

I think the assignment of roles in those two tables that we put into that report are still valid. There are certain things the industry should do. We assigned a role to the Department of Energy, which I do not think it will pick up necessarily, and that's doing what we called at the time "creative research," looking for new ways of bringing on better safety.

NRC, because of its interest, maybe should pick up part of that cudgel. I am uncertain about DOE right now. It's an important issue. Most of yours is confirmatory, but not exploratory. I am sorry -- in NRC. But I think that role becomss important.

It's also important that the industry do that, particularly in the areas that John is going into in looking at advanced reactors. The safety systems have to evolve a new form there, but I think NRC needs that, and I recommend -- and Jack brought along copies of the 1983 ERAB report that was done both for NRC and DOE by a subcommittee of relatively good guys, of which Hal wa a member. We went over the whole safety

program internationally and everywhere else, the safety research program. And the report is almost valid today; not much has changed. So I recommend it to you at least for superficial reading.

MR. TAYLOR: One other comment. I don't know that I would word it, "should NRC do research to permit relaxation." That is, they should be doing research in areas of uncertainty with the objective position of reducing those uncertainties and gaining greater understanding. If they find in the process of this, relaxation, fine. If they find in the process there is going to be additional restriction, okay, that has to be applied, too. So I would keep that as a pretty neutral type of approach.

MR. CULLER: I have another quick comment. As we clearly enumerated in this ERAB report, one of the difficult things is to take advantage of research already done within NRC, within EPRI. There is a lot more known from ten or 15 years' worth of safety research than has been incorporated back into the regulatory process. And that particular mechanism within NRC needs attention, and that's one of our principal conclusions in 1983, and I repeat it now. Taking advantage of what research has been done is not evident within the regulatory process.

MR. WYLIE: Let me ask a question. We just got through going through the research budget for this year,

and during that process this came up time and time again, "Well, industry ought to be doing this research, maybe industry should be doing this" -- you mentioned that a moment ago -- "that NRC should be doing certain things, and industry should be doing certain things."

Is there any active coordination going on between industry and NRC to identify these areas where industry is going to be doing it --

MR. CULLER: We almost jointly plan.

MR. TAYLOR: We meet with Bob Minogue, myself and my senior staff and Bob and his senior staff, roughly every four to six months, and we each lay out our existing programs, and we try to avoid any place where there is duplication.

And very often we wil come up with joint projects. We have quite a few joint projects. Each of us put money into the contractor on an agreed-upon joint plan, set up a management committee to run the project, and some of our best projects are done that way.

MR. CULLER: Yes.

MR. TAYLOR: Because the guy who puts his money in wants to use the results, so NRC wants to use them and we want to use them. Some of our best projects.

MR. WYLIE: They are in, I call it, "aging it." That's not exactly the right term, but it has to do with how long we're going to run these plants with the equipment we

have.

MR. CULLER: Longevity.

MR. WYLIE: Yes. That's one area the NRC was spending quite a bit of money on, and they got cut back quite a bit in this budget cut.

MR. TAYLOR: That's too bad, because we, too, have a program there and, in fact, have been eliciting support from DOE, in light of the reductions and so on we see on the NRC side, because to be done properly it's a very expensive in-depth program. But we believe it's extremely important from the utility viewpoint. The ability to generate power out of a system without having to put new investment is the most important economics that we can take.

MR. WYLIE: That has to be a joint effort between industry --

MR. CULLER: We recognize that. We have a very stable program and a relatively good-size one.

There is another reason that NRC should do it, I think, and that is, sometime beginning around the year 2000 you have to decide on whether you're going to relicense reactors whose license are up, and it's going to take ten years to figure out what the status of the plant is.

So we have started researching measurement techniques of trying to decide how much lifetime is left as well as trying to decide what kind of maintenance to extend

to critical items within the plant that will be necessary as a routine to keep those things that could deteriorate because of another element's failure from deteriorating.

So it's a broad program, and it certainly is going to be important in relicensing and ultimately in the decision to shut down, and you most certainly are going to be involved in that process by 1990 because you're going to have to begin to think about what you're going to do with the licensing, the relicensing of reactors, or the shutdown of same.

MR. LEWIS: I am not very well informed on this, but I have always had the feeling that it will never be economic to shut down a major reactor.

MR. CULLER: That's correct.

MR. LEWIS: It will always be economic to fix what needs to be fixed, to keep it going.

MR. CARBON: Except maybe the pressure vessel.

MR. CULLER: We are looking at that, incidentally. I don't know whether you want to discuss this or not, but our own view is the lifetime of the reactors may be 80 or 100 years.

MR. LEWIS: I would anneal the pressure vessel or replace it. An aircraft has an infinite license. It really does.

MR. TAYLOR: We discussed that with the aircraft industry.

MR. LEWIS: You just replace the parts that wear out. It's like George Washington's ax.

MR. CULLER: One of the things that John is going to do in looking at advanced light-water reactors is to consider the complete replacement of every component within the plant so that the balance-of-plant and all the concrete and other things like that can go on and on and on. So we're going to try to lay things out to see what the cost effects and safety effects will be so we can get at everything for easy replacement and maintenance and begin to consider reactors like dams at least or maybe reactors like dams-and-a-half, even.

But the full data on the pressure vessels and all indicate there is relaxation in the embrittlement and all. Certainly, there is a 60-year life. We're certain of 40 and 50, but certainly 60 or 70. And the limiting is the embrittlement in the pressure vessel.

MR. LEWIS: You can replace it.

MR. TAYLOR: We've put a lot of urgency on the program at this juncture because we realize there are many actions a utility can take to reduce the burden on his plant to give him greater opportunity for extended life without replacement, et cetera. The whole episode of cyclic burden, more care is taken to minimize than that than you're going to move out toward the end of those fatigue limits a lot slower.

MR. CULLER: Reducing the number of challenges to the safety system is another important element. So it's an important program, and we were very concerned at the loss in the NRC budget because we had a reasonable basis for beginning this effort with Minogue.

MR. TAYLOR: There is tremendous cost effectiveness in joint efforts. Let me repeat that. And this effort, in view of the essential involvement of NRC in making judgments technically on life extension, NRC should have a vigorous program, just work together so that we're not duplicating, we're sharing resources.

MR. CULLER: In many of these areas we recognize we can't do all of this work ourselves because there is the regulatory view and consideration that has to go along parallel with the development of technique. Otherwise, we're out of phase, we really don't know where to go.

The whole question of this research is an important one, and I hope you can raise it in the consciousness of budgeteers.

MR. TAYLOR: Standardization --

MR. CARBON: Excuse me.

MR. TAYLOR: Standardization, that's an extremely important question, what do we really mean. I don't think we made an adequate definition of standardization from the industrial side or from the regulatory side. We are trying to

help to answer that question. Our adavnced LWR program has as a subsidiary goal a contribution to standardization. We believe in setting -- the deliverables in this program is not a design, but an in-depth set of utility requirements which will elicit from the design the goals of simplification, reduced probability of core-melt, et cetera, et cetera. And we feel that setting those requirements will be a significant step towards a standardized system.

We are evaluating as to the degree to which we can enlarge that objective to stipulating functional systems requirements, formfit function type of standardization, which would be, in my judgment, the ultimate standardization you would like to get to, a formfit function, set of specifications where, with that definition, the utility or its agent could go out in a competitive market and solicit suppliers to provide equipment and systems to fit the formfit function specs.

It's very difficult, and we are hoping to help define that. We certainly don't mean duplication.

MR. CULLER: And not involve duplication.

MR. TAYLOR: That is not in the interests of an effective technology, and it certainly doesn't fit the United States industrial competitive structure, multisupplier, many utilities, and so on.

MR. CARBON: I wasn't sure that I understand your

word "duplication." You don't want duplication? I am not sure that I understood what you meant.

MR. CULLER: Replication.

MR. TAYLOR: Replication.

MR. CULLER: I think we would duplicate all the requirements and such. In the evolution of our thinking about this, we have said it's obviously crazy to have a whole standard plant which you can't change or improve some elements of. So we would break the plant down into functional groups. You may standardize the package around the steam generator and its controls with a set of requirements and criteria, and when things look like we have a major chance of improving those, we will change that whole package, so that there is a constant evolutionary pattern that is available, but the standards ought to be recognized and changed only when there is a formal move to change the standards and requirements criteria.

