UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
***
MEETING WITH NUCLEAR SAFETY
RESEARCH REVIEW COMMITTEE (NSRRC)
***
PUBLIC MEETING
***

Nuclear Regulatory Commission
Commission Hearing Room
11555 Rockville Pike
Rockville, Maryland

Friday, May 2, 1997

The Commission met in open session, pursuant to notice, at 10:53 a.m., the Honorable SHIRLEY A. JACKSON, Chairman of the Commission, presiding.

COMMISSIONERS PRESENT:
SHIRLEY A. JACKSON, Chairman of the Commission
KENNETH C. ROGERS, Member of the Commission
EDWARD McGAFFIGAN, JR., Commissioner.

STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

JOHN C. HOYLE, Secretary
KAREN D. CYR, General Counsel
E.T. BOULETTE, NSRRC Chairman
S. GEORGE BANKOFF, NSRRC
MICHAEL W. GOLAY, NSRRC
CHARLES MAYO, NSRRC
CHRISTINE M. MITCHELL, NSRRC
JOHN TAYLOR, NSRRC
SUMIO YUKAWA, NSRRC
DAVID MORRISON, Director, Office of Nuclear Regulatory Research

P R O C E E D I N G S

[10:53 a.m.]

CHAIRMAN JACKSON: Good morning, ladies and gentlemen.

I am pleased to welcome Dr. E. Thomas Boulette and members of the Nuclear Safety Research Review Committee, and Dr. David Morrison, Director of the Office of Nuclear Regulatory Research, to brief the Commission on recent activities of the committee.

The Nuclear Safety Research Review Committee or the NSRRC, as it is called, advises the director of Nuclear Regulatory Research and, through him, the Commission on the quality and conduct of NRC research activities and gives recommendations concerning the overall management and direction of the Nuclear Safety Research Program.

At today's briefing, the following topics will be

discussed. First, observation and recommendations of four subcommittees, among them the Materials and Engineering Subcommittee, a joint report from the INC and Human Factors Subcommittee and the PRA Subcommittee. And, finally, the Accident Analysis Subcommittee.

Also discussed will be research core capabilities and the committee's view of these, comments on the committee's effectiveness in support of research and comments addressing the Commission's questions concerning

. 4

human reliability analysis and their relationship to PRA.

The Commission appreciates your effort and look forward to hearing from you. I understand that if there is any presentational material, it has already been made available.

Please start, Mr. Boulette.

DR. BOULETTE: Thank you, Chairman Jackson, and good morning, Commissioner Rogers, Commissioner McGaffigan.

We are pleased to be here this morning to give you our views of the research program that the NRC is very dependent upon. We will also afford you an opportunity to meet the membership. I know you haven't done that before. And in fact what we have planned is that every member at the table be speaking.

The agenda is relatively tight. I was present for the ACRS meeting and I can see how these proceedings go. I am going to encourage the membership of this committee to be cognizant of the time and the messages that we are trying to present to you.

CHAIRMAN JACKSON: It is we who caused the delay.

DR. BOULETTE: A couple of comments about the committee itself.

Historically, there have been 12 members on this committee. Currently there are only seven. Soon, there will be only six unless we -- unless Dr. Morrison is

. 5

successful in recruiting some other members. One of the concerns that we have is the breadth of expertise that the Committee is trying to sustain so we will be working on that over the next couple of months.

To make the committee effective, we have broken it up into five subcommittees, four of which are very active. One is somewhat inactive because of the area of expertise on high-level waste.

The four committees will report to you this morning their findings at their recent meetings and their views of the specific areas of which they have responsibility.

The committees include the committee on PRA. Mike Golay is the chair of that committee. Another committee is Human Factors and INC. Charles Mayo is the chair of that subcommittee. Accident Analysis is the third subcommittee and George Bankoff is the chair of that subcommittee. And Materials and Engineering is the fourth and that is chaired by Sumio Yukawa.

We try to meet twice a year as the full committee and the subcommittees try to meet two to three times a year. We have no staff so most of what you get is a bit sophomoric, I think, in terms of the quality of the typing. That is because I do the typing of the reports.

We have tried to address the concerns that the

. 6

Commission had in terms of the interface between this committee and the ACRS. I think we have been very active

this past 12 months in doing that. The way we do that is to try to be very cognizant of their schedule and the meetings that they have and then selectively select a member of our committee to attend some of the meetings. There have been at least a half a dozen or so meetings that we have been participating in. It has been very useful to us. It helps to focus on what we may want to talk to the staff about.

With these preliminary comments, I will move on to the next subject on the agenda which is a report on the joint meeting of the INC and Human Factors and the PRA subcommittees and that is Charles Mayo.

MR. MAYO: Okay, thank you.

Our committees had a joint meeting primarily to review and prepare response to the questions that had been posed about the use of human reliability analysis and PRA and we reviewed the human performance program plan, the PRA implementation plan and other material provided to us and concluded that the research projects in human factors and human reliability analysis are largely unrelated. This seems to be primarily driven by user needs to perform reliability analysis and the licensing space as opposed to developing methods and data specifically directed to the human reliability analysis problem and applications of it.

RES does have two programs in human reliability analysis area and considers them to have somewhat limited scope. There is the Athena project on the areas of the commission and the organizational factors management. I would have to say that our subcommittee has been concerned about the issue of the organizational factors research program for a number of years and I came on the committee as previous work was ending so I don't know the historical details but we still have some concerns about progress in that area.

