OFFICIAL TRANSCRIPT OF PROCEEDINGS

Agency: Nuclear Regulatory Commission

Title: Nuclear Safety Research Review Committee

Docket No.

LOCATION: Bethesda, Maryland

DATE: Thursday, January 13, 1994 **PAGES:** 1 - 252

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PDR ADVCM NACNSRRC
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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

***

NUCLEAR SAFETY RESEARCH REVIEW COMMITTEE

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Holiday Inn
Versailles 4 Room
8120 Wisconsin Avenue
Bethesda, Maryland

Thursday, January 13th, 1994

The above-entitled proceedings commenced at 8:30 o'clock a.m., pursuant to notice, D. Morrison, Committee Chairman, presiding.

PARTICIPANTS:

DAVID L. MORRISON, Chairman
ERIC S. BECKJORD
GEORGE SEGE
THOMAS E. BOULETTE
SOL BURSTEIN

PARTICIPANTS, CONTINUED:

ROBERT D. HATCHER
HERBERT S. ISBIN
EDWIN E. KINTNER
FRED J. MOLZ
NEIL E. TODREAS
THEMIS P. SPEIS
ROBERT E. UHRIG
RICHARD C. VOGEL
LAWRENCE C. SHAD
JOHN W. CRAIG
BRIAN SHERON
FRANK COFFMAN
GEORGE BIRCHARD
NICK COSTANZI

PROCEEDINGS

[8:30 a.m.]

MR. MORRISON: I would like to call the Nuclear Safety Research Review Committee to order. As you are aware, we operate under the provisions of the Federal Advisory Committee Act. This meeting has been duly noticed in the Federal Register. It is opening to the public. I would say, if any public member wishes to make a comment, please coordinate it through George Sege, our Federal Official here, so that we may have the appropriate particulars around your comment before it is given.

With that, I would like to move on to the agenda, which I assume all of our members have received. I appreciate everyone showing up bright and early this morning. Especially I would like to welcome our newest member, Bob Hatcher. We are pleased you could join us, Bob. I think you are well known to the Committee members with your activities in the field of nuclear power.

MR. BURSTEIN: I am surprised you are letting down the mission requirements.

[Laughter.]

MR. HATCHER: Notice where he is sitting.

[Laughter.]

MR. HATCHER: I can see that. There is a large osmotic gradient between solid and liquid.

MR. MORRISON: Well, I hope you will be his mentor during this meeting and make sure that things happen appropriately.

With that, I would like to turn the meeting over to Eric Beckjord for a few opening remarks.

MR. BECKJORD: Well, I want to join Dave Morrison in welcoming Bob Hatcher. It is a great pleasure. I am glad to see you. It has been some time in the making. We are delighted that you are here.

We have a ceremonial occasion to observe, but we are going to await the arrival of the photographer for that purpose. So, I will pass on for the moment now.

As you know, the term of Committee members is two years, for a total of three terms, making six. And we have a -- several of your members will be leaving the Committee this year. Our Chairman for these four years now, Dr. David Morrison, is one of those who will be leaving the Committee. I want to come back to that, as I say, when the photographer arrives.

We do have the matter of a new Chairman. Dave and I have conferred on that, and we have -- we are proposing to you that Ed Kintner will serve as Chairman, beginning with the meeting in -- the next full meeting which, have we scheduled? We will be scheduling that in June. We are proposing that Ed Kintner become the Chairman effective as

of that meeting. Ed has served with this Committee a number of years. I certainly look forward to his chairmanship of this Committee. I think it will be a very interesting time. Is there anything that you would like to add?

MR. MORRISON: The only thing I would add to that is we have had some good discussions with Ed, and I think that he will make a very good Chairman, and quite an easy transition for this particular committee. I have been very pleased to serve as Chairman for the last four years. I think a lot of credit to the Committee and its operations goes back to Neil Todreas, our first Chairman, who really got us started in the right direction. So, I think, Ed, it may be up to you to fill the shoes more of Neil who got us started right and carry us on into the future, than what I did as a caretaker in between.

But, getting back to the next meeting, George will be surveying each of the members to see what availabilities there are in May and June. We want to try to get this scheduled as soon as possible, since the Commission did ask us a couple of months ago to meet with them again. In fact, if my memory was correct, we had a date scheduled in November which would have been very difficult for us to make at the time it was scheduled. Unfortunately, because of other commitments, the Commission had to postpone that meeting, and they decided that they would then meet the next

time after this meeting that we set on. So, we will be planning to meet with them in May or June, whenever our next meeting is scheduled.

I would say, unless something comes up in our discussions of the Subcommittee reports, and that there are some real burning issues that need to be addressed between now and then, that the next full Committee meeting would be the next activity of this Committee. Now, we can defer that obviously until we find out what the Subcommittee reports have uncovered and whether there is anything that needs to be addressed by a Subcommittee. But, having read the drafts of the Subcommittee reports, I didn't feel that there were any open issues that were that timely that couldn't wait until the next Committee meeting. So, that will be an item we want to cover later in the day as we go along here.