MR. CARBON: But you're not going to build 727s and 747s and so on. You're going to slide from the 727 to a 747, is that right?

MR. CULLER: Well, we may slide from 727A to 727Z.

MR. CARBON: That's a better example.

MR. CULLER: I think we will try to preserve the concepts and the requirements, but there may be internal elements within the package that change from time to time to improve either operability, use better materials or something

like that.

MR. TAYLOR: Significant progress was made on the NSSS by individual NSSS suppliers and standardization. The Westinghouse system, if you wanted a 600-megawatt unit, you got two pumps, two steam generators identically the same, and if you wanted a 900-megawatt unit, you got three of them. If you wanted a 1200-megawatt unit, you got four of them.

Changes were made as field experience showed you had to make changs, and they were applied across the board. That is a formfit function-type of specification.

Westinghouse in that scheme went out to some suppliers for charging pumps, heat exchangers and various other kinds of equipment, giving geometric specs, envelope requirements and flow, temperature, functional performance specifications, and accepted the technology which that individual supplier provided him in meeting the specs, and was able to make choices on a competitive bid basis.

That's what we have to try to extend to the entire plant, and then the more difficult issue is can you extend that concept across a group of NSS suppliers as well and have it make sense?

MR. CULLER: We ultimately believe that our standardization of requirements and criteria for performance by the utilitis will evolve a standard design amongst the suppliers. I mean you will see the same system you will see

time and again. If it doesn't, then we will take another look at it. But we don't intend to build, as the French do, five identical units in a row, although the utility could elect to buy five at a time and have them built that way.

MR. CARBON: Do the Commissioners use standardization that same way?

MR. TAYLOR: No.

MR. CULLER: No.

MR. TAYLOR: My impression is that Commissiner Zech looks upon it as replication. I have not heard from any of the other Commissioners really a very clear statement as to what they mean.

MR. CULLER: I think Joe views it a little bit more like John does than any -- I talked to Tom Roberts once about a year ago. His idea was, between replication and some evolutionary changes allowed.

MR. TAYLOR: So there is a perception, which is not quite accurate, on the part of some people that the French standardization program is a duplication or replication program and that the naval standardization program is a replication program. It's not true. They have consciously standardized and even replicated many elements of the program; for example, site requirements have required them to have different cooling systems and other affairs of that sort.

Now, seismic is an interesting one. We are going to

try to emulate that. In the seismic case they chose an envelope seismic requirement, and when the site required higher requirements they made up the difference with seismic buffers and they built the plant upon pillars of laminations of neoprene and steel so that that little bit above the envelope requirements was taken up in the buffers.

MR. LEWIS: How many French plants are built?

MR. CULLER: Two plants in southern France and two plants in southern South Africa have those buffers. That's an intriguing way to handle it.

MR. LEWIS: I didn't know any French plants actually had it.

MR. REMICK: There is an important point here. I hope the Commission is aware of what industry is thinking, because they way they were proposing it, you would have a grand rulemaking for a standardized plant that you basically wouldn't make changes. You want a rulemaking every time you want to change one of these modules.

MR. CULLER: We will most certainly preserve the element.

MR. TAYLOR: If you are talking the kind of requirements we intend to set and you extend that to formfit function, there is a hope that that could match a set of regulations which covered the waterfront.

MR. CULLER: That's why we have the agreement with

NRC to work along as we evolve these.

MR. TAYLOR: It gets back to the issue that the industry would like to see happen. Don't tell us how to achieve safety; just set us the goals that you want to achieve.

MR. CULLER: Let me make sure that we don't give you the impression that we think for each plant some element of this package will change. We don't. But it would be a little bit foolish to say this is the kind of plant we're going to build for 20 years and find three years later or four years later that there is an elegant, simple way to operate the steam generators without collecting crud and such, that kind of thing. If that kind of change occurs, we will go back and we will restandardize with NRC that element, and we will make sure by the other standardization of teh package around it that it will fit.

MR. REMICK: Am I correct, in their thinking there was something like five years' certification subject to some kind of renewal for three or five years, something like that?

MR. TAYLOR: Yes.

MR. REMICK: Is this consistent with your thinking?

MR. CULLER: Yes. I think so. All we're saying is we don't believe a replicate is necessary to satisfy that condition.

MR. TAYLOR: Nor that rigor mortis is necessary.

MR. CULLER: Rigor mortis cannot be set in, otherwise we're not going to survive very long.

MR. TAYLOR: Again, you don't see that in the French program or the naval reactor program.

MR. LEWIS: I never heard the term "rigor mortis" used in connection with birds.

MR. TAYLOR: He shouldn't have used it.

(Laughter.)

MR. CARBON: For whatever it's worth, some of us were looking at transcripts of the Commissioners meeting, yesterday, from just this past February, and at a quick look it seemed to me they were thinking duplicates or replicates.

MR. TAYLOR: I know Commissioner Zech has expressed that because in a presentation we made of our advanced LWR program, that subject came up, and it was very clear to me that's what he had in mind. And we said that was not what we had in mind and evident disapointment on his part.

MR. CULLER: I think what we may do is sponsor one of our classic workshops where we get everybody together and let them argue about what they mean.

MR. TAYLOR: I don't think we're ready to do an intelligent job yet.

MR. CULLER: We will be.

MR. TAYLOR: We have in the effort to define this, have a sheet, a two-dimensional array which starts at the top

broad requirements, works itself down to the detailed requirements, standards, systems design, component design, maintenance, operation, and construction, and across the other way, the level of standardization which we think we an achieve.

And we're going to go with each one of these boxes and see if we can determine are we going to be able to standardize this part, are we going to be able to standardize this, and how? Some will be duplication or replication in the sense of the requirements. Others will be formfit function standardization, and probably when you get down to a certain level, there will be no standardization.

MR. CULLER: Incidentally, there is another element. I think maybe the Japanese may be approaching it this way. I am not absolutely sure, but they've done something else that we haven't really gotten into place, and I doubt whether the utilities will support. The Japanese are setting up big proof-test centers. They have appropriated some $500 million to set up a testing center to test the gear that goes in for failure rate.

Now, this goes through all kinds of analyses -- and we have discussed this for years -- about having some center to test gear to failure. We did that on the valve work, as you all probably remember. We did get some failure rate data on the big blow valve.

But, the total information package, the proofing out of equipment, are you going to buy on performance requirements, and wire these for manufacturers so they have to test to failure? Or how will you guarantee performance without replication of some kind? Have you decided that?

MR. TAYLOR: We haven't gotten into that detail. Certainly, we're going to establish the performance testing requirements, that's right.

MR. CULLER: There is another element that always comes out of this that no one ever talks about. You really have to have some idea of how the gear is going to perform if you do good PRA, and we do not exactly buy to performance requirements now, test performance requirements, on individual pieces of equipment always, but it's an element that has to emerge as I think we go through this exercise right now, and I don't know how NRC proposes to handle it, or anything else.

Now, enough on that one.

MR. WYLIE: Let me ask one question. You say you're not ready to put it on your workshop and talk about it now. When will you be?

MR. TAYLOR: I would say a year from now.

MR. CULLER: Yes. If we had gotten started two years ago, we would have had it already. We're just getting well launched.

MR. REMICK: I would suggest if you do that, you should have a part for the industry lawyers to get hold of the NRC lawyers for well over a year. You know, the idea of having a rulemaking for standardization is great. I think it's great. What do you mean? I haven't found anybody yet who knows what it means.

MR. CULLER: It will be a year after we have the workshop before we involve any of the lawyers.

MR. REMICK: If they're going to have a rulemaking, they better decide what they mean.

MR. CULLER: The rulemaking has to come a lot after we have the concept.

MR. LEWIS: Do they have to have a rulemaking?

MR. CULLER: It's the proposed way to handle it rather than the normal licensing process. You would have a rulemaking. Whether that's an ECCS type of rulemaking or it's a rulemaking that we routinely go through. Nobody has really thought out what they mean by it. It sounds great to everybody.

MR. TAYLOR: It's a marvelous buzz word.

MR. REMICK: I haven't found anybody who knows what it means. Sort of we tend to have rulemaking for each standard design and a rulemaking for sites, then you get to match those designs for the site. It's the concept, but what that rulemaking is, nobody knows.

