UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BRIEFING BY NUCLEAR SAFETY RESEARCH
REVIEW COMMITTEE

- - - -

PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Friday, May 20, 1994

The Commission met in open session, pursuant to notice, at 1:00 p.m., Ivan Selin, Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
E. GAIL de PLANQUE, Commissioner

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

1:00 p.m.

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

The Commission is pleased to welcome the members of the Nuclear Safety Research Review Committee to brief us on issues of mutual interest. This Committee provides a valuable service to the NRC by providing advice to the Director of the Office of Nuclear Regulatory Research on matters related to our program of safety research.

The Committee has served us very well over the years, continues to do so, and in large part that is thanks to the efforts of Doctor Morrison, Doctor Bush, and Professor Todreas, who are retiring from the Committee, I'm sorry to say, although we're pleased to have Mr. Kintner to be the new Chairman.

The Commission has thanked the members in the past, continues to appreciate your dedicated and distinguished service.

We'd also like to welcome several new members, Professor Baratta, Professor Golay, Professor Golay, Professor Mayo, and Professor Yukawa.

Today we're looking forward to hearing your views on the matters which we asked you about in

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STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

JOHN HOYLE, Acting Secretary

MARTIN MALSCH, Office of the General Counsel

DR. DAVID MORRISON, Retiring Chairman, NSRRC

EDWIN KINTNER, Chairman, NSRRC

DR. NEIL TODREAS, Retiring Member, NSRRC

DR. SPENCER BUSH, Retiring Member, NSRRC

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the July 21st, 1993 staff requirements memorandum, and we're looking forward to these discussions.

I understand copies of the SRM are available.

Commissioners?

This is your swan song. Let's make it good.

DOCTOR MORRISON: Thank you for the confidence.

I'm indeed pleased and honored to be able to open the discussions this afternoon. I would just make sure we add one other person to the list that you mentioned, Mr. Chairman, and that is Professor Robert Hatcher who is new to the Committee since our last meeting with you in July of last year. We have four new members with us today.

I'll just make some summary comments, then ask both Neil and Spence Bush, as the other long-in-tooth retiring members, to add any thoughts that they might have to mine.

We certainly have taken your questions to heart and spent some time discussing them and what we hope is that we will continue a dialogue here today. I'm not sure that we have any real specific answers to any of these questions, but I think we have some

thoughts with regard to how things might proceed.

In general the questions, as noted in the SRM, dealt with the content of the research program and its ability to respond in a timely manner to the regulatory mission. At the same time, there are some real questions about being able to maintain essential competence in terms of either staff size or skills or disciplines to be able to have the ability to respond as well as to anticipate regulatory needs.

I think the answers to all these questions really have to be put in the context of the very special role that research and I think in a broader sense science and technology information have in a regulatory agency. It's my belief that the credibility of information and the fidelity of its use within the Regulatory Commission is an essential characteristic. Timeliness is of equal importance. And to fulfill these requirements, nationally and internationally recognized engineers and scientists must be involved and the Agency must have a commitment to continual improvement of its technical information base.

Now over the last six years that the Committee has been in operation we've observed substantial improvements in the organization, planning

and management of NRC's research program. It's become very responsive to its internal users and its customers, the NRR and NMSS, but at the same time it has undergone a substantial shrinkage in its research budget. On behalf of the Committee, I'd like to express our credit to those improvements that really belong to the senior management.

I think I'd also be remiss if we didn't express the concern of the Committee of being able to find capable replacements for Eric Beckjord and Jack Heltemes who are going to retire over the next several months or so. I don't want to overlook the role that Themis Speis has played and I hope that he will be with us for a longer period of time so that the continued success of the program will depend upon it. But, I think you have a challenge in front of you to try to find some very capable replacements.

CHAIRMAN SELIN: Thank you. We're quite aware of this and feel this need very sharply.

DOCTOR MORRISON: I think we'd like to start out with just refreshing you and ourselves on the dynamic environment in which NRC operates nowadays.

The future of the nuclear power program in the United States certainly is uncertain. There

doesn't appear to us to be any state or federal policies that are very supportive of the continuation of nuclear power and certainly none supporting the expansion of it.

Enthusiasm for license renewal has diminished, whether it be only a financial concern or an economic concern on behalf of the utilities or maybe there's something hidden in that agenda.

Waste management is obviously an unsolved problem.

Yet, the NRC has to fulfill its obligations to the public with regard to the safety of operating reactors as well as maintain the expertise to look forward into the future where some of these conditions may change or be altered.

Collectively we believe that there is a strong basis for the continuation of a research program. And this research program, if it continues in a strong way while addressing, say, the concerns of advanced reactors, the issues raised or possibly to be raised by license renewal, decommissioning or waste management, will provide that sort of capability that will be necessary to extend and maintain and sustain the competence that one needs for any anticipated issues.

Now, the two go very much hand in hand. All of the subjects you've raised in your memo to us are very much interlinked and one can't really separate the content from the program from the maintenance of capability to the skills that are needed. But on the other hand, if there's not a solid research program, all of these things become very difficult to sustain and may indeed disappear over time.

With regard to the general content of the research program, which was sort of the substance of your first question, the Committee, based upon its deliberations, concludes that the program is in general doing the right kinds of things.

We do want to point out that there must be a balance between the experimentation, the phenomenological modeling, and the numerical analysis. The Committee has looked at this over the six years it has been in existence and certainly will continue to do so because without that balance we don't believe that you have, even though you may be talking about the right areas, the balance to be able to use the kind of information that is generated from the research programs.

Leading to one of your second topics with

regard to the question of sacred cows, again the Committee had difficulty dealing with those issues given the previous comment where we feel that the research program is working on the right areas. However, we would like to bring to your attention some issues more of procedure and policy rather than is ues with regard to substance in the research program.

First and foremost on the list is the subject of independency, which I'm sure has been discussed around this table and others for a number of years. How much of the work that is being done by industry or other applicants has to be duplicated by the NRC? How much can remain just confirmatory research? And the question of being able to perhaps join efforts, funding capabilities, whatever it may be, is something that we think needs to be looked at under the broad heading of a sacred cow. It's an issue that's of policy and procedure, not an issue of substance.

In the same manner, it's been our impression based upon our discussions with the research staff over the years that the federal procurement rules indeed at least put barriers in the way of an effective research program being conducted in perhaps the most efficient manner. We'll give you

that challenge to be able to solve how one might deal with the federal procurement rules, but there is the perception at least on the staff that these are barriers for them to be fully effective in their use of the funds that they are involved with.

There are some concerns with regard to the nature of the research programs within this sacred cow and we would only raise a caution flag saying that how much should be done in a very fundamental research area, especially in the waste management since there are lots of activities underway within the Department of Energy, and maybe there would be some questions in the same role with regard to severe accidents. What would you do if you didn't have the severe accident research program? We have not formed a comprehensive opinion in the Committee, but these are issues that have been raised.