Additionally, in looking at the programs that were going on or could be going on, the data needs, we had the analysis that there was likely to be significant relevant experience in the NRC operating database and we could see references in some of the program plans to this being collected and the licensee event report improved and so on to develop for human reliability data. We feel that this is a research area or opportunity for data that should not be ignored and particularly in comparison to the classical human reliability analysis type data that has come from other industries.

And the final point was there was a belief that the two projects that are currently going on did not constitute a developed research plan to develop the human reliability, human factors analysis into use in the PRA but

that improvements certainly could be made through a longer term program.

CHAIRMAN JACKSON: Let me ask you a couple questions.

You talked about the human reliability analysis program having limited scope. Has the committee made any specific recommendations on an expanded scope?

MR. MAYO: We have not had the opportunity to do that. We had a busy meeting when we got to this point.

CHAIRMAN JACKSON: Do you plan to make recommendations?

MR. MAYO: We are trying to get together again in the early part of the summer and discuss this, after we have

had a better sense for material we received and feedback from the ACRS.

CHAIRMAN JACKSON: You mentioned that user needs do not address development of human reliability analysis, that portion of the PRAs -- I'm going to call it HRAs from now on. To what extent has the current state of the art in HRA limited our ability to apply PRA results in the regulatory arena.

MR. MAYO: That question I must defer to some of my colleagues on the Committee.

DR. BOULETTE: Christine, can you take that question?

To what extent can HRA be effectively used in PRA, I think, is the nature of the question.

CHAIRMAN JACKSON: Yes, in the regulatory arena.

MS. MITCHELL: I think that if you have a -- to the extent that you are able to model human operators, you have a stronger model. To the extent that you are not or you don't have particularly valid data for that, it limits, limits your overall model.

My understanding is that HRA is pretty primitive at this point in time. My understanding from your last session with Dr. Apostolakis is that -- and I concur -- is that it's a mess. So it needs some attention, although I caution that this isn't just a matter of money and effort; this is the state of affairs in lots of other industries. Modeling human performance and using those models in an analytic way is not widely done anyplace.

CHAIRMAN JACKSON: And you mentioned that analysis of operating experience should be a resource for relating HF, HRA and PRA. Why is that not happening?

MR. MAYO: I believe it is happening in certain ways. Our exposure to date has been limited to what we read about projects in the program plans, particularly in AEOD activities, which we haven't gotten into much detail on.

I guess our concern was the absence of seeing active work going on within the RES division itself.

MR. GOLAY: I think there is another point, if I can offer a comment, which is that in order for data to be useful in modeling, there has to be a coupling between the model development and understanding that the case is being analyzed. And the lack of interaction between research and AEOD was effectively a lost opportunity that we were drawing attention to, in that AEOD has been using PRA to try to understand some events, precursor analysis, for example. But the feedback link to the research program and to setting the agenda to refining the models to understanding results that they are getting wasn't there.

So the format, for example, in which the AEOD evidence was being interpreted was not in a state where researchers could make easy use of it so it was not making the kind of contribution that could be made at fairly modest marginal cost, it appeared.

CHAIRMAN JACKSON: Well, in fact, now AEOD and research are part of the same organization and it was meant to address some of this. So, Dr. Morrison, can you give is some edification relative to what is happening in this regard?

DR. MORRISON: Yes. We are very, very much moving out based upon both the recommendations that ACRS made in this broad area as well as the comments that NRC has made.

Two things to note, one is that there has been a

recent reorganization within the Office of Research that placed HRA or actually people from PRA that had been doing some HRA activities, into the human factors area and vice versa, so that they are closely coupled and, second, this group is developing a human performance, human reliability plan that is basically going to be an agency wide plan that has its origins in research and trying to address the immediate needs that have been raised by both committees.

That plan should be available for review, I would think, by the subcommittee here at the early summer meeting so that there will be an opportunity to get feedback on the plan that is being developed.

CHAIRMAN JACKSON: What about the issue of specifically linkages between research and AEOD or research drawing on the AEOD operating database?

DR. MORRISON: Well, those have existed in the past. Obviously, they need to be strengthened. They are in the process of being strengthened. We have been working quite closely with AEOD in the accident sequence precursor efforts and we can broaden out on that particular basis.

CHAIRMAN JACKSON: Well, the question I guess I am asking you is, as part of this agency wide plan, is this issue of cross linkage and, you know, use of the database being explicitly addressed? Because you are right, it has existed all the time but the Committee is making a statement

as has made -- been made by ACRS that the activities are unrelated and that the database has not been drawn upon.

DR. MORRISON: Well, it will be explicitly addressed in the plan and what steps we will take to make sure that that continues.

CHAIRMAN JACKSON: Commissioner Rogers?

COMMISSIONER ROGERS: No questions.

COMMISSIONER McGAFFIGAN: Could I ask the relationship between your body and ACRS in looking at this issue? You are both looking at it simultaneously and reviewing plans, both finding them not very acceptable at the moment and telling the staff that they have to rework, as ACRS, Mr. Apostolakis, said, the staff is in agreement and has gone back to the drawing board.

But what is the value added of your look at it compared to ACRS or how should we think about rationalizing that?

MR. MAYO: Well, we are developing a relationship with ACRS. In my particular case, I was unable to attend their last subcommittee meeting so I personally did not participate, but our other committee members have been attending the ACRS meetings and I have seen, as mentioned earlier, progress in coordinating our activities.

MR. GOLAY: I will add one thing.

The mandates of the two groups are somewhat

different, in that our committee is concerned with the research program throughout NRC. The ACRS is concerned with the reactors, reactor-related activities of NRC and there is an intersection concerned with research related to reactors, which is the bulk of research but not entirely.