MR. LEWIS: But they don't have to have one, or do they?

MR. SAUTER: At the Severe Accident policy statement it would require a rulemaking for each standardized --

MR. REMICK: That's what it says in there, yes. But what it means --

MR. TAYLOR: It looks like the lawyers got there first.

High-level waste, Floyd is very active in this on the Scientific Advisory Board to EPA, and the subject of standard-setting.

My own plea with you and the NRC is to get deeply involved in what used to be exclusively NRC's jurisdiction in setting standards. EPA has run away with this, and if the present approach is accepted, forget it, we won't have a repository, in my judgment. What is it, ten orders of magnitude?

MR. CULLER: Not quite. It's 10 to the minus 13 now. It may be minus 10 to the minus 12.

MR. TAYLOR: This is in terms of cancer incidence?

MR. CULLER: Yes.

MR. TAYLOR: What is the normal cancer incidence, about 10 to the minus 3?

MR. CULLER: Yes. One in -- two in 10 to the minus 4, four in 10 to the minus 4. That's not right. It's 20,000

in 100,000. I am sorry. I back off. My mind is not working.

We are meeting with Dan Egan tomorrow because there is a new writeup on the requirements.

First off, the special committee looking at standards pointed out the way it was being set, essentially due to ALARA for salt mine and other repositories, and took the level at which waste can be contained or a modeling effort to show, and used it as a standard which essentially said that there was about one chance -- 10 to the -9 probability of having a thousand cancer deaths over 10,000 years. And that was the dose criteria.

We said that this set radiation levels so that the radiation equivalent would be like jumping four feet in the air for a year's dose. And this was so far lower than any other radiation standard that we were concerned about being able to prove that we could license such a plant by proving that it would meet these requirements; and secondly, that the unnecessary conservatism we thought would eventually translate itself into a measure of hazard and the question ultimately would be asked, "Why are occupational exposures and exposures to background radiation not set lower than this?"

The regulations, as set up, have been tightened just a little bit. The procedure for estimating the probabilities of whether or not the repository can meet the required release rates and several other elements of conservatism now appear to

us in a rewrite that just came out two weeks ago to make it -- possibly -- to make it impossible to prove that you can meet the requirements in the licensing process.

So we are going to talk with Dan tomorrow and see whether or not there is any way to relieve these. It is important, however, that NRC fully recognize the part of the proof and the management of the waste farm which they are going to administer has prescribed regulations on how they are going to decide whether the system is safe or not and how they calculate the probabilisties.

In addition to that, there is a role that NRC most certainly should undertake -- and I am taking this advice from Bob Catlin, whom many of you know -- Bob suggests for NRC that as the repositories are built, presuming that they are, that NRC should set up a way of validating the model by which the licenses are granted, there is a rate at which mateerials might move, and all. The collection of data over a long period of time should be checked back in evaluation of models.

Now, we recognize that no one knows how to do this at these low levels, so there are several phases. The feasibility of checking the licensing model should first be studied. And as Bob's contribution and my contribution to this discussion with you, that's the thing that he suggested, plus the general awareness that the levels being set are exceedingly low and that it may be very difficult to execute a

rational licensing procedure that will guarantee that we can meet the low levels.

MR. LEWIS: When you quoted this 10 to the -9, were you inventing those numbers?

MR. CULLER: No.

MR. LEWIS: Those are real numbers?

MR. CULLER: Yes. I will send you Bob's comparative risk chart as to where the long-term waste repository falls in the protective --

MR. TAYLOR: It's like 10 to the-13.

MR. LEWIS: I would be grateful. I assumed you were joking.

MR. CULLER: No, no. It's beyond death by meteorite.

MR. LEWIS: Which we don't know very well.

(Laughter.)

MR. CULLER: We don't know. Take two orders of magnitude here.

MR. TAYLOR: The present judgment is that the repository design, in fact, is down in that vicinity, but the problem is to prove it. There's no way we can prove it.

MR. CULLER: The truth of the matter is Dan did a very good job of modeling this, and salt and the other things will come out to 10 to the -9 or something like that, just naturally. And that's where the level was set.

MR. LEWIS: I wasn't aware it was that far off.

MR. CULLER: Let me get Bob to send you some stuff, and you will understand it very quickly because he has calculated it out.

MR. TAYLOR: Are you going to be here tomorrow? I can give you that chart tomorrow.

MR. LEWIS: Yes, I will be here.

MR. TAYLOR: I will give it to you tomorrow, drop it off.

MR. CULLER: Bob's in town tomorrow.

MR. TAYLOR: I have a copy of it.

MR. REMICK: Is it something that can be copied?

MR. TAYLOR: Yes.

MR. REMICK: It would probably be better to give it to John so we can all get copies.

MR. CULLER: we will do it. I think Bob may be coming in to talk to the Waste Disposal hearings tomorrow or something like that, I am not sure.

MR. LEWIS: It's really peripheral to this committee's job.

MR. CULLER: The only reason brought it up was just the general awareness of what's happening.

MR. TAYLOR: Besides the industry, what it means to NRC, you will have a regulatory task that's impossible.

MR. CULLER: Absolutely. Perhaps.

MR. MOELLER: There are a lot of aspects to this, as I am sure you know much better than we, because you've been involved in the Science Advisory Board. But the full committee is going to consider the subject tomorrow, and we have had a rather interesting time in dealing with EPA, NRC, and DOE on this matter.

For example, the EPA people have called a few days ago and told us they will be unable to come and talk to the full committee tomorrow on this subject. And further complicating the situation is that both the DOE staff and the NRC staff, not the Commissioners but the working staff, the Dan Egans of NRC and DOE have signed off on EPA's proposed standards.

MR. CULLER: But the standards have been rewritten since they saw the last draft. It's very different. I just got the revised copy last week, two weeks ago, and we've just been through it. That's why we asked Dan to come talk with us tomorrow morning at 8:00 o'clock because I don't understand. What's more, the whole process was essentially everyone agreed that it was awfully safe and why not let it stay safe?

The technical advisory review committee, however, reacted -- everybody on it -- as being too high, and the recommendations basically were, for probably good reasons, not taken up by the full committee and then acted on. We recommended at least an order-of-magnitude reduction in the

severity of the limits and perhaps more but at least a factor of ten was desirable.

Okay. I will get you the information.

MR. LEWIS: I always give popular speeches saying, "There's no problem I know in which the difference between the perceived risk and the actual risk is greater than in that question."

MR. CULLER: That's very true. Essentially, I am not being totally critical of EPA. They did a pretty good job in figuring out how to approach it, but they set the limits too low.

MR. TAYLOR: Decommisssioning. From the viewpoint of the industry, a stable, well-designed set of regulations governing decommissioning is needed, and my understanding is NRC is, in fact, on the track of establishing those. So I don't know that in any new initiatives are needed. But certainly, to complete the present effort in this respect is a very important framework from which the uti.ities can then begin to do their own long-range planning and decommissioning and clear up issues of uncertainty on costs and so on, which will continue to exist in a strong way if the regulatory framework is not established.

MR. CULLER: Is that our last one?

MR. TAYLOR: Sabotage. My own judgment is that the best way we can effect the sabotage threat for future plants

is by the approach we are taking of making the plants easier to operate, therefore, in my judgment, harder to mess up, and provide these highly effective diagnostic aids which, in effect, make much more visible something that is inherently wrong in the system, maybe in an in-depth sense, and don't put any specific effort on sabotage per se, because it leads one into almost a nightmare of intellectual what-iffing that I don't know how one could contend with.

If we are successful in the goal of having the ability for the operator to flash up tremendous amount of in-depth information onto a CRT with a push of a button, we have a very fine chance of him being able to spot some subtle saboteur effort, an insider-type effort.

MR. CULLER: The only thought I had here is that, as you know, the international agency has produced, with the aid of almost everyone in the world, a set of guides, which are just not publicized, on taking care of sabotage and direct intervention. Not everybody follows them. But before taking off on any major programs, I think talking with the IAEA in-depth to find out what experience they have had and what the reactions would be is a logical argument.

I have reviewed them. I have been on the scientific advisory committee there for about 12 or 15 years. I know what most of them are. They are not widely distributed because it would defeat the purpose of the guides. And they

are never discussed in the literature, as a consequence. But there has been a lot of work on it.