Now that leads us to another question that is very much related to the sacred cow issue, and that is in the development and maintenance of codes which are very much the heart of the analysis activities that the Nuclear Regulatory Commission does. Again, we see this as an issue of process and policy, that certainly independent analysis is necessary to confirm the capabilities or the analyses presented by others.

The question is, does that imply developing your own codes or simply being able to maintain, understand and use the information in a very informed way that the applicant submits?

The most current issue that would relate to that is the question, if the Commission has the task of reviewing CANDU applications, is it necessary to develop the necessary codes for that or can one rely on either the experiences that go back many years to the N Reactor or some of the experience that the Canadians have rather than starting from scratch to develop a whole new suite of codes for CANDU reactors? Whether that's a sacred cow or not at least fits in the same policy and procedure orientation.

There certainly is indication based on the presentation made to us by the staff that the research operations are staying ahead of many of the problems. There were very few that were brought to our attention that they feel that they are falling behind, so I think we're comfortable with that answer based upon the work that our subcommittees have done over the last couple years in looking into these individual activities.

Technical disciplines still remain a challenge, especially in light of the reengineering of

the government, the down-sizing, possible early retirements, questions about the future directions of the Agency, but we believe that it's certainly essential to maintain those disciplines that are really unique to NRC's mission.

Thermal hydraulics is perhaps at the top of the list in that category that we see that there's no one else in the country maintaining this kind of capability other than perhaps that is done in the universities, and then there's the question of being able to access it on the timely basis needed for regulation.

I think close behind that is the kind of capabilities that are needed in probabilistic risk assessment, some of the reliability and statistics supporting that.

And severe accident analysis and containment performance are again fairly unique areas.

As the advanced reactors go forward it will be necessary for the capabilities to be able to look at the technologies involved in advanced reactors and those obviously will include some of the digital information and control plus the human factors area.

As one gets farther down the list in some of the technologies that are now residing within the

Office of Research, while they're important and a representative capability is necessary in areas such as environmental science and radiation protection and health effects, those are not as essential a capability as we would designate to the ones that are higher on the list.

We are aware of the proposal that you've made, Commissioner Rogers, with regard to some of the capabilities that you believe are necessary, professional capabilities that are necessary in the research operations. We certainly are comfortable with those as a statement of the capabilities. What the NSRRC would like is the ability to discuss this subject with you in further detail and perhaps get some sense of what the implementation aspects if this might be. It looks like it's going in the right direction, but sometimes the implementation causes it to get off the track. If you would like the benefit of our Committee's input, I'm sure the Chairman --

COMMISSIONER ROGERS: Well, I certainly would, but I invite my other colleagues to join me as well if they're so inclined.

DOCTOR MORRISON: I think I've just given you a job.

CHAIRMAN SELIN: Doctor Morrison, I'd like

to ask you or Mr. Kintner a little bit of a broader question on this topic. We've effectively asked you not only to take a look at the quality if the research, the bottom-up, but take a look a little bit from the top down. The disciplines and the sacred cows are not so much central.

The really central question is, if our research program is successful -- in other words, carries out its goals -- will it meet the functions that it's supposed to meet? And is that a question that you're -- as opposed to the normal question of will it carry out it's goals. Is this a question that the Committee is comfortable in addressing or not?

DOCTOR MORRISON: The Committee certainly has talked about those issues. I think I would be remiss if I said we have a unanimity of opinion. I can give you certainly my own. I'm comfortable that the work will fulfill the mission as required, brought to a logical conclusion.

Now, whether Ed or --

Neil, you've been around as long as I have. Do you have a comment on that?

DOCTOR TODREAS: To me, the issue is whether you're going to have the depth of people to -- the depth of people here and in the field with what

you're able to maintain to respond to the emerging questions that come up. I'm not sure that's going to be the case. I think you may go into a transient and dip below a reasonable comfort level.

DOCTOR MORRISON: Spence, do you have anything you want to add to that?

DOCTOR BUSH: No, I don't think so. I think that covers it pretty well.

CHAIRMAN SELIN: Thank you.

DOCTOR MORRISON: All right. That basically sort of summarizes the overall conclusions we've reached with regard to the questions you raised, and obviously we're ready to address any other issues.

Neil, unless you have broader comments you want to make at this time --

DOCTOR TODREAS: No, I'll come in after we have a more focused discussion on this.

DOCTOR MORRISON: Spence, anything?

DOCTOR BUSH: No. I would prefer to wait, I think.

DOCTOR MORRISON: Okay.

CHAIRMAN SELIN: Ken, do you want to --

COMMISSIONER ROGERS: Well, I'm not sure where we want to begin, but I think your point is the one that I'm most concerned about. What should we be

doing? What steps should we be taking to make sure that we have the capability to do the job for the future?

We don't know entirely what that future is going to hold, but we do know that we have 100 reactors out there right now operating. We have problems that arise from time to time. Technical questions arise from time to time. Those matters are not entirely settled and we need an in-house capability to deal with those as they arise, and that is not always just purely from a strictly regulatory point of view.

There are technical issues that come up that in my opinion we must be able to deal with. Sometimes they represent the rebirth of an old issue that was thought put to bed many years ago, studied in some depth but perhaps not all aspects of it entirely covered, and then forgotten. And so it means to me that one must maintain a kind of institutional memory on technical issues, and therefore continuity is an important aspect of what we do.

I think that we are unique. There is no other organization that I can see in the United States that is concerned with the technical issues related to nuclear safety. There may be concern with technical

issues in somewhat overlapping fields but that has no interest in maintaining a fundamental capability to deal with technical and scientific issues that are related to the kinds of nuclear safety questions that may arise.

I see a little bit of a dilemma in thinking about the question that you posed, Doctor Morrison, about whether NRC has to maintain this independent stance and whether perhaps we've viewed it too much as a sacred cow. I think in some ways perhaps in the past we did, but today I think there's no other show in town and that as funds dry up for support of research in universities and industrial facilities shrink and even cooperative research activities for the utilities such as at EPRI have shrinking budgets in the nuclear area, how is the nation going to be served adequately by being able to call upon technically knowledgeable people concerned with safety issues in this important area? Because, we have a vast investment in this country in existing nuclear plants and in nuclear technology applied commercially and in medicine and so on and so forth.

And so what I do see is a very serious difficulty in our maintaining an ability to deal with technical issues in the future. We obviously can't

maintain all that technical expertise in-house, and yet it is shrinking outside of the Agency. I think it's a very serious problem. I've had some thoughts about how one might approach it here, but they're somewhat idiosyncratic I think in their approach, rather different from what the classical approach is, but nevertheless I think that these are issues that we must think about very hard.

It's all very well to say, well, we've got shrinking budgets we have to shrink. We've got shrinking FTEs we have to shrink. But we have a mission to carry out as well and at some point we better be darn sure we can do that. Your ability is not always measured in dollars or numbers of people. It's quality is what counts, and how do we maintain that quality within the organization? How do we do that? It seems to me that's the really essential question. I don't think we've lost it, but I look at derivatives and the derivatives are all in the wrong direction from that point of view.