CHAIRMAN JACKSON: Okay.

DR. BOULETTE: The next subject that we wanted to discuss with you is the subject of PRA and its use in risk-informed performance-based regulations and Mike Golay will speak to that.

MR. GOLAY: The subcommittee we have on PRA has put together partly to help the research group develop the capabilities which are needed to support all of the NRC in making performance-based regulation an effective reality. So I will make my comments sort of from that perspective.

Whenever we have reviewed their programs, it has always been to try to answer questions about what do they need to do in order to be an effective support and the thing that we are seeing is that there are ways that research could be much more valuable, primarily in promoting fluency concerning PRAs throughout the agency. They participate with AEOD in training and one of the things which we can see is that sensitivity to what PRA will tell you really has not permeated very much in the functioning of the agency, at least anecdotally it appears that way when you talk to

licensees and ask, do you ever see any evidence that performance-based regulation is a reality within the agency or in terms of how you resolve issues in dealing with the NRC and the answer is consistently that there is --

CHAIRMAN JACKSON: Are you saying risk-informed performance-based regulation or are you saying performance-based regulation?

MR. GOLAY: I mean the former. I was trying to be brief.

CHAIRMAN JACKSON: Okay, I just want to be sure I understand what you are talking about.

MR. GOLAY: No, that's what I mean.

That one of the things they say is that the staff appear really not to be knowledgeable about PRA or even aware that it is one of the tools which could be used in dealing with the questions which come up with the licensees.

CHAIRMAN JACKSON: Now, they are talking about the staff lacking knowledge, are you talking at the level of the resident inspectors, at the region-based inspectors?

MR. GOLAY: It is at the regions primarily, that's right. So consistently when you ask them, well, are you trying to pose some of your arguments in risk-based terms, they say, no, because the NRC is unable or unwilling to communicate in those terms.

Which comes back then to the research program

because of the role that they play in instilling those capabilities. I think one message is that they could be very valuable in being more vigorous in this kind of thing so that if you look at the second bullet, when we say, what is really meant here, say greater use of PRA is needed in guiding regulation, it really means in terms of dealing with licensees as opposed to formulation of policy or determination of new regulatory statements.

CHAIRMAN JACKSON: So this committee, has this committee had any role in reviewing or participating in the review of the PRA reg guide or standard review plan?

MR. GOLAY: Only because I took the initiative to get those documents and review them. Had I not done so, they would not have come to our attention.

CHAIRMAN JACKSON: You provided commentary back to the staff?

MR. GOLAY: No, I read them so I could, first of all, know what they are trying to do and if I were asked anything about them have some kind of answer.

But I am saying routinely that kind of thing is not brought to our attention.

CHAIRMAN JACKSON: I see.

MR. GOLAY: As we have been working so far.

CHAIRMAN JACKSON: So research has not had a role in reviewing these documents themselves?

. 16

DR. MORRISON: Well, research has had an integral role in developing the --

CHAIRMAN JACKSON: Developing them, right. But this committee was not asked to review them.

DR. MORRISON: No. This committee generally has not been asked to review regulatory guides or anything related to the rulemaking process.

CHAIRMAN JACKSON: Okay.

MR. GOLAY: Right.

The third bullet goes to also the interaction with the licensees and within the staff in that the other thing that I at least have become aware of is with the two thrusts that are going on in the agency at the moment, one concerned with strict conformance to commitments that licensees have made, that there is effectively an interference that is being created which I would say is working against performance-based regulation in that the licensees are asking, well, should we be paying attention to the letter of the law in fine detail without regard to the substance of what is being regulated and I think they are concluding that, yes, that that is the case, at least in the past year or so.

And, contrasting that to, well, should I try to use risk-informed performance-based regulatory approaches to problems which are, as you know, concerned with the

. 17

substance. There is some variation in how you pose those arguments.

Uniformly, what I am seeing is they are basically ruling out performance-based regulation as an approach and this has, I think, an important effect because it also decreases the resources within the licensees to play ball in the risk-informed performance-based regulatory arena. So we have got sort of systematic interaction here, which is undermining the needed growth of capabilities to support that approach to regulation, both within the utilities and, I would say, within the NRC.

You know, George, in the last session, spoke about this maturation time which is needed before the licensees are able to actually use this way of approaching problems effectively and what I am observing is that in fact that maturation is being suppressed by these two parallel sort of conflicting messages.

CHAIRMAN JACKSON: So you are suggesting that the licensees are suggesting that they should be relieved from their commitments because they have no safety significance?

MR. GOLAY: Not at all. I would say it is a matter of style rather than whether they feel they need to be strongly committed because resources have to be divided in some fashion and what they are doing is putting their resources into compliance and they are taking them away from

. 18

building the capability for risk-informed performance-based regulation. So it is having an effect in that fashion.

CHAIRMAN JACKSON: Well, you know, we have a risk-informed enforcement policy and we are a regulatory agency and so I think, you know, we have to come around this issue of compliance issues versus safety issues. If, in fact, licensees feel that there are compliance issues that do not

have a safety basis, I think all of us would welcome them being brought to our attention because I think we are not interested in having compliance against things that do not have a safety case. But I think that you cannot talk about a regulatory agency not expecting people to comply with something.

MR. GOLAY: Absolutely. Absolutely.

CHAIRMAN JACKSON: Okay.

MR. GOLAY: No question.

CHAIRMAN JACKSON: So I don't think we want to get off into those kinds of pejorative discussions.