I think that's all of the items I had.

MR. BECKJORD: Ed?

MR. KINTNER: I would like to say a few words. George called me and said what I would say if I were asked -- what would be my reaction. The first one is fear. Dealing with this bunch of curmudgeons, Burstein and Isbin and others, would lead to frighten anybody I would think, trying to get some kind of sense out of it. Second part of the fear is that, as I think everybody knows, and we have talked about it before, this program is entering into -- is

already in the beginning of a very very difficult time period for it -- the question of funding, the question of the resources -- personnel resources, and so forth, the question of the declining, as I see it, the declining forecast for nuclear power generated, the continued pressures in the industry to look for cheaper ways to generate electricity and so on are going to make for a very interesting part to look forward to.

I was reminded of a story that Abraham Lincoln said. Somebody was being carried out of town, tarred and feathered on a pole, and he was asked how he felt. He said, well, he would feel pretty bad, except for the honor of the thing. So, that is the way this is. It is an honor sort of to follow Todreas and Morrison in the job. Also, it is something of an honor because I really do think the Committee has an important role to play. It is a very very difficult role. It has, on the one hand, to maintain an independence of thought and action, as compared to the Department and the Division, but it also has a role -- it has to be a role of support -- to try to do whatever it can, whatever it says, in whatever arena that really does strengthen the final product of the division.

I might say one other thing which really bears on this and it one of the reasons I was willing to serve on the Committee, and one of the reasons -- I have got to say, I

didn't ask for this job. I did get a little arm-twisting on it. I have been promised to be relieved as soon as possible.

One of the reasons I agreed to do it is that I am absolutely firmly convinced that the answer to the problems of nuclear energy, whether it is the public -- the fear of radiation, the way we design and engineer plants, the way we operate them, the heart and soul of all that is eventually research -- that is to say, this is a field in which we don't know all of the answers by any means yet. We guess at them. We take steps that we hope mean for a safe operation. But, in the end, the only way that these things are going to be rationalized is by research -- by hard, tough, objective research. The only people who are doing much of it, at least in this country anymore is this division in the NRC. The industry is not doing much and not very many other sources of funds or even interest in doing research of any significance. So, what this Committee does to assist the division in making an effective and pertinent research program, I think, to the degree it can do it, is important. And, to the degree that the Committee can help and that I can help in any way as Chairman, we will do it.

MR. BECKJORD: Thank you, Ed. We are delighted that you are stepping up to this job, and looking forward to working with you on the Committee in this time ahead.

Let's see, do you have any comments on the agenda that you would like to make?

MR. MORRISON: Yes. I would like to make just a couple of comments on the agenda, as I think everyone has seen the agenda. We will spend whatever time is necessary today, reviewing the Subcommittee reports and the deliberations that follow these things, so that we can hopefully adopt the Subcommittee reports on behalf of the Committee and transmit them into Eric.

Late this afternoon I want to start a discussion of how we should approach responding to the questions that the Commission raised to us when we had our meeting with them this past year. It is not my intention this afternoon to develop the answers to the questions, more to make sure that we understand what issues we ought to bring up and how we should approach those questions. So, then tomorrow we can look at the individual items that were raised by the Commission and try to reach some sort of a Committee consensus on our thoughts and feelings about these, if not the answers to the specific questions that were raised in the staff memorandum to us.

One of the things that I think will be of very good input to this is the letter that Eric sent to us, I believe it was in December -- December 30 letter which I hope everyone has that with the attachments. If not, we

want to make sure that you have got it. It is a resporse to our July 7 and 8 Committee Report. Did everyone get this letter with the attachments?

MR. TODREAS: No. We have copies available for those of us who didn't get them or who left them at home. George, would you see that that happens?

MR. BURSTEIN: I think there are a lot of the same topics that were covered here.

MR. MORRISON: In fact, we raised them at our meeting and Eric has responded to them and there is some very good back-up information that I think will guide our discussion both this afternoon and tomorrow.

MR. BURSTEIN: Along with the staff requirements memorandum of July --

MR. MORRISON: Okay.

MR. BURSTEIN: -- if that would be convenient.

MR. MORRISON: Given that it is a fairly open meeting, we haven't planned a lot of staff presentations at least in detail. I have asked George to structure the agenda such that we, as a Committee, could spend more time than we normally do in discussion and less time than we normally do in listening to staff presentations, which I think is essential for us to have a meeting of that type to be able to address the questions. If we finish early tomorrow, we can leave early. If not, why, we will go to

the scheduled 4:15 adjournment time.

Eric, did you --

MR. BURSTEIN: Ladies and gentlemen, we ought to pay attention.