MR. KINTNER: The Committee has spent a lot of time on this subject, yesterday three or four hours and previous to that, because we see the same factors at work. And I guess I speak for the Committee when I say it seems to me one thing that the

Commission should establish is that research and technical competence in it is the bedrock of regulation. I mean, you can talk about all the other factors, but if you don't have that you're going to make some mistakes.

And therefore, in my view, in terms of the things that are happening in the nuclear industry generally, there should be and can be -- and this is maybe a very subjective statement -- a definite decision that the research activity is going to have some preferences with regard to not necessarily budget, not necessarily in numbers of personnel, but the ability to maintain, get and train the competence that's required to fit the principles that you have established. And that's -- it seems to me quite clear that the best interests are served from every point of view that it be the Commission's responsibilities if you did that. And that doesn't require a lot of people, doesn't necessarily require a lot of budget, but it does require that thought be given at every step to maintaining the excellence in the core that's capable of responding in the way you mentioned.

COMMISSIONER ROGERS: Well, to me the key is people of the highest quality, enthusiastic about their work, who look forward to coming to work every

day because there's not only interesting problems to work on but interesting people to bounce ideas off and to argue with from a technical point of view. And so it's an atmosphere that's very important, and you don't create an atmosphere with just dollars. You don't create it with just numbers of people. You really have to work at it, and I think every great university understands the challenges of attracting and maintaining people. It depends very much on the environment in which they find themselves. Good people want to work with other good people. I don't think it's very attractive for somebody to be paid a high salary to come to work every day and have nobody to talk to that makes any sense.

MR. KINTNER: Doctor Todreas has written down some thoughts on this subject.

You ought to state them.

They go beyond what I've said, but --

COMMISSIONER ROGERS: To me this is very fundamental.

MR. KINTNER: -- things that could be considered in terms of retaining the sort of capability you're talking to.

COMMISSIONER ROGERS: Well, I for one would certainly be interested in hearing them.

DOCTOR TODREAS: Well, let me first clarify that where I'm coming in is under this general principle discussion we've talked about and I'll put it in the framework of where we are in the Committee in terms of our discussion and what we see.

There's two areas we've talked about. One is maintaining competence in the contractor group, which I'll hit first, and the second is within the NRC, within the staff, two separate areas.

Within the contractor area, what we have done by reviewing what the staff laid out to us is try to identify or review area by area, piece by piece the importance of the area, say I&C, say thermal hydraulics, and then review what's the nature of the program proposed that will attract first-rate people at a contractor organization and how do you keep them there while they're waiting for the key questions that might come up. And part of the answer to that is generating really interesting important questions to work on that are at the state-of-the-art. When you go through that you can by area line up the size of the contractor group you need, the dollars that are required, and pretty soon you'll come up against the total budget you have and then you start to do the priority searching. But I think in the contractor

area that's underway by the staff here to examine it.

One other point associated with that, I realize in the advanced reactor program, for example, we had the chance, which we didn't capitalize on completely, to actually use some of the funding that we had to spend there to maybe start this process. We didn't do it because of the timeliness of the results that we needed relative to the certification process, running experiments in a timely way versus the process versus building.

But you may have other opportunities coming up which involve, again, the CANDU activity -- if that's opened up, that's rather large -- and maybe some activities in the international programs area. If there's enough time flexibility there, you could accomplish a programmatic goal at the same time as leveraging the money to secure and maintain a top-notch organization or group.

So I'm saying in the contract area the Committee has reviewed what the staff is doing and there's a step by step progression by area to work on it. The question is how much money does it build up to.

Now if I shift over into the staff, which is what Ed was referring to, the distinction there at

the staff, since they're not doing the hands-on research, you really want somebody who's very technically knowledgeable but also can implement contractually what they can understand and conceive of. So that requires breadth of personality, but we fundamentally are imploring a very, very strong technical capability in the staff as the underpinning.

And the specifics there would be for the Commission first to identify people in the submanagement area who are really your technical stars or your potential technical stars and create some kind of activity to nurture them -- maybe it's through education and special assignments, either labs, universities, maybe it's a mentoring arrangement under somebody here who is about to reach a retirement plateau but there's a few more years where you can really develop them -- but to identify a group of people and really make an effort focused on them.

The second point would be you've got to fill up the pipeline and you've got to fill up the pipeline with people who you can inculcate your values, your objective goals, and that really in my mind requires an intern program with graduate engineers at the bachelors and masters level but brought in fresh to refill your pipeline.

And then the third point is when you do those things you're liable, which is what I fear, to fall short in this transient because people are retiring faster than you can build in this strength. And the only way to plug that gap is by selective hires of very technically competent people, specific areas, from people available in industry and in labs. That's been done here in some specific cases. John Gallagher is an example of that. You have constraints. I hear all the time about hiring constraints, numbers, things like that, but you're going to have to fill that gap.

But those were the three points and we can elaborate on the specifics of them, but that's what Ed Kintner was referring to.

CHAIRMAN SELIN: I just had one question.

I think you made an assumption that the senior technical folks also in effect have to be the people who are managing the contractual aspects of the research in their areas. Is that true or is it possible to have a couple of experts in a number of areas who aren't necessarily directly acting as the contracting officers' technical representative? I mean, you don't have to teach here. Remember there are some advantages to working at NRC, even if you're

a highly technical person.

DOCTOR TODREAS: I guess what I think I've learned in life and I think at the NRC is you've got to control the destiny of your program. And the medium that you do that with is your contract and money, so you cannot give up the leverage relative to that. Now you're going to have to help me relative to what that means in terms of details of timing that you have to spend, but I'm very leery of a technical expert in an agency like this who has no leverage relative to ability to control the expenditure of funds because I don't think you've got the follow-through on the program.

CHAIRMAN SELIN: We don't have the internal resources to run a research program. If you don't have the contracts, then you really don't have anything to fall back on to get the work done that you need to get done.

DOCTOR TODREAS: Yes. Put another way maybe, what I'm saying, if you're a hired technical gun and you go around solving everybody else's problems who brings them through the door, but you have vision as to what really ought to be done and you don't have the ability to carry through and implement that vision because you don't involve the real medium

of exchange here, you're missing something. So I don't see this break.

CHAIRMAN SELIN: That's interesting. It's very helpful.

COMMISSIONER de PLANQUE: The issue of the procurement rules being an obstacle, could you elaborate a little more on that? Is this a problem that you see as fixable by administrative changes or is it something that's fundamental and inherent in the rules themselves?

DOCTOR MORRISON: I think there's probably two elements to that question. One is really an internal one, which I'm not sure whether it's administrative or management or outlook, is that one should be sure that all of the administrative functions, whether they be procurement or what else, do recognize that their customers are the people that are trying to get the projects done. And so there's the TQM concept of making sure that your customer is satisfied on that. We're sensing that that is improving, but still has a way to go.