MR. GOLAY: That's right. I only wanted to draw attention to some interactions which are effecting the advancement of performance-based regulation, which I think is really one of the key contributions that the agency has been making in recent years to improving safety.

We spoke -- on the fourth bullet, we already spoke about the coupling between AEOD and research and so I don't

think we need to say more about that. And I would say that basically the agency really can be congratulated for making good progress in development of the draft reg guides, revisions to the standard review plan, development of some PRA tools like the Saphire code suite.

So in building this infrastructure, there are some good things, good things to point to, and there are other areas where, if the resources could be applied, it would be good to make more rapid progress. I would say these primarily concern dealing with uncertainty that was spoken about in the last session.

I would say, dealing with data was not talked about very much but, again, this is an area where the NRC and particularly research could be effective in that what you really need is a systematic method for collecting data in a format which is going to be easily scrutinized, permit the data to be scrutinized and transformed into a format that will be useful in PRAs, and right now we don't have that. What we have is a more of an anecdotal data collection system existing within NRC, in INPO, in EPRI with the various PRA vendors and so on. So standardization and attention to that is very important because collection of data is a long-term process but a little up-front investment can pay off by being made early.

CHAIRMAN JACKSON: Do we need the reliability data

rule?

MR. GOLAY: I don't know the answer. I am more comfortable stating the goal than addressing the tactic.

CHAIRMAN JACKSON: Well, I think we all have the same goal. I think to get there requires a tactic.

MR. GOLAY: Yes. But in addressing sort of agenda items where research might think about applying more resources, those are I would say the two primary ones.

CHAIRMAN JACKSON: Okay.

Commissioner Rogers?

COMMISSIONER ROGERS: Yes. We are talking here about PRA and we are also talking about risk-informed performance-based regulation and the point that I feel sometimes gets lost here is the value of risk, a risk-informed point of view that is not entirely based upon a full quantitative PRA but it is, nevertheless, a risk ranking, a risk assessment in some way that isn't dependent totally upon having data, reliability data, that just simply may not exist. And yet that perspective is a very valuable

one.

I just wonder what your thoughts are on that, because it seems to me that we tend to keep coupling PRA or interpreting risk-informed performance-based regulation or risk-informed regulation in any way, whether it is performance-based or not, on the notion that it starts with

21

a PRA. It doesn't have to depend totally on a full PRA. A risk assessment can still be a very valuable beginning point for looking at a system and that is happening in the materials area but -- and I wonder to what extent you are aware of that.

In the materials processing plants, that is exactly what they are doing. They are not doing PRAs but they are doing risk categorization and risk classification as part of their overall systems analysis.

DR. YUKAWA: I would just like to make a comment here that I am a member of the PRA subcommittee but also I am making this comment as a member of the AMSE Boiler and Pressure Vessel Code at ISI. There have passed now in Section 11 several risk-based inspections. They are on piping. And I think the industry will look to what the Commission will do about that to see what the future holds for them. So that should be coming through as a code case pretty soon.

CHAIRMAN JACKSON: Within months or this year?

DR. YUKAWA: It has passed all the main committees now so it should be coming up within the next, latter half of this year anyway.

CHAIRMAN JACKSON: So this is specifically with reference to piping?

DR. YUKAWA: This is for -- there are two kinds of

22

code cases. One is very specific to a very specific line, a pipeline. The other is a more general one about risk-based inspection for a larger category of pipes. The first, more restrictive one, is only for class one piping.

CHAIRMAN JACKSON: Okay.

Commissioner McGaffigan? Okay.

DR. BOULETTE: The next item on the agenda is going to be discussed by Christine Mitchell. The subject is her review of the National Academy of Sciences report on digital INC.

Christine.

MS. MITCHELL: Thank you.

I guess I should introduce this by saying it is not really a review because I wear two hats. I served on that National Academy committee as well as on the NSRRC and so what is on your handout is just a high-level set of points and I would be happy to field questions.

I think the major things that the National Academy report provided include an affirmation that although digital technology is state-of-the-art technology and continues to change at an increasing rate, there is a great deal of experience with digital technology both in the nuclear industry and in many other industries. The point being that there is a tremendous amount of experience out there, even though it is not necessarily U.S. safety system experience

23

in the nuclear industry.

The second is that the committee affirmed that digital INC has the potential to enhance safety and reliability so we agree that this is a productive avenue to

pursue, basically agreeing with agencies such as the FAA, both on the flight deck and in air traffic control, that digital technology can make an improvement as well as being a cost efficient way to go.

And finally, in terms of nuclear applications and their particular cultural history and movement from analog to digital technology, that there are some special concerns that need to be looked at that are not necessarily the concerns of other agencies. I mean, I think the aviation industry is the one that has brought forward the -- as the example most often and, just an example of how the nuclear industry is different, redundancy, as I understand it, in the nuclear industry often means two identical things that can fail whereas airplanes never run with -- one way of achieving redundancy is two different implementations and the FAA said, well, you know, it would never occur to us to run an airplane with a jet on one side and a propeller on the other. We don't have that same set of or culture of implementing redundancy. So there are some very special things that need to be addressed as digital technology is implemented.

. 24

One of the things that came up during the ACRS briefing that I probably should address is our committee did not suggest that the staff loosen its rules in any way for digital technology. We, in fact, endorse the normal and conventional way that 10 CFR 50.59 has been applied. One of our members was a former commissioner, Jim Curtis, and we spent a lot of time trying to understand what the normal process was and stressed that we didn't think digital technology should require a change in that process. So we affirmed essentially how things are done now and suggested that no change be made.