MR. MORRISON: It is a new management technique. Do you have any other comments at this time, Eric?

MR. BECKJORD: Only when the photographer comes.

MR. MORRISON: All right. Well, we will bring him and get back to the other item.

Let's turn to the Advanced Reactor Subcommittee Report. Neil, I will ask you to lead the discussion on that report, if you would, please.

MR. TODREAS: The first thing I wanted to clarify is, if people have had a chance to read over it, I just received a copy myself two days ago from the end of the chain, after I released it. Apparently, although it was released before Christmas, because of the holidays and the fact I didn't communicate with you directly, it took awhile before it got mailed to the members. So, I am not sure how long they have had it in their hands, and whether they have had a chance each one to read through it thoroughly. That would dictate in a sense how to conduct the discussion.

MR. MORRISON: I apologize for that. I gave it to my secretary shortly after you gave it to me, so I didn't look and see that it was the fifth of January that was the

date she sent it out.

MR. BURSTEIN: Is this the one dated December 21, Neil?

MR. TODREAS: Yes. And it's -- it has got the heating Subcommittee-approved version submitted for Full Committee endorsement at this meeting.

What I would propose to do is just remind you of the headings in this report and to let you know of relevant activities that have transpired sense the December 21st draft, which in this area a few cases exist. And then we can just go on to a discussion of the points you bring up. I will not review the essence of the text, since I presume you have read -- you will have had a chance, or you have read through this as I am talking.

On page two, the boiler plate is over and we start with the substance. There is a heading at the top of page two with an overall perspective regarding the completeness of research activities for advanced reactors. We explored that through the discussion and we found the need, in several areas, for the NRC staff to clearly state the position. The position typically is that there is a technical basis sufficient, such that no research is needed. But, we wanted to staff to take their position, defend it and do so in a disciplined way that backed up and confirmed the discussions that were presented to us at the meeting.

The second hearing deals with thermal hydraulics analysis. It is particularly focused on the RELAP5, mod three. The first activity in the first activity in this whole area the Subcommittee dealt with was the idea of mounting a test facility -- getting that approved, getting that under construction, getting that started. That was the whole activity associated with ROSA. That went on -- it was about two years ago now. The Subcommittee was influential in that activity. The ACRS had a position, the staff, through RES and its director had a position, the various commissioners who were involved. Finally, the whole thing was resolved and ROSA was launched.

The whole idea of ROSA is to get data to confirm a code so that the Code can be used to be effectively the basis in the certification process. So, now the focus shifted to the adequacy of the technical activities at INEL and the technical capabilities at RES to execute this really key code development.

And, as the text refers to, there are two types of problems. There is a real problem associated with direction and effectiveness of technical capability being applied to the job. Then there is another problem associated with getting a constructive interaction among the various organizations that are both doing and overseeing this activity. And, in both cases, there was a need for action.

The request for action is written in the report.

Subsequent to this meeting, and, in a sense, as an outgrowth of the meeting, because Eric was at the meeting and we had a rather full discussion, within the NRC, there was a task force set up to bring focus and a thrust to try to accelerate resolution of both types of issues I talked about -- one bringing enhanced technical capability on the job and two, trying to smooth the interactions, make them constructive among the oversight groups.

There was an ACRS meeting in early January that was a focal point where the contractors and RES were to present their status to a technical review group and, in a sense, that could be a watershed on reestablishing a good, firm, mutually-supportive interaction and model for progress for the future. I was going to attend that meeting and I was not able to make it because of weather. In our discussion we might wind up hearing maybe from Eric on both the task force and the latest meeting interaction, to see whether that has an effect on our report.

That brings us go page four at the top. We did because we had Spence, we had Sol, we had Tom Boulette, we did get into engineering materials and components issues. We went through those. The result was generally as I had indicated. It didn't appear that research was necessary, but it did appear that position statements were desirable.

there was on exception, and that had to do with check valve reliability. On that, we asked for and are awaiting the RES position.

At the bottom of page four is a reference to two topics that have come up at previous Committee meetings, such as reliability of passive safety systems, and second is modular construction.

On the first, an NRC study that was underway at Sandia was terminated upon their close review, based on our questioning of the utility of that activity. There is a workshop that -- preparations for that have been going on. This will be held at Brookhaven, conducted by Brookhaven. I gather at Themis' suggestion, and he has been a part of this, the person who is organizing the workshop, Youngblood, has been in touch with me and made me aware of their efforts and their focus to try to set up the workshop. So, in terms of my service as Committee Chairman, I am trying to be supportive to him and give him the benefit of the history of our interaction. But, in no way are we dictating the scope of this workshop. It is the NRC's workshop. The benefits of that workshop need to be carefully considered, in context with the program for that. But, I know there is attention being paid to it. I don't know yet how well this will all come out, because it is a tough topic.