The other aspect I think is perhaps well beyond the immediate control of the Agency but in consort with some of the other agencies in trying to reinvent the government. The question is, can some

things be done with regard to the streamlining of the procurement process? The horror stories obviously run from a couple years to get a procurement done to some that get done fairly readily.

It seems like the major resource that NRC has used over the years, the national labs, is now becoming more difficult to access and perhaps even more expensive from what we hear as well. That's something that I think you had little to do with creating the problem, but nonetheless you're probably tarred by the same brush, and has to be handled at a higher level.

COMMISSIONER REMICK: If I may follow up on that, that's an area that has concerned me since coming as a Commissioner for a couple reasons, one because I've had a lot of staff members complain about the ability to get a job done because they can't get things out contractually, and I've at least in my earlier days as a Commissioner maybe even made some comments that from a standpoint of contracting at least with universities it's a not enlightened agency compared to some that in my own personal experience I've had interaction with, and ONR is certainly a good example.

I realize there are different types of

agencies, but I am concerned that sometimes in asking staff why they selected this particular research provider they indicated that, well, they could get that out in a hurry and if they went to the preferred place where they thought the real expertise was it was going to take nine months to a year. I must say, I don't care what the federal procurement regulation is. For a safety organization, there's something wrong if we're driven in trying to get safety-significant answers if we continue to accept that. So it's a continuing concern.

I am encouraged by some of the things that the staff has provided you, some of the innovations ongoing at the moment. I'm hopeful that that will improve the situation, but I hope also that the Committee will follow it because I certainly -- that particular subject, hearing from technical staff members, is one of the frustrating things that they face in trying to get their job done.

And I realize there are limitations and one must do this legally, but, if any agency has an argument sometimes to make exceptions or try to find ways of doing something innovatively, it's an organization that needs an answer to a safety question. And I don't think we are always willing to

step out. We're too willing to accept nay-sayers. And so I think it is an important area and I think it's an area which you should continue to follow, because it is frustrating a number of people trying to get a job done.

DOCTOR MORRISON: Well, certainly the Committee would support your view that quality should be number one, that expediency is not a good substitute for quality. The credibility of the whole program depends upon it.

COMMISSIONER REMICK: It sure does.

DOCTOR TODREAS: That's an item in our charter. It's been there from day one and it is brought up in discussions, so maybe we've sensitized the presenters that that's a question that will always be asked.

COMMISSIONER ROGERS: If I could come back to the list of important topics, which I totally agree with -- I think those are the important areas for research, from thermal hydraulics to human factors -- you did comment in one of your documents, January 14th I think it was, on the need for an over-arching strategy to integrate digital I&C and human factors. The staff responded to that in some way.

My reading of the staff's response was

that it didn't quite answer what you were saying and I wonder if perhaps this might not be a good opportunity for you to say a little bit more about what you really had in mind there, because I think there may have been some confusion in reading your remarks on the part of the staff as to what you intended for an over-arching strategy because it seems to me there are many ways one could view this and I'd like very much to hear what your own thoughts were.

My own personal experience over the years with the things which they would call human factors has always been very frustrating, it always seemed to me, particularly in a research sense, because it always seemed to me that this was one of the areas that had the most promise and yet the most difficult one to evaluate, to separate the truly useful from the really pedestrian, and I always had a great deal of difficulty with it whenever I had to make some kind of a decision about human factors research, industrial and organizational psychology or man-machine interface problems and things of this sort.

And so, I wondered really what your thought there is when you say "over-arching." Where does the arch start and where does it end in this process?

DOCTOR MORRISON: Let me make a quick comment, Ed, and toss it to you.

I think the response that we did get back from the staff perhaps misinterpreted what we were trying to say, that we were in no sense in the Committee trying to drive the design of advanced I&C systems and using the human factors as a way to get into the driving of the design.

On the other hand, this is not a new issue because our Human Factors Subcommittee has been dealing with this now for several years. And fundamentally it says you do have a human in the loop and it's a three-legged stool. It's not just hardware. It's not just software. There's a human in that loop and unless you have a strategy that starts from the guidelines that say, you know, how are we supposed to be really factoring in this system that has three components, NRC is falling short of being able to give the guidance to the industry.

Ed, since your subcommittee dealt with it in a lot of detail --

MR. KINTNER: The "over-arching" was Neil's word, but I think we all agreed with it and I think what the Chairman has said is correct.

You asked me a number of questions about

this last time we sat before you, which was almost a year ago. Didn't answer it very well, but it does seem to me there's two ways to look at it. One of them is that this should be looked at as a system, from a system point of view with the man being one part of the system. A good example of the dichotomy is the ACRS is asking for the National Academy study and wants to talk about the software and the hardware, the validation and the quality assurance associated with that, but don't talk about the men or women, and we think that falls short of the goal.

My personal sense is that there are tragedies coming, maybe not in the nuclear area. I think when it's all played out the helicopter thing is going to be a man-machine interface question. I think the Korean Airline tragedy was a man-machine interface. It goes beyond the design of the computers and the design of the software that goes into the computers to the fact that men are going to operate them. Humans are going to operate them and if you don't consider that in the first instance you are going to lose some of the advantages which modern capability and I&C, digital instrumentation and computers will bring you.

CHAIRMAN SELIN: As far as the human

factors research goes, I would be satisfied if it were possible to answer two questions. They're not simple questions. Well, they're simple questions but the answers aren't simple. Number one is, what should we use for the probabilities in these interfaces? And the second is, in looking at and evaluating whether it's designs or more likely operations, how do we take into account or how do we look for things that are just hard to do, you know, control rooms that are hard to operate, equipment? Those two things.

Remember, we're not designing the equipment. You know, we sometimes forget that our job is either confirmatory or truly regulatory, not to make up for deficiencies in research that's being done on the part of the people who design, whether it's low-level waste facilities or computer centers. And do we have a program or is it possible at our level to have a program? We're not supposed to be doing basic research. We're supposed to be finding out what's been achieved elsewhere and seeing how it could be converted to meet our needs.

MR. KINTNER: First of all, I would agree.

Human factors research is not very rewarding. I mean, it's very difficult to look into that and find the answer to this kind of question. On

the other hand, it seems to me also obvious that it is not too much to ask, if you're going to ask for a study of this whole subject by the National Academies, that the human aspect of it be included. And it does go beyond the designs of the control rooms, but the design of the control room was a major factor in TMI-2 and the same kind of errors can be made in the design of control rooms with modern equipment in them.

As a matter of fact, you may have also tried to operate the simulator in France. It doesn't seem to me that makes it very easy. I mean, I had a harder time with it than I would at TMI. So, there are these kinds of insights which nobody has established yet. It's very difficult to do so, but the Commission I think does need to be aware of these significant aspects of modern equipment. Now does that mean you're going to have to do research in an area where you shouldn't be doing it? Not necessarily.