MR. CARBON: One spot that some have wondered about with the effort to come up with standardized designs, whatever, the GESARs and so on, we are coming out with reactors that probably will be in operation for 75 years or something, and as far as I know, there isn't much effort or thought given at the initial design stage to things that you might be able to do quite easily and cheaply at that point that would be effective against potential insider sabotage or some such thing.

Part of this is aimed at saying, "Is there merit in giving more or special or some attention to what you can do in the way of design at this point in time, when we are starting to build these reactors? Maybe they will be ordered five or ten years from now, but with us for the next 50 to 75 years. Is there merit in paying perhaps more attention to the design of them from the dis-sabotage aspect than we do?"

MR. TAYLOR: My problem is to convert it from what we are trying to do, which is to essentially make them fail-safe with the approprite redundancies without reducing the necessity for immediate action in the event of something going wrong with equipment or an operator making an error, combined with the ability to have a very effective modern diagnostic capability, including the ability to flash up on a

screen in-depth information on the plant with indications of the state of that piece of equipment or system as against what it should be.

That is the primary defense against insider sabotage. If you open up the design process to answer the question, "What can someone do beyond what is covered by those kinds of capabilities, you get into a nightmare of 'what ifs.'"

MR. CULLER: Incidentally, there is another body of information, and I think many of you remember when Eugene Wigner was concerned with civil defense after the Cuban missile crisis. He spent nine years at Oak Ridge, three months a year, running a civil defense study. And sabotage and such to the nuclear systems were analyzed in pretty interesting depth by a relatively small group of people.

Conrad Chester is still there and did the work. He had Schlesinger involved and a lot of the Army defense of the United States and all, in looking at the consequences.

What I remember of the principal conclusions are these: Most of the accidents initiators that a saboteur can manage essentially are no worse -- are covered by the automatic shutdown and protection systems that had been designed in for normal safety. The only things were direct penetration of a concrete pressure vessel with shaped charges.

So Connie went out and they built a vessel of some

kind and shot shaped charges at it to see what would happen. We've driven telephone poles into containment vessels on rocket sleds and such.

So there is a hardness measure from external and analytical work that has been done in the civil defense program at Oak Ridge, and there are still guys around who remember every detail of it because every now and then it becomes an important issue again and they go back and do some more work.

As you look at it, you might want to involve these people in the ex-civil defense group at Oak Ridge. They can dig up pretty good analytical approaches and maybe some conclusions from that work.

MR. LEWIS: One thing you just said, I remember the American Physical Society study ten years ago dealt with sabotage in much those terms. They said that the group couldn't imagine an act of sabotage that could produce a worse accident than normal causes could produce, but can only increase the probability of it.

MR. CULLEN: That's correct. That was about the conclusion. A lot of things were tried. Connie is the most inventive guy I ever saw anyhow. He can think of all sorts of weird things. There was an excellent group of people. We pulled the best physicists and all out of the lab to work with Wigner over a long period of time. So it was handled

responsibly. It may not answer all of the questions that could be asked now, but nonetheless, it's background that shouldn't be lost.

MR. REMICK: I asked the Japanese if they were giving consideration to sabotage in their design, standardized design, and whether they thought they should. And their answer was, "Absolutely not."

MR. CULLER: I think that's a mistake, and I think the international agency would advise that that's a mistake. There is a lot of discussion that has gone on at pretty high levels about that.

MR. REMICK: I guess I wouldn't say it's a mistake. They were saying basically what you were there, that there is no need for additional work for sabotage.

MR. TAYLOR: The distinction between ours and theirs is external sabotage. We have much tighter security arrangements around our plants than they do. I would think that that's what the difference is they are eliciting.

MR. REMICK: If I recall, I have better figures in my notes. I think for a four-unit site, they have 40 guards total, all shifts. That's the total for their guard force, I think, is a total of 40.

MR. TAYLOR: We're not advocating forgetting the sabotage issue in the external sense.

MR. REMICK: I was thinking of design now. I am not

thinking terrorist type of thing. The thing we were talking about, that sabotage --

MR. TAYLOR: Or the ability for some troublemaker to enter the plant, not part of the staff, has been appropriately screened and trained. That's an important protection against sabotage, the external security.

MR. CULLER: John, do you have any other thoughts now?

MR. TAYLOR: Containment and siting I guess would drive everybody crazy if we go through each of these items. I am willing to quit.

MR. CULLER: Oh, I am sorry.

MR. TAYLOR: Shall we continue on, or are you just too exhausted?

MR. CARBON: We would like to continue.

MR. LEWIS: How long are we going to continue, Max?

MR. WYLIE: We are scheduled to 9:00.

MR. CARBON: Probably 9:00 o'clock or something.

MR. LEWIS: If they stay, I may stay a little longer, but if you just got back from overseas --

MR. TAYLOR: Containment and siting, certainly we have seen an evaluation of TMI-2 in our source term work that the strength of containment and its ability to hold together for substantial periods of time if a severe accident occurs areextremely important to capability.

I am not suggesting that we need at this juncture to make major changes in the present containment system. As we evolve future designs, we are going to look at such issues as you have raised, very, very carefully and make sure that, if anything, we improve that barrier in that whole defense-in-depth concept. It's an essential one, and it's proven to be better, perhaps, than we thought it was as a result of the evaluation of TMI-2.

MR. CULLER: We have also been exploding hydrogen in Horton spheres to look at shockwave rates of propagation of various waves and heat flashes and such to get a better indication of what might happen and how to protect against hydrogen overpressure. And I think the vessels we now have are adequate for that. There was some question on the smaller ones with ice condensors. Ignitors will take care of that.

MR. TAYLOR: We have tested those, and they seem to perform quite satisfactorily.

MR. CARBON: Let me pause for a minute and explore this question of when we break up.

(Discussion off the record.)

MR. TAYLOR: Backfitting.

MR. CULLER: Do you want to say anything about siting?

MR. TAYLOR: Oh. And siting. The whole content of the comment underneath is on containment. So I just didn't

prepare any response to the siting.

MR. CULLER: Let me give a derivative comment from lots of others, and I think you all know these, and I won't go at all into any expansion. If we get standardized plants, in whatever definition, and we get sort of a prelicensing of standardized plants, the problem of the site is as much of a problem to the utility in prequalifying sites, and it's under the federal control, it's nominally under federal plus state control with the safety requirements being set by the NRC.

But the other conditions are controlled very distinctly by the state itself. Siting is an important element in cost at times in qualifying the site, and it is also likely to be a restraining factor. I don't know what ACRS can do about this, because of the jurisdiction of the federal site does not extend into state sites exactly. Nonetheless, it's an important element and deserves some consideration.

We have suggested, as NRC has suggested, and DOE, that the utilities prebank sites, that they start qualifying sites either for fossil or nuclear stations well in advance. I am not sure that that's going to be uniformly done, and even though we may be able to speed up the process of construction and licensing by standardization and preapproval, the approval of a site is also a major factor. And other committees have observed this just as I am sure you will.

But I point it up only because it is not exactly under control in anybody's imagined future plans.

MR. TAYLOR: So then we are moving into the regulatory process, backfitting, establishing a backfitting policy that moves the threat of continuing backfit from the utilities is probably the most important step at stabilization that can be made.

Now, I am not suggesting that backfit can guarantee that there will be no backfit under any circumstances. There might well be a circumstance that requires it, carefully identified, reviewed, subject to cost-benefit analysis. But I know that backfitting policy statement is being worked on, and one that owuld give some reasonable assurance of a stabilization in terms of the incessant change that the plants have been subjected to up to now would be extremely valuable to the utility and would remove the concern that you have expressed here of a reluctance to want to talk about improvements even in future plants. It would help substantially that type of concern.

You also suggest certification points, which remind me of a prevalent industrial practice in the ASME code system where changes are made in codes and there is no desire on the part of the professional community or ASME to quell change. But when a code change is decided upon, is scheduled to be put into place at a certain time, and equipment that is built

prior to that does not have to be redone to meet the new requirement. It meets the old requirement. New equipment effective on the date specified meet the new requirement. So you remove the destabilization of what you have got, and you remove the threat against improvement for future equipment. We strongly encourage that.