On modular construction, we were not brought up-

to-date on the resolution of our last comment that's here. I don't think that is a particularly difficult issue, but we would like to close the door and remind the staff that when we have gone through items in there on our list, we would like to close them all out.

Then finally, on the severe accident issues for advanced reactors, because of Herb's participation in our meeting and his prior meeting with the Severe Accident Subcommittee, I think we were able to have a very smooth interface of the total Committee's activities relative to oversight of severe accident issues. That interface, in terms of this Advanced Reactor Subcommittee met. There were presentations at our meeting that were focused on the severe accident area specifically as it impacted advanced reactors.

We went over this. We had I think very good presentations from Brian on this area and Farouk. And it was made clear to us the design features of these reactors and then the logic for what phenomena would be important and how the NRC was mounting efforts to go down the line and pursue these design features.

So, page five which concludes the report on this subject, is basically a summary of this. While it doesn't have the words, it says everything looks okay. That is the summary of the report.

MR. MORRISON: All right. Thank you, Neil, for

the summary. I would like to do two things. One, we will break to take care of the other housekeeping items. While we are breaking, if the other members of the Subcommittee would like to think about any comments they want to make, I think we should come back issue by issue, Neil, and try to reach closure on each of the individual of the five issues you raised. Let's break now for the presentation. We will go off the record.

[Whereupon, the Committee conducted an awards presentation, held off the record.]

MR. MORRISON: Let's reconvene the meeting then and deal with the report by the Advanced Reactor Subcommittee. Why don't we get into the first topic on the overall perspective with regard to what is the completeness of the research activities? I assume by your remarks, Neil, that there was a fair discussion of this at the meeting, but you felt that the staff wasn't the one that was articulating the position, that it was the Committee that was doing that?

MR. TODREAS: No. They were articulating the position; but they weren't leading the discussion relative to questions in these areas. Let me say it has been particularly focused on materials and components issues. And we had a number of questions, positions -- questions as to what the positions were. So, we were driving the questions. We would finish one and another one would come

up. While we went through them all, we would like -- I guess it is Larry -- Larry is ready to respond quickly here. But, we wanted Larry, through Eric's office, to draw up and be explicit on the position through a number of these activities.

MR. SHAD: That was resulting from the meeting in Boston?

MR. TODREAS: Yes.

MR. SHAD: I think Chuck Serpan was there. I wasn't there.

MR. TODREAS: That's correct.

MR. SHAD: Yes. I would like to make some comments on this paragraph here. In the engineering area, most of these operating reactor research and license renewal research, they are applicable to advanced reactors. We only initiate advanced reactor research when the designs are sufficiently different or the current research is not sufficient. So, we have quite a lot of research in the Advanced I&C area, such as a look at the effect of EMI, radio frequency and smoke, et cetera. And also we have a lot of research in the structural design and construction area which are quite different from current reactors. Some of the examples are modular construction, experience space, seismic design, the new proposed criteria for piping design. So, altogether, we have about a total of $3.5 million in the

engineering area.

In the material area that you asked, like fatigue, 50A Class 3 Steel, AGN reactor internals, the reason we don't have research in this area is because we have sufficient research in the operator reactor area. All of the work in the operator reactor area are applicable to advanced reactors.

MR. TODREAS: What I would just suggest then in response -- this is -- this and the paragraph later basically question -- asking you to document that. I am sure -- and if I speak a little to emphasize a position I know Sol particularly holds, I am sure we are not trying to stimulate new research in areas of this sort, particularly when you feel and can lay out very clearly that what is existing, what is going on is sufficient.

MR. SHAD: Yes.

MR. TODREAS: That would be fine. This just reflects part of the ongoing dialogue. But, it might be useful -- for example, you did say in the structural design area you do have research going on.

MR. SHAD: Yes.

MR. TODREAS: That is probably, in retrospect now, the research we should have reviewed --

MR. SHAD: Yes.

MR. TODREAS: -- at the time. Now, I would say on

the modular area, you guys dropped the ball, because we had raised it. That was an open area, and you guys should have come back to us on it.

On the seismic area, I think collectively somehow we should have gotten together with you and realized that it was new, interesting research and we should go on and look at it. But, we can do that on the next round, if you respond and tell us on this.

MR. SHAD: Yes. If you remember, just before the meeting I think you and I were on the phone and I said this one mostly is Brian Sheron's program. Maybe we can do it in January or February -- we can give you a more detailed briefing about the programs.

MR. TODREAS: That's right.

MR. SHAD: So, at this Boston meeting, we really -- I just sent --

MR. TODREAS: Yes, we held it to one day.

MR. SHAD: We didn't have sufficient time to do it in Boston, so I suggest we do it sometime this year.

MR. KINTNER: It doesn't talk to seismic at all, does it?