CHAIRMAN SELIN: Well, is there research going on in aviation or in other areas that could be adapted to our needs or do we end up having to do more basic research if we need answers about how efficient or how effective can people be in computer centers? I mean, I would think there's nothing all that special

about a computer center to support a --

MR. KINTNER: Well, there's a lot of research going on. In aviation, for example, I think they have a whole center devoted to it. There's also research going on in aviation of the kinds of accidents that are occurring. There are near misses that are occurring. And all those things can be, without a lot of additional effort, considered.

What really, I think, worries us is that we don't see in the way the program is now organized that the implication of the human relationship in the system is sufficiently infused.

DOCTOR BUSH: Maybe I could make a comment.

CHAIRMAN SELIN: Please.

DOCTOR BUSH: I've participated now for about 12, 14 years in an international program. For the last six years one of the aspects of this has dealt with human factors, in the plebeian use, perhaps, but we talk about equipment. It has to do with the reliability of the individual when it comes to running a nondestructive examination, which of course is a basic requirement.

We found in that particular one that the operator over a period under stresses, this was a

stressor controlled experiment, his reliability ranged from ten percent to 90 percent in the same period for the same operator. There were various reasons for this, but it does indicate that at least when it comes to operation of equipment on a repetitive basis there are inherent problems that one must face up to.

Now this happened to be, as I say, a straightforward ultrasonic examination, but I could apply the same thing into a preventive maintenance program. It does not give one what I'd call a high level of confidence as to what the end product would be.

DOCTOR TODREAS: Let me just step in.

You may have made a very constructive comment for the Committee in terms of the future. This report that you refer to is worded and has the thrust that it does because when we reviewed the program we couldn't really find the central questions that the program was designed to answer. I hope that isn't too harsh, but we came away from that -- it turns out three of us are on that subcommittee -- we thought the reason was that there was no overall framework and --

CHAIRMAN SELIN: The Commission has been asking the same question in this area for a couple

years.

DOCTOR TODREAS: In fact, you know, what you've done by hypothesis is you've asked two very specific questions. If they turn out to be the right questions or reasonable base to develop the right questions, then one could then go back and examine the program against that. But the program now is sliced in a lot of small cuts and the linkage between those cuts isn't clear and some of the questions that individual slices are asking just doesn't taste right as far as satisfying.

CHAIRMAN SELIN: My part of this SRM, and I played a fairly minor part of it, but my part was really to get after that. When I say, if the programs are carried out successfully will they answer questions they have to answer, part of it is do we know what questions we're trying to answer.

In low-level waste, I'm interested in knowing what research we need to have to fill in the holes so that our licensing people can license a low-level waste facility, not how do you design them, et cetera. A lot of work is being done on transport, some of which seems to me to be sort of interesting but more design oriented than regulatory oriented.

Are you suggesting that maybe even across

the board there's a lack of the putting the couple of questions that the research program is supposed to answer or is this just in human factors?

DOCTOR TODREAS: You said "across the board." I'm not suggesting that at all.

CHAIRMAN SELIN: I was giving you a chance. You know, it's your last session. Why not? Go out with a flame.

DOCTOR TODREAS: I hope when you read the other reports and all you can see we're very focused on debate about how to answer the question and the technical sufficiency of it. We don't come out with such broad statements as where is the over-arching framework. So, no, I think it's endemic in this area and it's because --

CHAIRMAN SELIN: This area being human factors?

DOCTOR TODREAS: Human factors and digital I&C together. And the reason is this is just regenerated. The area activity was regenerated in the research program, so it's not that old. We nor the staff have had all that much experience in it, but we're all really branded that as you move into advanced reactors and actually backfits into existing reactors this is the one area with a real potential to

make a big positive difference or to really hurt you, and so we're very sensitive about this area.

CHAIRMAN SELIN: I see.

COMMISSIONER de PLANQUE: You talked about work being done for other industries in the human factors area. Do you sense that our staff is sufficiently well plugged into those?

MR. KINTNER: We have made this point in several of our reports from the Subcommittee and I think there's been a considerable improvement in that regard. I doubt that you would pick anyone in the staff and ask them or could ask them to recount to you thoroughly and with adequate knowledge what's going on in the world in this field. I just don't think it's vital to that end, but it should be.

DOCTOR TODREAS: We were even taken to task on that, if you read the rebuttal that you referred to. In past reports, we said, "Get out and do this." In January we reviewed the programs and it seemed they were getting out and doing it so much that that was the whole emphasis and there was not enough integration and then pouring forth. So, we made that comment and then people turned around and said, "Gee, you told us to do this."

But you have to do it, but then you've got

to stop, integrate it and get smart yourself. I think we're at that point.

DOCTOR MORRISON: One might apologize a little bit on the basis of the staff. They're having a very difficult time, as we are even on the Committee, finding an individual that can bridge that whole gap or see the systems context. You get people in the I&C area that are very much oriented toward that or you get way over in the human factors side or someone is a software engineer. We've been trying to fill a gap on the Committee itself and there just isn't an individual that pops out, yes, that is the person. Unfortunately, when you get to three persons, then you've lost the systems integration capabilities. I can't fully blame the staff for not being able to do it either.

COMMISSIONER ROGERS: In the staff's response to one of your letters, and it had to do -- well, it was on some of your comments, the staff indicated its cautious approach to the question of being out in front of the industry on a matter and cited the legislative history of the Energy Reorganization Act of 1974 and so on, and finally wound up by saying RES, that is our research area, cannot lead the industry toward a particular strategic

vision or integrating initiative without acting inconsistently with this legislative intent concerning its mission scope.

Well, it seems to me that that's both true and false. We do it all the time, unconsciously. Regulation itself leads the industry. Why is it that the nuclear power plant industry is so retarded with respect to the introduction of digital I&C systems. It's not because they didn't know about them, it's because as a regulatory body we just didn't know how to deal with those things. So, we did lead the industry, we led it backwards, not forwards, but we led it.

So, I think that one has to recognize that yes, caution should be duly exercised here, but I think that what you're saying, this necessity of clearly recognizing how the integration of the human being into the loop that includes the digital -- I don't see that happening in our industry. The industries you've talked about, yes, they're dealing with it. I don't see it happening in the nuclear power plant industry as such. There may be little shoots of it, little green shoots popping up, but it hasn't gotten very far or gone very far yet. I think that our concerns with safety here in this area,

proper concerns of safety, in fact, can exercise leadership and force a strategic vision. I think what's lacking has been a strategic vision in this activity, in the design and execution of nuclear power plants.

There's a great deal of caution on the part of our licensees as well as the vendor as to what the NRC is going to accept. We had a devil of a time coming to the conclusion that we would allow somebody to unplug an analog device and put a digital one in that was tried and true and tested and had a little tiny bit of software in it because it had a software reliability question that was really quite different from the software reliability questions when you have a massive hundred thousand lines of code situation.

So, somehow it does seem to me that in our own way we can, in fact, force a strategic vision where we really think that that's lacking in the industry and it's needed for safety. I wonder if you want to comment on that. You got the letter, right? It went back to you on April 28th.