CHAIRMAN JACKSON: Commissioner Rogers?

COMMISSIONER ROGERS: No questions.

CHAIRMAN JACKSON: Commissioner McGaffigan?

COMMISSIONER McGAFFIGAN: On that last point, that is not the way the staff interpreted the recommendation and in their response they thought, based on the document that they have submitted to the Commission and we have now put out for public comment that you were suggesting that small changes, which is the heart of the debate over whether we ever endorsed INSAC 125 or we didn't and the staff didn't, that the small changes in safety are going to get there, to our end-reviewed safety question or not.

Small changes, in the view of the staff, is an unreviewed safety question and so they did reject that part

. 25

of your recommendation, you know. I know that there is probably debate. We are going to have it in the comments on the 50.59 paper. But I think where the staff has been for some time is that they did not endorse INSAC 125 over this fundamental issue.

MS. MITCHELL: Again, I think that we were very careful to say that what was intended here was that digital technology shouldn't be treated in any way that was different than previous technology. And that just because it had software or hardware that it was automatically an unreviewed safety question was not something that our committee endorsed.

My understanding was that the agency, in terms of these generic letters, has had several drafts of these letters and so there wasn't just one stand on this.

COMMISSIONER McGAFFIGAN: Could I ask a second

question that goes to what are the implications of this report for the research program of NRC as opposed to our rulemaking or reg guide efforts? Is there additional research or different research than what we are currently doing in this area?

MS. MITCHELL: The committee made recommendations for action as well as recommendations for how research could proceed or be improved in each of the six technical areas and two strategic areas, so we had some very specific

. 26

recommendations.

COMMISSIONER McGAFFIGAN: How large -- a question the Chairman doesn't want me to ask --

CHAIRMAN JACKSON: No, no, no --

COMMISSIONER McGAFFIGAN: What order of magnitude, what order of magnitude research program that we are not currently conducting or reorientation of a current program that, you know, are we talking $5 million per year? Did you get into that level of detail?

MS. MITCHELL: We didn't get into a specific number but I, as a committee member, tried very hard to prevent my fellow committee members from taking unresolved research issues or even technical issues and dumping them in the category of this needs research and this needs dollars before we can continue.

So we tried to suggest directions that could be pursued in light of where things were and where things were likely to be.

CHAIRMAN JACKSON: I just wish to point out for the record that my fellow commissioner and I are actually in concurrence. I am always interested in what the net net dollar amount is but, having spent my career doing research, I know it is very important to define what the problem is, what the research is you want to do, what scope makes sense and what dollars it would take to accomplish that scope and

. 27

then one decides on the strategy of how to parse those dollars.

I think in the end what would constitute the right program and what it would cost is something we are interested in.

DR. BOULETTE: It does raise a point I was going to mention in closing and I may as well bring it up now. This committee is unique in its ability to or in its focus in looking at the broad scope of the research program and trying to help the director to prioritize his efforts or the efforts of the staff.

These questions come up and I've got a note in the back of this folder that says the next meeting we have, we have got to talk about shutdown research because it is clearly an area that is significant. As a licensee, I know that. There has been a lot of effort in the industry to try to respond to that concern. As we respond to it, it is very clear that this is a different game, shutdown operation.

So I am sure that Dave and this committee will talk about that over the next several months and try to bring some plan to this.

MR. MAYO: May I make a statement?

I would like to add to Christine Mitchell's statements. I certainly believe there is additional research to be performed. Since I have been on this

. 28

committee for several years, we have been saying, well, we

are not doing much right now because we are waiting on the study. I have read the recommendations and the report and I believe there is a lot of substance to them and it is something that our subcommittee will be picking up at the next meeting.

CHAIRMAN JACKSON: Okay.

DR. BOULETTE: The next area to be presented to you is in the area of accident analyses and George Bankoff will do that.

George, go ahead.

DR. BANKOFF: In connection with this general idea of longer range view for this committee, I have condensed this report to just three bullets and I welcome comments. There is a lot of meat here and I would like to go over them in just a little detail.

The first thing has to do with the recent development due to a rather extensive study spearheaded by Professor Theophonus at Santa Barbara who, for which he has just received the Ernest Lawrence award from DOE on the strong likelihood of lower head integrity which means, basically, that if you have a reactor with a flooded cavity, if you have that type of design such that you can flood the bottom half of the reactor, that boiling heat transfer will prevent -- will be sufficient to prevent the failure of the

reactor, the retention in core of the melt, the core melt.

That is of such significance, obviously, that it is worth examining it more fully in the research area and justifying further work, possibly. The basic correlations have been shown to exist for various scales of the reactor and it is very simply a function only of the angle, the polar angle of the position. So in view of this, we are recommending that this be examined and maybe reallocate some money.

Now, what this means, basically, is that some reactors such as the AP 600 do have floodable cavities. That is an important thing right there. Some existing reactors also have this. Others, many others do not and so the existing program, which is part of a very large program internationally, should be continued because this does not apply to them. But it is an opportunity for the United States to lead in this area, become again a leader in severe accident technology.

The second bullet has to do with the existing codes and the current scaling methodology. I was very pleased to have a chance, and under the initiative with better cooperation between ACRS and our committee to act as an observer and a participant in the Thermal Hydraulics Committee meetings and as a result of that, I had some rather -- some severe concerns about the current scaling

methodology which I think should not impede in any way the existing process for licensing of AP 600, that is far gone and so forth. But I think that it is time, this methodology is 15 years old, it has never been really examined impartially and objectively and that it is a long-range subject for study, worthwhile, that this is a suggestion.