MR. SHAD: In the Boston meeting nothing was covered in seismic or in some of the other design or code areas. So, I think we need a separate meeting on this.

MR. TODREAS: Larry, I remember now did bring it

up. At the time, it didn't sound like I guess to Spence and myself as hot a topic for discussion as trying to pin down the status of these other things.

MR. SHAD: Right.

MR. TODREAS: Maybe in retrospect, we need a half an hour update on seismic, maybe even sometime over the next days.

MR. SHAD: Yes. We have one very hot issue -- so called industry proposed criteria for piping design. They want to change the ASME code, and they have some problems. We can give you a briefing on this. This is a very -- it is going to be a very hot area.

MR. TODREAS: Okay. The seismic issue though that I remember very well that we had brougnt up in I think the Committee as a whole is we have been very interested in your efforts to try to close on these criteria between the EPRI and the Livermore.

MR. SHAD: That is doing very well. That should be finishing September/October of this year. We have a project together with industry, DOE, EPRI, NRC. We are well on the way. I think the project will be closed some time in September and October. Hopefully the issue will be closed too.

MR. MORRISON: Sol?

MR. BURSTEIN: I think Neil has characterized my

concerns, as well as other members of this Committee very well, in the sense that nobody here that I know about is seeking expansion of the research effort. We are seeking to -- I think the word was closure that so many people dislike on a number of areas. Yet when we discussed these items the concern is what is the basis for saying we now have enough information or it is being carried out somewhere else?

Now, in the Advanced Reactors group, we have certain very sensitive things that are unique to advanced reactors. While we talked about check valves, for example, as being a nuclear plant disease, the low differential pressures that concern us are probably applicable only in certain advanced reactor locations. That is why, in that instance, it becomes a matter for this Subcommittee and not one for maybe some other jurisdictions. So, you have a problem of helping us designate the areas where work on let's say these check valves or aging or something else is generically being conducted. And we talked about this in the Aging Subcommittee meeting. For example, aging begins on day one and we have identified no new areas. Still, we are talking about a 60-year license for the advanced reactors, and that may imply some differences unique to this particular area that might not be applicable elsewhere.

Let me call your attention, if I may -- this is an inside discussion that members of the Advanced Reactor

Subcommittee have had -- to the top of page four, where the top half of that page is devoted to the same subject that the last sentence on the first paragraph, page two discusses -- and to see if you have any difficulties in the light of this discussion with anything that is said. If I may, Mr. Chairman, there are some words here that ask, the staff to do things. I just wonder whether, in the light of what we have said, that presents you with any particular concerns?

MR. SHAD: On page four, I am reading right now, really, I have no problem with here. But, all of these area -- we do have research for operating reactors and license renewal that are applicable to advanced reactors. As you say, we don't want to reopen a new program just because of advanced reactor. There is some new research in the operating reactor. For instance, this SA508 Class 3 steel -- we have a program on this. Fatigue -- we have a program on this, and they are applicable for 60 years. We have -- all of the programs we did right now -- we extend it to 60 years. So, whatever the age of the program, it is good for 60 years and it is also good for advanced reactors. The reactor internals -- the so-called radiation assisted intergranule stress cracking, we are programming this. They are applicable for advanced reactor. So, all of these programs - except check valve -- we do have a new program, because that is different, as you said. Small differential

pressure, we have a new program on this. All of the other programs -- we have programs in the operating reactors and licensure, and they are applicable to advanced reactors. But, in the structural area --

MR. BURSTEIN: May I ask, in this context, Mr. Chairman? There are places in the budgets where dollars may appear let's say for fatigue, and I don't know whether they appear under an advanced reactor umbrella or under some other generic heading and whether that influences where we might be discussing the technical features of these specific items.

MR. SHAD: The fatigue does not appear in advanced reactor project. It appears in open reactor project, because we don't need additional -- as you said, and we agree with you, we will not do any advanced reactor research unless there is sufficient difference in design criteria.

MR. BURSTEIN: I hope this discussion has helped. It has certainly helped me, and I hope it has helped the other members of the Committee understand the differences between what we were addressing I think, Neil, specifically, and the answers we were getting.

MR. MORRISON: As I am hearing this, and certainly, the record itself will help clarify it, I would just question whether we need anymore words in this text. Because the sentence that comes through in a very blunt

manner is, "at this time..." -- which indeed is a qualification -- "...no addition topics for research applicable to advanced reactors were identified by the Subcommittee, and no additional research has been identified by NRR or RES." I accept the Subcommittee's intention that we don't want to identify necessarily anymore research. On the other hand, it seems to me, when you put that in a different context, it sets the level of expectation by the industry, as well as the regulatory guidance that may come out of the research program, with regard to advanced reactors. It is basically a very bold statement. It says we know enough, or that there aren't any major issues that we need to reopen or address further. I just want to make sure that we, as a Committee, feel comfortable about such a bold statement?