MR. CARBON: Do you find CRGR to be an effective --

MR. TAYLOR: It's an extremely important step that was taken by NRC. It has been somewhat hamstrung by Commissioner guidance at hte very early stage of its forulation, which to the best of my knowledge it's still operating under that kind of constraint, and it would be very helpful if it were given more authority than it has today.

MR. CULLER: This is one of the more important technical issues that I think you identified for discussion, and I know other industry people surely must have commented to the same effect. We feel it distinctly in the research and development side as well.

MR. REMICK: I guess it's not in there. Do you think that the cost-benefit analysis should be part of the backfitting?

MR. TAYLOR: Yes.

MR. CULLER: Yes. We think this hierarchical analysis of PRA as it gradually becomes available as a technique, individual PRAs on plants will provide a basis of

saying the backfit requirement for this system will provide only a marginal increase in safety; therefore, don't do it. And I think one of the proposed wordings of backfitting rules are that there must be a substantial increase in safety and an evaluation of costs that would justify it. And I think there are tools that can be brought to bear again that will make the judgment a little bit simpler.

I am certain that the industry and the NRC will move and more to hierarchical analyses with PRA, and once they're individually done for each plant, then the determination of the importance of backfit for safety will be a little bit easier to make and specific to the plant rather than generic.

MR. CARBON: We have been in discussions of this type where the question comes up as to what costs should be included when you do something like this.

MR. CULLER: We're familiar with it.

You first.

MR. TAYLOR: All right. Our judgment is the more standard cost-benefit evaluation of the cost to make the modification against the benefit achieved should be the basis, not looking into the cost avoidance associated with the probability of this action avoiding an accident, et cetera.

MR. CULLER: Or the utilities' cost in a risk of a very major loss, economic loss.

MR. TAYLOR: Substitute power and all the potential

consequential loss should not be a basis.

MR. CULLER: Before you came in, we were talking about this, and all of us could think of the system biting back at both the NRC for regulation and not using the lower standards, which they don't, or the industry in saying we can basically -- we're much safer because we need economic protection, safety standards that will protect our economic investment, that are more stringent than the health and safety.

Well, the argument in each case can loop back and bite. As a consequence, I think the nice thing to do is to know that that kind of information is undoubtedly true, but not to use it in an evaluation procedure, and we haven't talked a lot about this, but that was a conclusion after about an hour of fooling around.

MR. CULLER: Is that enough, Max?

MR. CARBON: I think so.

MR. CULLER: If you want, we will explore it some more and write to you, but it's an imperfectly formed thought.

MR. CARBON: That's fine.

MR. TAYLOR: On performance versus prescriptive approach, we talked about that earlier. I would strongly advocate a movement towards performance type of regulation for the future, and again try to stabilize the present regulations for the present plants.

And I think the end result of moving to performance will be to achieve, if anything, more effective safety at a substantially less agony and expense in the regulatory process. Should the NRC encourage smaller plants? I would say not specifically. Let the industry determine whether it wants to go ahead with smaller plants or larger plants, and make your judgments on their safety adequacy.

We in our own program have a separate effort that is directed to developing conceptual designs of small plants where our purpose is to see if there is unique benefits achieveable from the small plants that cannot be achieved from big plants, such as in high level of modular construction, such as in a substantially higher degree of achievement of low coremelt probability, such as easy achievement of seismic requirements, and see if there is something about the small unit that can't be extended to the large and therefore you are not forgoing the economy of scale which has led us to the larger systems.

MR. CARBON: Part of the thought there was, could you perhaps go to smaller modular units which could be more thoroughly tested for safety?

MR. CULLER: Yes, we saw that.

MR. TAYLOR: It is possible to perform tests less expensively with the smaller units. My own judgment is that we have learned such an enormous lore that bears on safety

from these prsent systems, which are quite large, that we would not, even though it was easier and cheaper to test the small units, we probably would not achieve the same level of understanding of their safety characteristics.

MR. CULLER: We explored this --

MR. TAYLOR: Until they were fully deployed, and we've gotten the same level of experience.

MR. CULLER: We explored this while it was still at Oak Ridge, when safety was still part of the AEC, and the subject basically was how would you test for temperature and pressure simultaneously? You're going to run the plant under nuclear conditions and run a scram or what?

What we decided is it's almost equally difficult to test a plant of one size or another. The complexity is very high. You didn't want to make the plant radioactive before you did the test. Then the providing power for a large or quarter-core or tenth-core of electric heat available shaped to the burnoff characteristics of the fuel became an almost impossibly difficult test procedure.

Again, there is lore on that period of looking at how and would conduct tests if you want to conduct tests, if you wanted to do so. It's a good idea, and it probably deserves some exploration. There may be merit in it, but I don't think that it would offset part of the economies of scale, and as John said, we think we know more and more about

how the reactor is operated under safety excursions.

MR. TAYLOR: On the last element, we have experienced a high degree of cooperation and interest by the NRC staff in our advanced light-water program and the safety closure issues. No inhibitions of any kind that we have been able to see, except for the issue, of course, of their ability to staff and provide the resource allocation while still meeting their other obligations.

We have gotten a letter from Chairman Palladino supporting this adanced LWR program and pledging substantial staff support in carrying out the reviews that are involved. So I see no inhibition there. I would suggest that ACRS might inject in a more explicit form the issue of how they would see themselves and NRC treating the evaluation of advanced systems and the formulation of regulation in the process. It's not made too explicit in this writeup that we have here today.

Now, our present plans, there is no question of timidity, let me call it, on the part of the industry to be proposing changes of any kind in this present uncertain regulatory atmosphere. The adversary relationship is counterprodutive. I don't know that anything can be done about it. In our own work on the research side, we're gratified that we can sit down on regular intervals and discuss our mutual programs to the best of my knowledge, there is no inhibition in sharing our knowledge and data with

each other on the research side.

Because of the adversary arrangement, we don't talk to the NRR Branch of NRC without the presence of duly constituted utility personnel, whose interests are very much involved in any decision or move on the part of NRR in this very adversary relationship.

We accept this constraint actually very readily because it means that we can keep back from the adversary front, and by being back from the adversary front, have a much better chance of retaining technical objectivity and credibility, which is probably the most important quality that we can provide for the utilities in times of issues of technical question and judgment.

MR. CULLER: The industry actually provides us with a cover. We are never asked to enter the adversarial hearings. There are times when we will perform as an expert witness or something like that, but we rarely have to be cross-examined or anything like that in any kind of hearing. And if we did it very frequently, more than once every three or four years, we would soon lose our position of technical objectivity.

MR. REMICK: I don't think we were limiting it, though, to the hearing process. It's a whole concept of if it's from industry, you've got to look very, very closely at the motives. It's that concept, because certainly they would

only be looking at their best interests. It's a feeling if you can't trust INPO or you can't trust EPRI because the money comes from the utility. That kind of adversarial relationship that exists that is much broader than the licensing or hearing process. Or if the Commission does something, then there are branches of Congress that are clobbering them.

Just one recently, it was obvious -- we just read about it in the papers -- the reason the Commission obviously did it was because of pressure from industry lobbyists, Price-Anderson.

MR. TAYLOR: I wish it could be understood on both sides fully, as fully as possible, that the true demand upon the utility to protect its investment is greater than the demand to provide public safety. In other words, if you have a severe accident, you have overnight lost that investment, and it's a catastrophe for the utility. It's a partial catastrophe for the industry. The credit rating reductions for the entire nuclear industry have been extremely severe as a result of TMI-2. If you don't have a severe accident, you don't worry about public safety.

So there is a common objective that should reduce this adversarial situation, but I have no hope that in the future, in the foreseeable future, it will change.

MR. REMICK: There is a broader one, national objective of alternate energy source. Nuclear, that should

drive us from a national perspetive. That's what drives the Japanese.

MR. CULLER: I have a suggestion here, and I don't think it will bear fruit. But I do think, since you are in this state of reexamination, the possibility or removing the quasi-legal procedures should be explored in a formal sense and not by the staff itself, but get some group in, using advice from overseas, the Swedes, the British or the French.