Finally, this -- the combining of four major codes. We have a code update program. And combining that into a single modern code is clearly a worthwhile idea but it needs to be done quite cautiously. There has been a lot of experience and money invested in the present codes, they function reasonably well. What we want to make sure is that we do it cautiously, that we don't degrade capabilities at

the same time as we add to convenience.

CHAIRMAN JACKSON: Well, I guess the question I have is, is this a generalized caution or are there some specific concerns in terms of the approaches being taken or contemplated that are problematic?

DR. BANKOFF: Well, there are some features such as the introduction of transport equations for interfacial area which in principle are interesting but the existing correlations, the existing data in general do not involve interfacial area and so the question is what the database would be when one transfers that into a complex plan.

There is a desire to simplify the codes in the

sense that they would no longer have more than two fields. This may or may not be -- this is a goal that had been expressed from the beginning but it may not be achievable without severe loss of accuracy.

They are talking about also maintaining existing integral capabilities and that is also worthwhile but it is necessary to really have a cost/benefit analysis, because those are expensive, to decide what are the gaps in our knowledge that are really important and will these proposed experiments fill those gaps.

CHAIRMAN JACKSON: Commissioner Rogers?

COMMISSIONER ROGERS: Yes. It was just on this question of experimental validation of final results.

Do you think that there are existing facilities in the world that can provide the data that would be needed to validate a master code of this type?

DR. BANKOFF: Well, I think there are lots of data that has been used to validate existing codes and the question is whether the new code would handle those data as well. We don't have to necessarily get new data. What we have to be able to do is to show that the new code will have the breadth of capability and the accuracy as well for a complex plant, because it is a very -- it can do very well one place and fail miserably in another.

CHAIRMAN JACKSON: My take is that there is a

subtlety to Commissioner Rogers's question, if I may. Because, presumably, the idea of developing this large master code is meant to address certain vulnerabilities or holes in the existing disparatized codes. If that is the case, then, you know, there is a separate issue of modeling the regions and thermal hydraulic space that can be modeled with existing codes versus going and addressing regions that are not addressed.

I am not a thermal hydraullics expert and I think the question, at least the way I would take it, would be are there existing experimental capabilities around the world that would allow one to have some appreciation for the ability of the larger code being contemplated to in fact give information in regions that the current codes do not?

DR. BANKOFF: Well, let me answer by saying I think the major -- a major consideration in combining these codes is maintainability and to reduce the cost of keeping four codes up to one. That is a major consideration. Then the question is, what about all these facilities that have been used in the past? We have facilities, for AP 600 there is an Italian facility, there is a Japanese facility. We have one at Oregon State, we have something at Purdue.

So all of these facilities, all they do is take money.

COMMISSIONER ROGERS: They are all based on some
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kind of a single aspect of the system, either modeling full height at the spec facility or modeling something else at the Rosa Facility or trying to model everything else, everything at the Oregon State facility at a quarter scale. So there are scaling questions that are involved with every single one of those facilities and now we are talking about a master code that we hope to be able to rely on but in the long run, the question really comes to something like what the Chairman has said.

Are we going to wind up with the need, really, to validate something in addition to whatever data -- provide data in addition to whatever is there?

DR. BANKOFF: The point is that any, any code that is really good and that has been developed for this kind of data should predict data from any one of these. It should not be limited. You should be able to go back, not only that to the integral scale test but you should be able to look at separate effects tests, smaller scale. It should be code which is quite general. That is the hope of it.

Now, the reason we think about caution is that it never worked out that you can make it that general, that it works very well here but doesn't do so well in some other places.

So when we say it has to be done cautiously, it has to be done with continuous checking to make sure that
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you haven't lost something at the same time as you are gaining something.

DR. BOULETTE: Isn't it also true, though, George, that the data set that is being derived for a specific code is derived with that code in mind if you want so it has limitations?

CHAIRMAN JACKSON: Right, that's what we are talking about.

COMMISSIONER ROGERS: That is what we are talking about.

DR. BOULETTE: And my answer would be there would have to be some verification.

COMMISSIONER ROGERS: And my impression is that in every one of these experiments you can get pretty good results if you adjust certain parameters. But then you readjust those parameters when you look at another experiment and that is not a master code; that is something else.

DR. BANKOFF: That has been the situation now. Blind experiments in advance are -- I mean, blind predictions in advance are very difficult.

CHAIRMAN JACKSON: Commissioner McGaffigan?

COMMISSIONER McGAFFIGAN: Just one point of clarification. The advice you are giving us at the moment sounds very similar to advice Dr. Caton gave us last fall
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when he was looking on behalf of ACRS.

Is that right? You participated with him and do you agree with Ivan Caton's --

DR. BANKOFF: On the codes?

COMMISSIONER McGAFFIGAN: On the codes.

He had some of the same concerns about --

DR. BANKOFF: I didn't go to that meeting so I can't really say.

CHAIRMAN JACKSON: I think we should move on.

DR. BOULETTE: Very good. The next subject is

materials and engineering and in this case it is Sumio Yukawa.

DR. YUKAWA: The scope of this subcommittee is to do research that helps support maintenance and control of pressure and structural integrity of the whole pressure boundary system and, as such, it includes materials, engineering and performance evaluation of components and items that primarily constitute the first line of defense in this defense in depth strategy. So it is items like the reactor pressure vessel, piping, valves and so on.