MR. BURSTEIN: Excuse me. Are you suggesting we add the words "at this time?"

MR. MORRISON: Well, you have "at this time" in there now. Is that sufficient qualification so that, if something comes up two months from now, we don't feel embarrassed?

MR. ISBIN: I think that is absolutely correct.

MR. KINTNER: Could I talk about the question -- it is perhaps premature, but, in looking at it from another perspective, it may not. I think the discussion we have had

so far leads up to this. These plants, the evolutionary, as well as the passive plants, are sufficiently different from present ones in systems designs, not -- the technology is supposed to be the same, the materials and the heat transfer coefficients and so forth, so that no question would arise from those fundamentals. But, the systems are so much different that I would, on my own, want to have a very thorough preliminary set of tests -- tests, not just check out whether this pump runs, tests of all of the codes and considerations that go into the design before I would want to take that plant critical.

And the question of what those tests are I would presume would come up some time in ITAAC and so forth, is a long way off, maybe never, if nobody builds one in the United States. But, the question of what those tests -- those pre-operational tests on a fuel plant would be could in fact color the testing you do on ROSA and so forth. The question I raise is whether somebody shouldn't be thinking about that in some small way and relate that back to what testing is going on in all of the shorter-term timeframe? Do you understand what I am saying, Neil?

MR. TODREAS: The reason I am having trouble is the testing you are talking about is vendor-required testing. And you are saying the results of that will feedback to research needs?

MR. KINTNER: Yes. Let me tell you, the vendors are not going to do it to the degree it ought to be done unless somebody on the regulatory side says we need this to confirm. They are going to say we know all that, we will just go ahead and start it up and run.

I go back to Mark I. We built a full-scale plant, non-radioactive at Bettis, and ran all of those hydraulic tests of all kinds, including a core -- represented the Mark I core, to get a full understanding of all these issues before we went critical on Mark I. I don't know that this has to be -- nobody wants to build a prototype; but, thinking about what preliminary tests you do beyond what -- this come back, to some degree, to my own distrust of codes. I mean, you can write codes, and you can test them at Oregon State and ROSA and so forth. If you are going to take a reactor to power and run it for 60 years on the basis of that without testing it in full size in the actual machine, I guess my question is, I wouldn't. If you wouldn't, then maybe that colors what you would do in the meantime with the shorter-term testing program. Do you understand now?

It is awfully early -- or maybe it isn't early -- to think about it.

MR. BURSTEIN: Excuse me. We are getting into a discussion about what an owner might do and the risks that any enterprise might possess, versus the analysis and the

experiments that are necessary to verify a regulatory approval environment. I think there are two different animals, if I may say so.

I might be willing to take the risk of running a reactor, without having a full-scale test, as long as there are a bunch of other reactors out there that have already been run. That is the case. Now, when we start talking about systems, I am not sure I know what you mean. But, certainly, we have argued long and hard about the system experiments that are being run at this time at ROSA, at Argonne, at other places, to verify the codes and the analysis.

Now, to mock-up a full-scale SBWR system might be something that General Electric and Northern States Power might want to do together, but is that essential for licensing?

MR. KINTNER: No. I am talking about a series of tests on the first machine that you intend to run as a power reactor. Preliminary --

MR. BURSTEIN: I don't think that is in the nature of regulatory research. I think that is in the nature of a commercial relationship.

MR. KINTNER: Right. But, I will say two things. One, thinking about what those tests would be should presumably make some coloration of the research program that

is research, and, secondly, unless somebody thinks about it, it ain't going to be done as well as it ought to be done. I think the regulator is going to have to press the industry to do it and do it right.

Sol, the reason that I am so sensitive to this is that I have tried very hard in that arena to get people to think about this and actually to recognize that they are going to have a full-scale prototype so far as the machine is concerned, to do these tests, and nobody give a damn. I mean, they are going to depend on RELAP5 or its equivalent in other areas. I don't think that is enough. So, and you are right, there is a difference. All I am suggesting is some thought might color the way these people look at the test program that they want run on their test machines.

MR. MOLZ: Well, I am certainly far from an expert in any of these areas. But, whenever anybody mentions relying on a code to do any kind of a test that people think needs to be done, I really get shivers about that. I am not high on code evaluations of real world things. So, a lot of what you say makes sense.

MR. TODREAS: What I am trying to figure out is on this top paragraph where are we going. Dave, you raise a question is it a sufficient caveat to say at this time the -- as I think about the real exception is when you talk about advanced reactors we are only talking about what is in the

purview of this Committee. There is certainly a lot more research needed in the I&C through that other Committee. So, somehow this sentence has got to refer to Ed's other Committee. Then this second point, while I understand what Ed said and agree with what Fred said, I am not sure what to do with it in the context of this paragraph, unless -- other than to take it as a general warning, which I think that "at this time" means just at this time. I can envision six months down the road we are going to find new research. And, if somebody thinks the finding of new research and the desire to launch it will be impeded by a sentence like this because it will be misread and misinterpreted by others, then we ought to do some surgery on it, because the door is certainly not closed forever. Forever I think means probably starting in June we will start to find stuff.