Now, you may even wish to get a group of people who would actively look at this system versus theirs. I don't believe that anything will come of it, but the idea of having to take depositions in a safety incident almost is almost quasi-legal -- well, they are legal because the idea now, because of the presence of the courts as a final arbiter, is you have to have legally supportable evidence. I do think that is desirable before we go further down the road of having safety defined by lawyers or whether the man is honest or dishonest, and the credibility of a witness in investigations of safety seems to be an exaggeration of a process that should more frequently discuss substance rather than the procedural aspects.

MR. REMICK: Floyd, that is not an NRC statute. Congress has written in the Atomic Energy Act that these decisions should be made following the Administrative Procedures Act. So it'a a congressional type --

MR. CULLER: I understand that. But unless the NRC challenges it as a procedure that might be suspect, no one else will. And that's the only reason for suggesting it. I don't think anything will come of it. I think the lawyer groups and all understand the adversarial process and only that as a basis of making decisions. And it may be the only one that's available to us, but I would not give it up entirely. It may be a tilt at a windmill, but other countries manage. And as a consequence, it is not therefore not impossible.

The British use the "white paper" technique. They bring in a board of inquiry, frequently a judge of outstanding reputation to make a determination, and then they stick with that determination.

There are other processes, and I do believe opening the issue to intelligent thought rather than controversy is something that the ACRS might be able to do as an independent look at the procedure.

MR. SAUTER: I would like to make a comment on this. I thin one of the root causes, not the only one, but one of the root causes of the advancing nature of the adversarial relationship is the fact that as a regulatory process -- and I won't say this is solely the result of the NRC; I think it's the whole community that has contributed -- that we have tended to lose sight of the overall objective,

the end product, if you will, of regulation, and have become very focused on the means.

We lost sight of the fact, I think, largely that the overall objective here is to have safely operating plants, and we have become very narrowly focused one way of achieving that; namely, the present proscriptive body of regulations that is involved.

So meeting those regulations has itself become the end of the process. The means have become the end, and in so doing, we have given over the game largely to the lawyers because now it's a legal question. Have you satisfied this requirement or not? It's not a technical question. Are we promoting a safe plant?

MR. CARBON: I think we share your views on that.

MR. SAUTER: I think, in terms of long-range focus for the NRC to try to shift away from that focus back to a focus for objectives through, in my view, moving towards performance-oriented regulation rather than proscriptive regulation, will go a long way to alleviate this problem.

MR. TAYLOR: The subsidiary question here is the role of fines. We had a brush with this issue last year when a group of CEOs asked us to undertake a study of the enforcement system that existed with NRC. And a serious issue in their minds in asking us to do this study was the concern that fines were counterproductive, that fines could be

absorbed by the utility in view of its many other major financial commitments. But to the operator and the managing supervisor, they were enormous, and they put them enormously on the defensive, and once they were threatened with a fine, then the whole emphasis was to protect themselves, find the data that would take care of that, diverting them from a balanced view toward operating that plant properly.

They also expressed some concern -- had no evidence for it -- but if this process continued, perhaps some of their people would hold back information, which would be the worst thing for everybody.

So we began to lay out a plan for that study, and our first move was to begin to elicit the opinions of behavioral experts. We got a very strong refrain that the effective way to make improvements is to emphasize the positive, identify the places where someone had done their job well, to those who aren't doing it well, have some reward system for those who did it well.

And they cited examples of such things as Equal Employment Opportunity enforcement practices, where the negative did not get any improvement and the positives did.

Our board decided that was not a proper role for EPRI to play unless NRC was deeply involved, and we have informed NRC, in fact, with a letter to Chairman Palladino, of our planning. And then we, of course, wrote back to say the

board did not approve our proceeding with this program unless NRC, in fact, engaged us to do so.

NRC since, as you know, has set up a small panel consisting of Dennis Wilkinson, one of our people, Jack Parris, who would have, in fact, been deeply involved in this work, and I can't remember the other person. A much less in-depth study than we would have carried out if we were to go.

So I would suggest as one of the long-range planning elements the introduction of behavioral experts to look at the issue of motivation associated with enforcement actions like fines, find out whether or no this concern that we have heard from senior utility executives that these can be counterproductive, is right, and what ameliorating actions might be taken.

MR. CULLER: Fines give the image of criminal negligence, and it certainly shuts off any kind of progressive thought at the time an investigation starts, of fines are a likely outcome. That's basically the advice we got at our preliminary study.

MR. CARBON: Why don't you just skip 4 and 5 in the interest of time.

MR. REMICK: Let me just ask one question there. I had a thought about this myself. Would you say that all fines are bad?

MR. TAYLOR: No.

MR. CULLER: No. We wouldn't say that at all.

MR. TAYLOR: We should study these.

MR. CULLER: If there is a real case where you can see criminal negligence or something like that, man, I think they ought to really be hooked, and I wouldn't charge them a little bit of money, I would charge them a lot. But in the routine investigation of trips and incidents and things that have even safety significance, I think we're much better off in achieving the end result of safer operation or safer design or whatever by a cooperative-like investigation rather than trying to hold the fine as a way of beating people into an awareness of safety.

Now, that could be wrong, but most of the preliminary advice we got certainly went that way.

MR. WYLIE: Would you say the FAA approach to regulation and a separate investigative body like NTSB has merit in the nuclear industry?

MR. CULLER: We think so. I am sure John does, too. It has its limits.

MR. TAYLOR: There is a big difference in the situation if there is a plane crash, that's it, the plane is no longer operating, et cetera. So the scheme of everything is frozen. Investigators come in and take care of it. It makes a lot of sense.

If you apply that literally to the nuclear power plant, I am not sure it's correct. I understand -- I don't know the details -- that to some extent that approach was applied to Davis Besse. But here you have a plant that is still alive, and plants in a shutdown condition are not automatically safe no matter what happens, and the thought of freezing is not exactly clear to me is the safest approach to take.

Furthermore, I hear -- and I may not have the right information -- that lawyers were brought in immediately along with the investigation. As a result, the plant management was saying, "We have to have our lawyers," and you and I know what happens in terms of open communication if that is what happens.

MR. REMICK: You mean in the NRC response team we have lawyers?

MR. TAYLOR: I was told that is hearsay. I would ask you to check it before you believe it.

MR. CULLER: Incidentally, my reaction is almost identical to John's.

MR. SAUTER: I have heard the thing --

MR. TAYLOR: It's only hearsay.

MR. WYLIE: Maybe another comment. Of course, you know this type of thing has been proposed for the NRC.

MR. CULLER: I think you have to approach it with

care, as John said, because there has no harm done to anyone, except the implication that harm could have resulted, whereas in the case of the FAA they are investigating an accident that killed somebody.

MR. TAYLOR: It's over with, you know, and you don't have a --

MR. CULLER: Say there are cracks in the wing or something like that that appear under test.

MR. WYLIE: They investigate -- I forget the number -- like 3500 a year. But it's of all levels. They generally look at about six or seven crashes a year.

MR. TAYLOR: I think what we're saying is the process could be applied, but it has to be applied with consideration of the real differences in the two fields.

MR. WYLIE: One thing that has gone forth, though, is the use of designated representatives in the party systems in their investigation where it's not all the regulatory bodies. In this case of Davis-Besse, this is 100 percent NRC people.

MR. TAYLOR: Yes. That's an issue. That designated representative idea has a lot of merit. In fact, it directs itself in the next area as a way to enlarge the up-to-date experience and knowledge of the regulatory staff. But the question is, is it tolerable in a highly adversarial arrangement in a nuclear program? It probably is unacceptable

in our present atmosphere.

MR. CULLER: I wonder at times what would happen if you asked the utilities to investigate. You would probably get a better report.

MR. WYLIE: Sure you would.

MR. CARBON: Why don't you pick out the most important parts in Numbers 6 and 7, and maybe we can try to move ahead.

MR. TAYLOR: Indicators of performance. There is real movement on the part of INPO to establish those in a more complete, highly measureable, visible form. I would suggest that that's the best way for that to happen. And then NRC is in a position to monitor progress and overview and audit that type of thing as distinct from NRC setting it up.

An elite to operate the plants, well-trained people are certainly required. I don't know that I would want to describe that as "an elite."

And, of course, strong judgment is that the industry can, should provide effective high-quality training and this will not be aided by a central government training capability.