This research area has been an area that involves maturing technology, by and large, as exemplified by big programs like the Heavy Section Steel Technology Program that has been in existence for about 25 years now, the Piping Integrity Program and several other rather large

programs.

The question comes up, well, have we learned enough? And especially in these days of decreasing resources.

Yet we feel, yes, there is a need for selective research because newer issues and needs are coming along, particularly in the areas of less conservative regulations, license renewal issues and, as we have mentioned here earlier, databases for PRA.

So there is a need, we feel, to have research programs in these selective areas and in this context I would like to say that research staff has scheduled a peer review of the whole reactor pressure vessel integrity program for early July and I don't know what the outcome of that will be but it certainly will be some of these questions and issues will be covered there.

We suggest, perhaps, that there ought to be similar critical reviews of other program areas, depending on what the results of this peer review are.

Now, on the next bullet, the third bullet, the third item, I think you have received a letter already which was prompted by a question about well are there simpler or easier ways to measure some of these degradations and properties that accompanies thermal and radiation damage and so forth and I think the reply you received was pretty much,

well, there is very little hope for that right now in the near future.

Given that, we think that basic research to improve mechanistic understanding of the processes that underline engineering performance still needs continuing support.

Then on the fourth and last item, in the direction setting issues, DSI 22, it suggested that opportunities for the three C's, I call them three C's in research, coordination, cooperation, collaboration with industry and international programs and to that I would like to add perhaps that the Naval Reactors Program ought to be somehow or another included. Now there is a lot of questions about that but my impression is that the Naval Reactors Program is now releasing a lot of their at least research study results.

One in particular that I am familiar with has to do with a chemical species diffusion model that really helps to understand what the role of fatigue crack growth in a light water reactor environment is. If we had known about it or this information -- we, I mean, in particular the

Boiler and Pressure Vessel Code, if we had known this information we could have done some things differently in the code and presumably it would affect the research program also.

. 38

CHAIRMAN JACKSON: So it is called the Chemical Species what?

DR. YUKAWA: This is a diffusion model for specific chemical species in the water that has put an impact on whether or not fatigue crack growth is aided and abetted by the light water reactor environments or not and that is a very, very interesting issue and more than interesting it can be used in defining when the problem is there and when it is not there.

Now, so I just mentioned this about the Naval Reactors Program. I leave it up to somebody more than myself to try to see what can be done there.

CHAIRMAN JACKSON: So you are saying there are perhaps some opportunities in our own yard?

DR. YUKAWA: Yes, I think there is. Because after all, they are operating the same systems that we are and many of the same materials and the same engineering problems.

CHAIRMAN JACKSON: Okay, Commissioner Rogers?

COMMISSIONER ROGERS: Nothing.

CHAIRMAN JACKSON: Commissioner McGaffigan?

COMMISSIONER McGAFFIGAN: I do think that's a worthwhile suggestion to follow up.

CHAIRMAN JACKSON: That's right, exactly.

COMMISSIONER McGAFFIGAN: I wonder if we could ask

. 39

Dr. Morrison if he has had any chance to look into that.

DR. MORRISON: I haven't had a chance to look into that specific recommendation that Sumio has made. But we do maintain a continuing relationship with the Naval Reactors program and will put that specific item on the table.

COMMISSIONER McGAFFIGAN: Do you get a chance to review the Naval Reactors Research Program and have some visibility into it or is it invisible?

DR. MORRISON: No, it is more picking up instances like this when we get involved in it that we can tie into a specific request. We don't have a broad interaction with Naval Reactors.

CHAIRMAN JACKSON: A lot of the stuff is not generally available.

COMMISSIONER McGAFFIGAN: I understand. I have always felt that Naval Reactors erred on the side of -- too far on the side of keeping everything --

CHAIRMAN JACKSON: Right. I mean, I think the point is made that there is opportunity there and I think that's the point.

DR. MORRISON: Certainly on a very generic issue like this. There are as many differences as there are similarities between the Naval reactors and the light water reactors that we use.

CHAIRMAN JACKSON: Right. And perhaps we can be

. 40

more aggressive in pursing these avenues.

DR. MORRISON: Right.

CHAIRMAN JACKSON: That's your point, I think. Okay.

DR. BOULETTE: And that's a comment, again, that we were going to make in a broader scope, not only the Naval Research Program but other initiatives with the industry,

conceivably.

The next subject that we wanted to discuss is entitled Methodology of Core Research Capabilities Definition. This was going to be presented to you by John Taylor. I think some of you know John. He is a retired executive with EPRI.

John called in yesterday with the flu. I volunteered to do his presentation. I have also acquired his flu so we will see what happens.

What I thought I might do is read his words. I can do this in about a minute, minute-and-a-half, I think, and hopefully it will stimulate some questions. If it does, I will invite the members of the committee to help me out with the questions.

John says that the methodology which research has developed to define core capabilities is systematic and thorough and should provide an objective assessment of core research capability requirements. The five-step approach is

. 41

appropriate. The definition of what constitutes a core research capability, identification of the research functions where support from a core research capability is needed, development of criteria to indicate the amount of support needed for each regulatory function and the importance of that support to the regulatory mission of the agency, documentation of the staff and contract resources needed for each core capability as derived from the first three steps and identification about areas of research that needs to be assessed for core capability.

The Office of Research is to be commended for their efforts as they develop the methodology to obtain the viewpoints of the NRC user offices, NRC program managers and the national labs, deans of nuclear engineering of six universities and industry personnel involved in nuclear research. The following suggestions are made which the committee judges will enhance the results of application of the methodology.