MR. SHAD: We do have new research right now, that is what you describe here.

MR. ISBIN: I am sorry. Would you repeat that?

MR. SHAD: We do have other advanced reactor research other than what you described here. As I said, a lot of seismic research -- you see, I don't know whether you are familiar with advanced reactor cooperating in a first of a kind during -- before the ITAAC has established the first of a kind during -- they have four topics. Two topics are in the seismic area. One topic is the new proposed criteria

for piping design and the seismic loading. The other topic is experience-based seismic qualification. So, the industry will spend a hundred million dollars on these four subjects in this area. And we do have programs in these areas.

MR. TODREAS: The way you have got to read this paragraph, Larry, is you have got a research program. We went in the meeting and started asking all kinds of questions about design features and things like that. As a result of all of those questions, nobody decided hey, there is a gap and we need a new research program to close it. That is what that paragraph says.

MR. SHAD: Yes, I know. But, the thing is that we have only one person there. I thought that meeting was not talk -- only talked about the reason we only had one person there -- about the subject would be covered in February or October or September.

MR. TODREAS: Well, okay. I understand that. Even that one person was able to answer all of our questions, along with Brian in particular. They were able to answer all the questions and close off any indication that hey, this Subcommittee has come up with some holes in the program, and you guys ought to go back and launch a new research program. If you had five you couldn't have done it better.

MR. MORRISON: I think perhaps the surgery, Neil,

might be to tie it back to the second sentence in your letter -- that the agenda covered simply the thermal hydraulic engineering materials and components, passive safety -- passive system reliability and spare accident issues. If we could find a set of words to lead us back there, I -- I like the conclusion that you reached, but I just want to make sure that we have kept ourselves reasonably covered by this.

MR. TODREAS: What I would propose is during the day let me do the surgery, and we come to a final ratification of that point later.

MR. MORRISON: Fine. I think that would be quite appropriate. Well, why don't we look at the thermal hydraulic analysis capability and the issues that the Subcommittee addressed there. Do the members of the Subcommittee have any additional comments besides what Neil has presented?

[No response.]

MR. MORRISON: Neil, as you went over this particular section of the report, you noted the formation of a task force within the NRC at the ACRS meeting. Did anyone attend the ACRS meeting? Does that shed any light on the subject?

MR. TODREAS: No. I was supposed to -- as I said, supposed to go, but I didn't get there.

MR. MORRISON: Herb, were you able to attend that?

MR. ISBIN: No one invited me.

MR. MORRISON: No one invited you? All right. So, we have no insights from that. Eric, do you or any of the staff want to comment on the task force, just to give us an insight of where that is and where it is going?

MR. BECKJORD: Yes. We have just -- I received the task force letter last week. I don't have a copy of it with me. We can have one for the meeting tomorrow. Brian, would you summarize the -- since you are a member of the task force, I think you can give us the best summary of the conclusions.

MR. SHERON: Well, what the task force did is we interviewed a number of let me say experts and knowledgeable people in this area. Professor Todreas was one in this area. We also interviewed the thermal hydraulic consultants which are Professor Hassan from Texas A&M, Professor Mahaffey from Penn State, Professor Ransom from Purdue, and Professor Peter Griffith from MIT. We also interviewed Professor Catton, who is Chairman of the Thermal Hydraulic Phenomena Subcommittee. We interviewed Professor Baratta from Penn State -- the reason being that Professor Baratta had spent six months at the NRC on a -- it is like a sabbatical. Therefore, he had some first-hand knowledge of the capabilities of the staff and had attended some

Subcommittee meetings -- ACRS Subcommittee meetings.

The upshot of all of these interviews -- and we asked them a series of questions, with regard to such things as how accurate do the codes need to be for the purposes which the NRC is going to use them, and, in general, what are your thoughts about the current efforts and where the future is. I think there was a consensus almost with everybody that one thing we need to do is make more use of some of the expertise and talent at the universities in the area -- thermal hydraulics. There needs to be a way in which we can involve experts in various areas more directly in the program and call upon those experts when necessary to help us in terms of either defending the codes or whatever before some of the oversight committees.

We also concluded, in general, that the staff probably needed some enhancement in the technical area. We noted that, with the addition of one individual, Mr. Joe Kelly, to the staff, that we have started that process. We -- the task group had recommended that perhaps two or three more individuals of the same caliber of Mr. Kelly be added to the Reactor and Plant Systems Branch Staff. That is something I guess Mr. Beckjord will have to take up with the powers that be in terms of staffing levels and so forth. But, basically, the upshot was that there is a general enhancement that will be needed in this area if we are to

maintain excellence, if you want to call it that, in the thermal hydraulic area, as opposed to say just maintenance. That is sort of, in a nutshell, what we concluded with the task group.