Personnel concerns. One inference in part of those questions was, we have got to find another role for the Staff. And you know, in a business you never do that. You find a real function that is needed, and you look for the people to do that. And if you don't have that function, then

you make arrangements for hopefully, humane separation.

And I would strongly urge that to be your basis for planning. Don't ask what you are going to do with the people, just ask what you really should do and then find out whether you need people and what kind and so on to do it.

MR. CARBON: Well, part of this one has that flavor, and that is certainly true. And the question could be raised, can the government do that?

Part of it also though, has the flavor, the agency has been heavily design-oriented. And the future maybe its problems will be more on the operational side. And will it have the expertise, or does it have the expertise for high-level waste when it has been working in the design reactors?

So, it is more than than this.

MR. TAYLOR: Yes. Well, we earlier commented strongly, a greater involvement by NRC in the high-level wastes regulatory standardsetting area is very important.

MR. CULLER: And in being able to follow the waste --

MR. TAYLOR: My own judgment --

MR. CARBON: I think the point was that as the NRC areas of responsibility change in the future, will it have the kind of people it needs?

MR. CULLER: The only way that it will is by

anticipation. And I think the idea of a longer-range plan must identify what future responsibilities will be placed upon the NRC, and an approach to providing the necessary knowledge.

My own recommendation in many respects is to push as rapidly as industry can and will respond, to push more and more of the primary responsibility for audit, for control, to the industry, and put the NRC a little bit more and more into auditing what is going on to make sure that the criterion standards for operation are met.

Now the industry is going to move a little bit slowly this way. But they are moving in that direction. And John has cited several areas where this is moving.

The cooperative part of that I think is the way the major burdens for having a large number of people in NRC do the operating control can be shifted to industry. And that is the direction to go because they will have a better responsibility base than the inspector coming in from the outside.

MR. TAYLOR: On the specific question of changing the capability of people to meet a different type of work, my own experience with this has been very favorable when we talk about professional people, where it is near impractical -- in fact has ended up in my own experience with literally having to lay off hundreds and hundreds of people while you are hiring hundreds otherwise -- is between such things as factory

personnel versus professional personnel.

But, I have seen just specifically in that in Westinghouse moving people who have been spending a good part of their career in reactor design to various operations in radwaste work which has been strongly emphasized, and making the transition beautifully.

So, I think by dint of some training and recognition that you have got capable people on the staff that can adapt in the technology environment, and that can be accomplished.

MR. CULLER: There are other sources of training and knowledge and the national labs are heavily layered with them. And they have been in these areas a long time. They can send people out, get them acquainted with the basic science behind it, and then bring them into the regulatory role.

MR. CARBON: Let me suggest, unless the Members have questions, that we jump to your broad --

MR. REMICK: Just one thing. I would be curious if you had a comment on the $1000 a manrem?

MR. TAYLOR: We are satisfied with that.

MR. CULLER: You mean is it enough?

MR. REMICK: Well, it was one of the issues there, the last item there. I wanted to know if you had any views based on that?

MR. CULLER: My response in a semi-offhand way is

that $1000 a manrem may add up to a $10 million cost. And that is pretty expensive. There are no insurance judgments that have yet made it there.

MR. REMICK: Does it give you a problem?

MR. TAYLOR: I think it has been accepted. It is an operating tool.

MR. MOELLER: It is a surrogate for economic and other losses.

MR. CULLER: Of course.

We have no real opinion or objection, I suppose.

MR. SAUTER: As long as it is made clear that it is a surrogate. Some people think you ought to add the other economic costs on top of it.

MR. WYLIE: That is a big problem, this business of economic on-site costs being added on top of that.

MR. SAUTER: I think it is acceptable if it is made clear it is as a surrogate not only for actual public health, but for everything else.

MR. CULLER: The whole issue of economic on-site loss really deserves some attention, I think, because it is likely to stick around for a while. And I don't know, it seems inappropriate to us to use that plus other -- the surrogate of $10 million, let's say. But, I don't think our opinions are going to be enough to resolve that issue with staff positions and other things like that that move in that

direction.

Let me preface this remark basically by three or four years' worth of thinking summed up in a moment.

The regulatory process that we have been involved in, technical regulation in the United States, has the unique characteristic of taking a broad law in Congress, or a set of laws and setting up essentially the regulatory criteria, the procedures by which they will be enforced. They also set up the appeals procedure and are judge and jury as well as the investigation.

The process is so powerful that it has all sorts of internal loops that deserve attention, and it becomes a fourth branch of government basically, which no one will touch to see exactly how it performs because it is politically a difficult task. And no one in Congress really wants to get back into the morass.

The Administration, although responsible, has an indirect responsibility, because the independent regulatory commissions are creatures of the Congress and the administrative appointments as such are the only way that real checks and balances can occur.

It seemed to me that prudence in any system requires some sort of an overall audit and evaluation of performance. And years ago I started thinking, in the first big wave after Three Mile Island, what do we do in the way of regulatory

change?

I suggested the role of the ACRS should be clearly defined as an auditor of performance of the NRC, and that a formal audit of performance should be established.

This says you should not be a creature of funding by the NRC. That you should have a degree of independence, perhaps, to perform this function.

If this is done, it is not something that will be done without staff and without a reasonable amount of time.

In order to provide for this activity, auditing, and another important role that I think ACRS already has, I suggest that it might be desirable for ACRS not to review the licensing actions as routine. To remove ACRS from the routine work pattern of NRC as a "me too" or separate identification; and that the emphasis within ACRS moves to the responsibility that you already have to explore new safety issues or possible improvements of safety in principle; to become the long-range thinker; to pick out major issues of safety and in difficult cases to adjudicate in licensing or operating problems; at the request of NRC to perform special reviews.

Basically, that is the whole of the proposal there.

Now, it sounds simple. I know it would be very difficult. Hal and I talked about it while we were doing this safety review for ERAB. He said, you know, it is a good idea. I have talked to some of the Commissioners about it in

the process, over the last few years.

I think it is a very good idea. And I think in the long run it will improve safety in the United States, particularly if NRC has a long-range plan to have someone come in and evaluate their performance and to report to the Congress, to the President, and to the utilities independently.

Then I have two other suggestions, that as a result of being on multiple committees, EPA and DOE here, and others, there is a woeful lack of coordination among the agencies that are responsible for the generation of safety and regulatory information in the United States. And I have sat through hours of essentially confusion that results from one group picking the other.

There is a formal council that is supposed to meet, but I swear to goodness I don't think that it is going to occur within the government agencies themselves.

At one point, something that did not get printed in the safety report -- I suggested to DOE that a super coordinating group in which there was industry representation to make sure that there was coordination, might be desirable. Many things are lost.

It is clear to me that NRC doesn't quite know what it is going to be getting from EPA and I know that DOE has already shucked it off as too complex an issue for them.

They, too, have a responsibility, and Ben Rusche is going to have trouble administering this new activity. But they have not yet responded forcefully to what the criteria setting with the EPA are.

Now, all of those issues in intergovernment level should be resolved to mutual agreement before these major policies hit the Congressional Record. It places the industry in the position of having to deal with the standard setter, the guy who thinks he is going to execute, and others.

So, I think attention paid to formal cooperation between the NRC, the EPA, the ACRS, DOE and certain other agencies -- the NCRP and the ACRP, who are responsible for the fundamental standard setting is important to safety in the United States, and you all might want to look at it as part of this review.

Those are the two issues that I wished to bring up. I have stated them almost to the extent that I have thought about them, but not quite.

There is another one which I will bring up, but I don't have any hopes for this at all. One of the great internal coordinating responsibilities within NRC is to coordinate the actions of the various review boards and panels with the NRC itself. There are other outside coordinating functions.

At one time when we were discussing the importance

of a five-man Commission, I suggested again when the reorganization acts were proposed, that each Commissioner be given a portfolio.

The first portfolio go to the coordination of the various agencies; the appeals boards, the hearing boards, and the NRC Staff functions and the NRC itself. One Commissioner has that portfolio.

There are potent relationships that must exist between states and the federal regulatory commissions in safety, and another Commissioner would have the responsibility of coordinating with 50 States.

The third Commissioner would have the responsibility of coordinating with the industry.

And the fourth Commissioner would coordinate among the agencies in Washington who are responsible for safety.