First, 39 areas of research have been identified, primarily in terms of technical skills, where the potential need for core capabilities will be assessed. To provide a clearer basis for the prioritization of these needs, it would be appropriate to define the Office of Research's R&D objectives as well as the technical skills, where are we going, what are we trying to accomplish?

. 42

The methodology provides a detailed form of prioritization for assessing for each skill area the regulatory needs which would be fulfilled in that area. Yet, review of the two examples of application of the methodology shows a relatively small difference in capability requirements between an area of high activity, work load driven, and one which is relatively inactive, expertise-driven.

In the planned application of the methodology existing research core capabilities that derived only from the staff of the Office of Research, the committee believes that NRR staff should also be considered as contributing to core capabilities where they have appropriate skills.

From the two examples of application of the methodology, it appears that less important areas will be assigned a minimum of one staff member, a full-time equivalent staff member. This may impose a higher staff requirement than funding permits. Consideration should be

given to providing all the needed capability in such areas through contractors, particularly the national labs.

The planned scope of the evaluation that is limited to the current understanding of the regulatory environment does not consider potential future needs and we heard of one this morning in terms of shutdown technology and some research that might be useful and applicable in

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that area.

This restriction inhibits planning for new initiatives, particularly in anticipatory research. Lead times in developing new skills can be lengthy.

Although the implementation of the core capability program logically follows the completion of the assessment and Commission approval of core capability needs, preliminary planning should be defined as to how these needs will be maintained or remedied. The implementation will be difficult because of the present and continuing budget restraints and further guidance can come on priorities by assessing the specific difficulties and costs of maintaining capabilities in each area.

This capability assessment is key to maintaining the necessary research competence to permit the Office of Research to meet its responsibilities. Accordingly, it is being given in-depth and high-priority attention by the manager of the Office of Research.

The above comments are intended, on the one hand, to help meet the capability requirements in a limited resource context and on the other hand to enlarge the assessment to include anticipatory research needs.

Those would have been John's comments. Are there any questions or comments to that?

CHAIRMAN JACKSON: Commissioner Rogers?

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COMMISSIONER ROGERS: No.

CHAIRMAN JACKSON: Commissioner McGaffigan?

COMMISSIONER McGAFFIGAN: No.

DR. BOULETTE: Let me take a few minutes to close and I will be very brief. I had two points that I wanted to make.

One focused on the role of research in the NRC. As you know, the ACRS has already presented its report to Congress and I won't repeat some of those things. But I should say this committee endorses those comments made by the ACRS. We strongly feel that there is a need for continuing and maintaining research in supporting the regulatory process. We are concerned, however, that research is primarily user need driven and that probably the Office of Research ought to try to balance its resources, as tight as they may be, to allow for some preemptive or some exploratory research and we have had discussions with Dr. Morrison about that.

The other point that we would make, and it is highlighting a point that Sumio made in terms of collaboration with the Naval Research Program, we do believe and we do want to encourage the Office of Research to be as collaborative as it can be with the industry and, in particular, for example, the issue of shutdown technology and the research that might support regulatory processes in

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that sphere. It would seem to me that working with the industry collaboratively would really help there.

A point that has come up on occasions within our committee and I think with the Commission is the

effectiveness of this committee. We have struggled with that for a couple of meetings now because it is a fairly subjective question. Some of the things that we hope to do to assess our effectiveness is to be more diligent about following up on the recommendations and concerns that we expressed in our reports to Dr. Morrison. So you will see in future reports from us a bringing back of older issues that we have raised and how they have been disposed of, how they have been addressed.

Hopefully, from that kind of review, we will be able to assess how effective we have been and how much we have been able to help shape the program of research.

With that, I would say that constitutes our report.

CHAIRMAN JACKSON: Commissioner Rogers?

COMMISSIONER ROGERS: I have nothing.

CHAIRMAN JACKSON: Well, I would like to thank you, Dr. Boulette, members of the committee, and Dr. Morrison, for the briefing. It has been very interesting.

Echoing your words, our research program has to

provide a strong and independent technical capability to undergird our regulatory programs and so the Commission appreciates the committee's efforts in this regard. We would urge you to continue to work with the staff to resolve issues and concerns.

I want to highlight again the area of human factors and because operational experience has shown and you have that experience that human performance is a major factor in the safe operation of nuclear plants and, as we have been talking about, the staff is developing for review an agency wide program plan for human reliability assessment and human performance evaluation. It is expected to be available by the end of June. I think it would be useful for your committee to review the plan, particularly from the point of view of its implications for research and to provide your views to the Commission through the Director of the Office of Research on the adequacy of the plan to advance the state of the art.

DR. BOULETTE: We will do that.

CHAIRMAN JACKSON: And let me just tell you some particular things that I think are important to look at and those have to do with the ability to assess errors of commission, cognitive errors, crew performance, human/machine interface effects and is effect upon performance, information technology effects and that comes

into -- that plays into the digital INC arena, as well as relevant social and organization effects on human performance.

I think if you can provide value-added in that arena and to report those views to the office director and, through him to the Commission, I think that we have talked about the need for effective research in these areas, a well scoped out program. But I believe that scope -- cost follows scope but you have to cost it out and I think, Dr. Morrison, you have gotten some clear indication that there is interest in these areas and I think we should also take to heart what came out of the discussion with Dr. Yukawa relative to looking close at hand for some additional data and research cooperation.

Unless there are any additional remarks by my

colleagues, we are adjourned.

[Whereupon, at 12:03 p.m., the meeting was concluded.]