MR. KINTNER: I think you said what we believe, at least what I believe and I think the Subcommittee believes is exactly right, that there is this restriction by law on you and what you can do.

But this is an area which is not going to be fixed by the industry without further understanding and application of regulatory influence as you said. I say again that in the first generation of reactors the instrumentation and control was sort of independent from everything else. They put this meter up here, this meter up here and this meter here and so forth and an operator is supposed to be able to know where to look when the accident occurs. If he doesn't, you have a Three Mile Island.

So, you're caught between the legal requirements and what I think is a broader requirement on the Commission to ensure that these factors are considered and incorporated up front. I don't see the industry doing it either. They're making beautiful control rooms, very pretty and very colorful, the questions of implication from the human point of view are not included in the way they should be.

DOCTOR TODREAS: I just wanted to comment and remind us all. You're reading a response from a research organization to a research review committee's observation. The hierarchy in this area is it starts with the applicant designer, then it goes to the regulation function, then it comes down to the research function. We're basically reacting at the

bottom, trying to decide is research in this area done correctly. The only way you can do it is if you know what the questions are. The only way you can have the questions is if you have the framework. So, we are reacting to the lack of framework being constructed higher up on the hierarchy.

Therefore, I say that that response in the letter is correct at the level in the hierarchy that it's written and represents. But the overall response that you're saying is right and wrong, it belies the fact that somehow in the whole stream of things in this industry and the regulatory function, we've got to get it fixed.

COMMISSIONER ROGERS: Well, yes, I think that's right. But what your remarks were all predicated on on a certain perception of where RES is in the hierarchy. You've just said it's the bottom. I don't really think that's necessarily the case. I think that the role of RES, and I'm saying that part of our organization -- that's why I call it RES and not research, it is a part, a statutory part of this Agency -- can have a more proactive role. It need not only be a totally reactive situation. It must, in fact, deliver to the users but it also has to deliver to the whole needs of the Commission as well.

I'd ask you whether you're really convinced that that's the only possibility for RES in this organization. I don't think it is.

DOCTOR TODREAS: No. That's a big introduction to the user needs issue --

DOCTOR MORRISON: Yes, I was just going to raise that. We're thinking along the same lines.

DOCTOR TODREAS: -- which we've talked about quite a bit.

DOCTOR MORRISON: I would raise it in a very general sense to begin with. I think maybe what we're seeing is the symptoms of the change in the program over a six year period of time, which was, I would say, very much bottoms-up driven to begin with and now it's user needs driven and it's on the spectrum of almost 100 percent user needs driven. I will say that the RES has been very responsive to user needs and certainly have ticked off a lot of the needs that have been tabled to them.

I think the question that the Committee is really thrashing about and realizes that there's not enough flexibility either in the budgeting or the staffing or the programmatic planning to accommodate, and we use the term "exploratory research," which may not be the right kind of label to put on it, but at

least an ability to explore areas that don't necessarily have a clearly identified need now, still are within the realm of what needs to be done with regard to nuclear reactor regulation, but some issues that you can spend some time and effort doing it.

It has two components to it, the amount of money to be set aside, and I think that's a management decision, whatever percentage of the total budget ought to be put in there. That's something that management has to be comfortable with. It looks like it's too low now. We were looking at a paper yesterday that says maybe 25 percent is the number. That may be too high. So, it's probably somewhere between zero and 25 percent. But of equal importance in my mind is to be able to put a fence around that and say, "Yes, I've committed this for a long enough period of time that I'll see the research reach some conclusion on it and not start it this year and pull it back next year," because that will sort of destroy the overall purpose in having it.

This could be an area where some research might be quite useful in the exploratory area and the --

COMMISSIONER ROGERS: Well, in fact, I think that's exactly what we did with human factors.

I think we had a fairly aggressive human factors program about ten years ago or so and then it just all of a sudden took a nose dive, went down to practically nothing and now we're trying to put it back together again in a way that seems to be a little more focused and relevant to other things.

But I think what it comes back down to is the necessity of really trying to understand what your purpose is behind a research area that you support and when it is inadequately thought through, then it is apt to start to grow just because everything likes to grow and then suddenly get cut off, rather than being able to maintain a reasonable level of effort with some usual fluctuations, but not excessive fluctuations, until it's very clear that it's done its job and perhaps it's time to close it out. That's a difficult decision, but those kinds of decisions have to be made as well. But I don't think the human factors has ever gotten to that. It's been sort of started up with enthusiasm, grown and then cut off because it wasn't really relevant and now it's starting up again. So, we're kind of into a saw-tooth function here on this that --

CHAIRMAN SELIN: Positive void coefficients.

DOCTOR MORRISON: Or from the more research standpoint that perhaps what we're asking for here in this over arching strategy is a premise under which one is doing the research. As long as you have a premise that you're going on, at least you see a direction.

CHAIRMAN SELIN: Without quibbling about it, there's a problem with this phrase "exploratory research," at least in my mind. I believe that a certain amount of the research should be done not because there are users who have asked for it. The function of the research management is to foresee problems and make sure work has been done, as well as respond to perceived problems. But it shouldn't be exploratory work. It should be work that we're doing -- I mean hopefully there's exploratory work going on elsewhere that we can adapt. It's trying to build up a stock of knowledge so that we have informed people or codes or products when we need them.

But in most cases, I would hope it would really be applied work. We're not doing basic thermal hydraulics, we're trying to figure out how to take the basic work and do the codes that fit the configurations and the situations, the small subset that arise in reactors.

DOCTOR MORRISON: Yes. I think all agencies have the problem of what label do you put on that. We're working quite a bit with the Environmental Protection Agency and they use the term "fundamental" as to distinguish that from basic.

COMMISSIONER de PLANQUE: Aren't we really talking now --

COMMISSIONER ROGERS: That helps a lot.

COMMISSIONER de PLANQUE: Aren't we really talking now is that Neil's hierarchy is what you're saying exists about 100 percent of the time now and you want some percentage of the cases where it goes in the other direction?

DOCTOR MORRISON: That's correct.

MR. KINTNER: And the words that you used in your memorandum, it seemed to me, bear directly on this subject, "provision of technical introspective capacity," which means to me it is not undirected, it's not exploratory. It does have a purpose within the mission, but nevertheless provides a technical base to allow people to think about things in a new way.

DOCTOR TODREAS: Introspective directed research.

MR. KINTNER: Maybe that's the title.

CHAIRMAN SELIN: Forrest?

COMMISSIONER REMICK: First, just a comment meant in humor, not to be critical. But in a former life, another advisory committee that I served on, on this question of is the question properly formulated, the committee used to say, "If you don't what the question is, how will you know when you have the answer?" It's so true. If you really don't know what you're headed for, you'll never know if you get there.