Now, it is different than the existing set. I still think that these functions are important, because on the outside we work with all parts of this operation. The disconnected nature of what goes on is more apparent to those who work within the agencies themselves.

I make those three suggestions now in the hopes that there is some possibility of improving the exchange of information and the resolution of significant problems in all of these three coordinating functions.

Now that is it. I am finished.

MR. CARBON: These strike me as very interesting ideas. I guess I don't personally have much comment at the moment.

MR. CULLER: I don't expect you to.

Now, I think we have finished, have we not?

MR. TAYLOR: We're going to be thrown out of here if we don't leave.

MR. CARBON: I have at least a couple of questions. Do you want to raise any? I will raise mine right away. We didn't have down here, and you have not mentioned, but in the long term is breeding of importance?

MR. CULLER: Sure.

MR. CARBON: How long a term?

MR. CULLER: I don't think that we -- let me say this. I think the breeder was probably the more economical form of reactor, and it maybe safer the way the system works. As far as the classic argument of when do you have to have a breeder to make sure we don't run out of uranium, I don't think that that is anywhere near. I think it is imprudent not to have a breeder program to take advantage of one of the better technologies that is evolving. I think you will find the Russians are thinking of putting only breeders up starting in 1990 in Western Russia.

MR. CARBON: They are?

MR. CULLER: Yes. That comes out of the scientific

advisory committee meetings. I think we will find that running at no pressure and the high-heat-transfer characteristics, we can design a breeder that will coast itself down almost. The British have operated their little reactor up at Dune Ray at full power, shut the pumps off, and let it coast itself down by natural convection.

EBR-2 has done it.

In our work at Como, which is sort of coordinating the big designs with the Department of Energy, we have looked at the breeders, and we are certain we can design two or three shutdown systems that will carry the reactor through by natural heat removal.

There are problems with breeders -- fires, probably sodium fires being as important as any.

We think that it is a good reactor, and with a little bit of care and thought, that it may be a reactor system that should be introduced. It's certain that other countries are going to do so. I think that it would be imprudent to not continue in some breeder effort in the United States.

We have worked out a long- and short-range plan at the request of the Department of Energy and coordinated with them basically what to do in the post-CRBR period. We have always worked on the long-range and never the CRBR. So these plans, if you want to review sometime and the thoughts

that exist, we would be happy to do so.

We think that the breeder is important and that breeding is important.

MR. CARBON: Can you see the government or EPRI or groups of utilities putting up money to finance building breeders soon?

MR. CULLER: There is no possibility, no possibility, that any reactor development will be funded by the utilities, nad any new reactor, gas-cooled, that requires demonstration, a breeder, whatever, that has to be built will have to come from the government. There is not that kind of risk money, nor do the utilities have the ability to raise money, borrow it, put it into the rate base to cover any new nuclear system.

So if reactors are to advance, if breeding or high-temperature reactors are brought in for chemical purposes and high-temperature heat, it will be done with government money.

MR. CARBON: This surprises me a little bit, such a clear-cut statement, because I keep reading where four or five utilities are supposedly serious about building a high-temperature gas cooler.

MR. CULLER: They're serious if the government pays for the prototype.

MR. CARBON: The whole works?

MR. CULLER: Yes. And the government is paying. The utilities are putting in, what, $5-6 million?

MR. TAYLOR: More like three.

MR. CULLER: Three. And the government is putting in 50.

Now, I am not being -- I don't mean to be flip about it, but the utilities do not have the latitude, because they are regulated, of raising that kind of investment money. The biggest sum that was ever raised was for the CRBR, and it was $256 million. And that could never be recreated.

MR. CARBON: My last question. Some people I think believe that we may very well change the organizational structure and have energy-producing companies or something like that, selling to utilities who, in turn, will distribute. Could you give us your views on the likelihood that anything like that will come about?

MR. TAYLOR: I don't think I heard --

MR. CULLER: Energy suply companies, people who supply energy and the utilities distribute it, say, a utility who generates selling to utilities who sell.

MR. TAYLOR: I think there i a probability for that. Right now it's happening in little, small ways. Big industrial companies are building some of their own generators, in part, to use for their own energy's need but also selling substantially in the PURPA legislation picture

where they get marginal prices for that energy, two to three times the average price which the utility -- costs, which the utility has to sustain in generating power in its system.

I can see in the nuclear program, with a stabilization of the regulatory situation and an evident need, a group of investors picking up one of these plants that has been canceled, on which billions have been spent at a very attractive price, finishing it, and furnishing electricity to the utilities. Those things are beginning to happen in small ways and can happen in big ways in such circumstances as I have described.

MR. CULLER: I believe there is, of all the energy resources that can be used to generate power, nuclear may have as great a need for a coordinated supply, maybe not one company, but a company who would be willing to design, build, and operate. And it has been considered by the utilities. We have suggested maybe regional supplies. Of course, you know, there are many people who use this as a major theme for reorganization.

I think that the utilities will move in that direction to some extent. There are other collective ways of getting coordination, the simplest of which is to form an engineering company which provides continuity in the engineering for the utilities, where as one company builds a reactor once every ten years, the engineering responsibility

moving from one plant to another provides for a learning curve and a continuity of experience. And all of these ideas have been discussed.

Right after Three Mile Island I proposed a customers engineering group to accumulate this kind of experience rather than having each utility. It was not exactly rejected, it just wasn't thought about. But as time goes on and competitive pressures and cogeneration emerge, the utilities are thinking more and more about different ways of configuring the industry. And within EEI now there is a very high-level committee looking at competitive forces and how they may affect in the future the structure of the industry itself.

It's all set up, and some of the thoughts that you're asking about will be explored in this policy analysis -- strategy and policy analysis group.

MR. REMICK: John, did I understand you to say -- I might have misunderstood what you said. I thought you said in the cases where the utilities are being forced to buy the cogenerated electricity, it is at two to three -- what would it be, the utilitiy costs?

Is that what you said?

MR. TAYLOR: The average cost of the system.

They pay the avoided cost, which is the cost that would be associated with the newest facility they could build.

MR. REMICK: That is in the range of two to three --

MR. CULLER: Idaho Power has about 5 mil power, a little bit less than that. Because they have a lot of hydro, I think it's about a 4 mil power. In a small unit that's coming on line. They have to pay 9.5 mils or 10 mils for the avoided cost of the maximum cost because they can't add more hydro. As a consequence, they have taken it to court.

MR. REMICK: Earlier, Floyd, you said something about hydro being very inexpensive.

In Japan I found it was the highest cost electricity of their four modes. They list that as the highest.

MR. TAYLOR: I don't think so, Forrest.

MR. REMICK: The reason, they said, is the capital costs. They're doing seismic considerations of dams.

MR. TAYLOR: Maybe they're talking about a new plant because their present plants --

MR. REMICK: I have to check my notes. I believe this was the basis of existing plants in Japan. Hydro was the highest. I have the figures somewhere, amps per kilowatt hour. Nuclear lost. It was just slightly lower than coal. It was surprising. We asked questions about it.

Don Rubio, by the way, I think was on that same --

MR. TAYLOR: I think he was on that same trip.

MR. REMICK: Where that discussion was held. I am trying to think if he was there. He was there certain days.

MR. CULLER: I wanted to tell you something else

about the cogeneration.

There are several locations in the United States where essentially a kind of abuse is occurring. There are many cogenerators who will put in a steam turbine and sell -- in some states it's only ten percent of the total heat to generate steam; and the rest of it, 90 percent of the energy goes into generating electricity. And Don Jordan in Houston Power and Light has about 5,000 megawatts proposed this way on marginal cost replacement.

So that a fully well-intentioned program is being abused in locations around the United States now, and some relook at this whole operation has to occur.

MR. CARBON: Some legislatures are already relooking at it.

Well, considering the time, let me thank you both very much for an excellent series.

MR. TAYLOR: I am honored you would spend this much time with us.

MR. CARBON: I also thank the subcommittee members.

(Whereupon, at 9:40 p.m., the meeting was adjourned.)

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of: ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Name of Proceeding: Subcommittee on Long-Range Plan for the Nuclear Regulatory Commission

Docket No.:

Place: Washington, D. C.

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were held as herein appears and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(Signature) Mimie Meltzer

(Typed Name of Reporter) Mimie Meltzer

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