Many of the questions that I had have been addressed. But one that I have, in your November letter you indicated that there appear to be some kind of a restriction on communication with DOE on the advanced light water reactor program. In reading the staff's response, I get the impression that there was perhaps a misunderstanding. Can I conclude that that issue is basically resolved?

MR. KINTNER: Neil?

DOCTOR TODREAS: We have to exchange a little bit more. We have talked about trying to get data through the naval reactors activity. In our Committee letter, which I prepared, I don't remember this --

COMMISSIONER REMICK: I see. I did not

associate with naval reactors, but perhaps it was intended. I thought it had to do with --

DOCTOR TODREAS: Steam generators.

COMMISSIONER REMICK: Is that what it was? I see.

DOCTOR TODREAS: Wasn't it steam generator --

MR. KINTNER: It was also an ALWR question.

COMMISSIONER REMICK: It was specifically ALWR, yes.

MR. KINTNER: And I think that's been very much improved.

COMMISSIONER REMICK: It has? Good. Okay. Good.

One area that I found particular interesting was your comment on the RELAP 5 code development program. I thought you had a lot of good comments there because it is an area that I've had some concern, and right or wrong. One of the reasons I was hoping that a group like yours would look into was a question of had we become somewhat complacent with our codes or had we declared victory too soon.

I was very pleased with the staff's April 28th response to you on that issue because I thought

it was a very candid self-assessment by the staff of the situation and proposals on what we should do. In fact, I think that's what the Commission had in mind. Certainly as one Commissioner, I had in mind in that particular area that the staff would do a very thorough, candid self-appraisal of that situation. But it is an area that, once again, I would hope that the Committee would keep in touch with because it's one that's going to take time and continued emphasis. So, I would hope that the Committee would continue to watch over that.

I don't know if you wish to make a comment or not. It was really not a question.

DOCTOR MORRISON: Well, let me ask Herb Isbin, who is Chairman of that Subcommittee, whether he has a comment to make on it.

Herb?

DOCTOR ISBIN: What we were really referring to is the advanced light water reactors.

DOCTOR MORRISON: All right. Neil then, do you have a comment on it?

DOCTOR TODREAS: We were fortunate enough or maybe it was prethought out that we had the director at that meeting, which was not held in Washington. So, it didn't require waiting for a

report. One could attend the meeting, listen to the meeting and the reason things moved off so fast is because it was moved from the interchange, not from waiting for an exchange of the reports.

COMMISSIONER REMICK: I see. I thought it was an excellent response from the staff.

Also, I would like to say I sincerely am very pleased with the work of the Committee. I think you've been doing some very fine work. Even sometimes you're probably right. But really, I think you've been doing an outstanding job and I'd like to take the opportunity to say that I would like to give credit to also Eric Beckjord and his associates for recommending people of this stature that are on the Committee and are joining the Committee because it's obvious you've not been selected to be a yes group. I think you've been a real credit to the NRC and your recommendations are right on target many times and extremely valuable to the Commission and to the staff. So, I sincerely thank you.

DOCTOR MORRISON: We appreciate very much your compliment.

CHAIRMAN SELIN: Commissioner de Planque?

COMMISSIONER de PLANQUE: I think Commissioner Remick put that very well, so I won't

reiterate it.

I have a couple of questions back on the area of staff. You talked about staff competence, about possibly identifying the super stars and setting up programs and mentoring systems. I think Commissioner Rogers talked about the necessity of setting up the right kind of environment so that the care and feeding and nurturing of research people goes along properly.

Did you have any other particular practical suggestions in this arena that you might like to bring forward?

DOCTOR MORRISON: I certainly don't have any beyond what Neil has already talked about.

Ed?

MR. KINTNER: No. It's just a question again of recognizing and having it understood throughout the Agency that research data, the results of research are the bedrock fundamentals from wnich all else builds. Eventually even the political aspects are going to give way to technical fact. That's why we believe this is so important and that special steps should be taken, even against the prejudices of other parts of the organization, to assure that they are able to get good people, train

good people, get the input at the bottom the way we have suggested, all the typical personnel steps which one takes when he wants to strengthen a specific organization.

DOCTOR MORRISON: That's actually, in my mind, probably a two or a three dimensioned problem that you're dealing with. One is to make sure that there's the technical competence there. I think over the years at least that I've been a part of the Committee, we've seen a good transfer of individuals from the regulatory side to the research side, which then kind of amplifies that technical competence or at least makes it acquainted with the user aspects of it which I think is a good second dimension to have, and talked about earlier then the whole business of being able to be an effective program manager certainly applies in being able to get the research done. That's sort of a different set of skills. One would like the individual, obviously, to walk on water in all three of those, but it's sometimes more biased one direction than another. Any program that could be done to effectively see that happen within the Agency in a deliberate manner rather than just on an ad hoc basis would be useful.

COMMISSIONER de PLANQUE: Okay.

DOCTOR TODREAS: At the risk of making a suggestion I won't be here to follow up on, I'll say that the Committee hasn't really picked up the essence of your question and gone through a complete discussion of more specifics. We've been after the framework to really see if the Agency and you as Commissioners would buy this. In fact, we thought maybe some of these specifics we're pushing a little too far, too fast before we knew the reaction. But I would say if you wanted more suggestions, I'm sure you'd get them.

COMMISSIONER de PLANQUE: Okay. One more in the same general area. You talked about the pipeline. Those of you who are connected with universities, what's the state of health of the pipeline?

DOCTOR TODREAS: What's the state of the health of the pipefitters who are maintaining the pipeline?

COMMISSIONER de PLANQUE: Well, that too. We tried our best.

DOCTOR TODREAS: Well, you know, obviously there's a shadow cast on the structure. Nuclear Engineering departments are under a great deal of stress from administrators who want to merge or cancel

departments. But there are a number of departments, probably 20 or so, that I think have resilience, have strength in them. The thing that sustains me quite a bit is if you look at -- if you read the vision of students when they have to write this essay on their applications as to why they're interested in entering a nuclear engineering department -- and by the way, in our department in terms of U.S. people, U.S. citizens wanting to go into fission reactor engineering, the strength is still there. But what's really interesting is the statesman-like long-range principled view that these students express relative to energy and a resilience ultimately back on fission energy.

The real problem is that ultimately. It may take so long to come back that we'll suffer a lag. But I think there's resilience there for five to ten years. But beyond that, I think there's a real problem.

COMMISSIONER de PLANQUE: Okay. Thank you very much.

CHAIRMAN SELIN: I appreciate very much these discussions. As far as the top down, it's not just human factors, there are other parts, the waste parts in particular where it would be useful in

discussing the research programs to try to come back to what other couple questions we're trying to answer than probably some other areas also. So, I wouldn't just pick out the human factors folks. They have a more complex job, I think, because they don't have such a solid body of hard outside research to go to.

I would say a few words to the people in Research. You know, you've said the right things, but it makes it sound like program matters, something you do on Wednesday mornings from 8:00 to 10:00. We've been putting enormous pressure on our research people to do a very good job of managing the program, even to the financial side of things and not just to making sure that the statements are workable, well structured and the work is there. It's a very difficult job that we're asking them to do.

We have noted that the labs, all of which work for the Department of Energy, have a factor of two or greater in what they charge for essentially equivalent services in different cases and we expect people to take this into account when they're letting contracts. So, it's a lot beyond what you normally think of as just a contract monitor into trying to get the work.

Nevertheless, we have a research program

which, in spite of all the support it gets in this room, is not terribly popular on the Hill or with the people who have to pay for it and we don't have a simple answer that says, "What would happen if it were 20 percent more or 20 percent less? What would the impact be, even the long run, on regulation?" Part of answering the question is to get to the point and say, "Well, what would happen if we weren't doing the work to answer this question or answer that question?"

I'm a little uncomfortable asking a technical advisory committee to do so much top down work, but I personally find your answers very helpful and to continue on what question are you answering, why are you doing it yourself, isn't there material outside that you can adapt instead of doing, and when will you know when you're done? Those are three terrific questions to put into each and every group that you work with, but bearing in mind -- you know, I'm trying to tell these guys to run their programs a little more efficiently. Commissioner Rogers says you've got to more of an expert in what you're doing, et cetera. You know, we're all directors of research on this Commission and so we all have great interests. It's really tough to be in the research area at NRC.

So, with a certain amount of sympathy but

nevertheless the fact is that this is the hardest part of the program to defend. The one with the payoff that's the longest are in some ways the most duplicative. There's really nothing we do in Research that we don't do to some degree in the two program offices or in some degree in AEOD. It's a really tough job they have and we need your help, they need your help on these topics.

DOCTOR MORRISON: Well, I would like to say that I think our new chairman of the Committee is very capable of asking those same kinds of questions. In fact, he posed a number of those to us before we started this last meeting.

So, Ed, let me toss it to you to carry on.

MR. KINTNER: Well, I think before I do, would you say a few words, Spence?

DOCTOR BUSH: Okay. Last chance to express by biases.

I've been around quite awhile working on the AEC/NRC, close to 40 years now. That includes a few stints on ACRS, three on this one and quite a few special assignments. My views haven't changed an awful lot, I would indicate, in some of the broad issues that were addressed by Dave and Neil. I'll get down to some specific ones that I've been close to,

some of them for 30 years.

My interest has always been in preventing and minimizing the severe accidents. I've looked at this, what you can do. So, that's where my long-term interests lie.

A few items, and I'll draw an ultimate conclusion on this. Passive components, of course, have interested me ever since the '60s. The reactor pressure vessel is near and dear to my heart. Piping, steam generators, NDE so hopefully you can close the loop and not have these kind of problems. For the last 15 years I've been looking at seismic in the context of how much can it do particularly to piping systems or how much won't it do. That's a more important part of it. Of course, you've had a very high program, the Commission has, in aging.

My interest is less in active components. The one I am interested in I consider a major problem is valves. I guess I would sum up, and this is a personal opinion but I don't think it differs too much from that opinion of the Committee, is that you will need to retain expertise at some appropriate level, which I can't predict. The three areas that I would place in the top hierarchy would be the pressure vessel. Even though we've done work since 1966, there

are still loose ends there. The second one, not too surprisingly, is the steam generator, which I think is going to haunt us for some time to come. Finally, the third one that worries me more than all the others from the point of view of its potential impact on accidents, are valves. So, I guess my swan song would be that those are the areas that I believe that you will have to retain the expertise both within the Commission and with your contractors, at least in the foreseeable.

COMMISSIONER REMICK: Spence, you remind me of something. When Doctor Morrison listed several areas in which it was important for the NRC to have the expertise because we can't look to others and the heavy section steel technology was one I was going to suggest. At least it's one that I always add to that list. So, I very much agree with what you're saying. It's one of those things that if we didn't do it, I'm not sure where we would look for others to do it when we need those answers as we've had to have a couple times in recent years.

MR. KINTNER: Let me just say a few words in closing. One of them is that it should be obvious that it's a matter of some pride to follow in the footsteps of these two gentlemen who have brought in

six years, it's obvious to me who have been here two years, that this Committee has had some influence. It's also obvious that one of the reasons we can say what we have said about the Research Program is because the Commission itself has put the pressure on, as you say, to do these things well.

The Committee is made up of a very broad spectrum of technical competence. Just to repeat, the competence is being brought into the Committee. Let me give a little more introduction to each one of these new members.

Doctor Charles Mayo is Professor of Nuclear Engineering, Director of Nuclear Reactor Program, North Carolina State. He was for many years in system and liability controls in Babcock and Wilcox and then Science Applications and he has included among his extensive interests reliability and failure modes in a facts analysis. So, there in one gentleman is a very broad kind of experience.

Doctor Yukawa has 31 years in General Electric's Turbine Division in materials work and that includes design application services, performance evaluation, vessels, piping and nuclear power plant components in support of the General Electric reactor systems.

Doctor Golay has been Professor at MIT since 1986 and Assistant Professor since 1971 and he has written extensively on nuclear power topics. His special field is fluid mechanics and heat transfer and a broad range of other nuclear subjects.

The last person who is joining us today is not here because he is ill, Doctor Anthony Baratta from Penn State, Professor, Department of Nuclear Engineering at Penn State. Before that he had a long period of time in naval reactors. His activities include extensive research in reactor physics, reactor instrumentation and significant thermal hydraulics work.

Doctor Robert Hatcher was not here the last time. He's here this time and I would like to point out that he is an eminent structural geologist, has done a lot of work in seismic activities. He was a member and still is a member of the National Academy of Sciences Board on Radioactive Waste Management, which will be very useful in that field for us. He was President last year of the Geological Society of America. He's now a distinguished scientists and a Professor at the University of Tennessee.

It seems to me that this has been a very excellent job of the director in selecting these

people to the Committee. I can only say that it's been an enthusiastic group. They have, in fact, worked hard at what they're doing. We will continue to do that. It's going to be very difficult to fill the shoes of Dave and Neil and it's going to be even more difficult because of the departure of people like -- what's your name again?

The fact that just as this sort of change of shift takes place on the Committee, that we are going to lose the Director of Research is, in fact, troubling. This comes at a time when, as we see it, there are going to be changes in the nuclear field and in the requirements eventually in the participation of the Nuclear Regulatory Commission and many factors overseas as well as here. It's going to be a changing circumstance over the next year or so and I can only say that I, and I'm sure the rest of the Committee, will do our very best to be helpful to you.

COMMISSIONER ROGERS: The Chairman, I think, has had to step out. Let me just, on behalf of him and my other Commissioners, thank you, Dave and Neil for your wonderful service on the Committee. I think it's been very, very helpful to us.

Ed, we look forward to working with you and the new members of the Committee.

We thank you all very much for everything and look forward to seeing you again at an appropriate time. Thank you.

MR. KINTNER: Thank you.

(Whereupon, at 2:29 p.m., the above-entitled matter was concluded.)