The implementation of some of these recommendations I had planned to address in my presentation tomorrow morning on maintaining code expertise. I could do that now if you want or I could just wait until tomorrow morning and give you what our plan is in this area. And, if you would like -- I was in attendance at the ACRS Subcommittee meeting on January 4th and 5th -- if you would like it summarized, I could try to give my impression, if that would be helpful.

MR. MORRISON: Do you think that that would add something?

MR. BECKJORD: Yes, I think it would. I would like to say one thing first, to explain a little bit more about this task group on thermal hydraulics. It consisted of -- there were three members, Ashok Thadani, of Nuclear Reactor Regulation was the Chairman of the group, Brian was a member, and Warren Minners was a member. Warren -- in fact, this was Warren's last service to the office of Research, because he retired at the beginning of January after along career with the NRC.

The group met in December. It got under way in I

guess the first or earliest part of the second week in December and completed its work by -- right after New Years. I received the -- the formal report of the task group was followed up by a few days. I received it last week.

The genesis of the group really came from a conversation that I had with Neil in the middle of the fall regarding the thermal hydraulics effort, in which -- in the course of the conversation he expressed some concerns that he had about that effort. He felt that, in particular, the comments and criticism that the ACRS Subcommittee on Thermal Hydraulics had made relative to the -- primarily to the AP600 thermal hydraulics effort, but, to a lesser extent, on the SBWR. And he felt -- his view was that we really needed to take those criticisms seriously and deal with them in one of two ways. One way would be to say, yes there is a problem, w are going to -- this is our definition of the problem, and here is what we are going to do to fix it; or alternatively, we could say we recognize the comment, but we have concluded, for the following reasons, that the code, as the case may be or the correlation, whatever it is, is considered adequate for these reasons and that it does not have risk or operational significance relative to the design. So, I thought about that and talked with some of our people and concluded finally that the best way for us to approach it would be to have our own internal review of the

effort for these two conceptual designs. So, I decided to ask this group to undertake that review on a very quick schedule and give their advice. I wanted the user office to be centrally involved in this, and that is why I asked Dr. Thadani to chair it.

They reviewed -- there were a number of questions that were given to them -- questions such as what is the -- what level of verification and validation is needed? What are the criteria that we should apply to our thermal hydraulics research and the related code work, so as to decide when we have developed an adequate answer to the questions when have we done enough? This was the type of question that was put to them.

And, as Brian said, the task group undertook to interview a number of people in this area and to consider the status of work on the advanced reactors, and then to come back and tell us what they felt should be done about the situation. So, that is the context for this activity. I have received that report now, and are in a stage of deliberating how to apply it and what actions to take.

MR. ISBIN: Your use of the term "interview," these are discussions singly with each of the consultants? Is that what you mean? Was there a group?

MR. SHERON: We met with each of -- everyone that we talked with we met with individually, with the exception

of the thermal hydraulic consultants, okay, which is Mahaffey, Griffith, Hasan and Ransom. We met with them collectively.

MR. ISBIN: Aren't these all thermal hydraulic consultants that we are talking about? I am a little bit confused now.

MR. SHERON: I use the word consultant in the sense that they are -- we are funding them, okay? I mean, we are not funding Neil, okay? But, we interviewed Neil.

MR. ISBIN: Individually? I am just trying to get an idea of what. Okay?

MR. TODREAS: Yes. They had an interview scheduled with a separate discussion. I presume you did the same thing with Catton?

MR. SHERON: Yes.

MR. TODREAS: And there were -- I forget how many others were present?

MR. SHERON: I think the ones who were separate were you, Professor Catton, Professor Baratta. And then the four thermal hydraulic consultants -- we just had an open discussion with them because it was during one of their meetings.

MR. ISBIN: So, you need to make a decision now, is that right, Eric, on the basis of this report?

MR. BECKJORD: Yes.

MR. ISBIN: And when might we hear what you will be doing?

MR. BECKJORD: Well, it will be soon. I mean, it will certainly be before the next meeting.

MR. ISBIN: Will it be partly in response to this letter?

MR. BECKJORD: Well, I think the -- I view them as separate matters. I mean, there will be a separate response. Depending on the timing of our response to this letter, we may deal with it -- we may describe what we will do in the letter. We haven't really formulated -- since we haven't received the letter yet, we haven't decided when we are going to answer it.

But, I might mention one other thing just to complete the relationships here. Brian referred to a meeting with Advisory Committee on Reactor Safeguards, Thermal Hydraulic Subcommittee, which has been in preparation for some time, I think basically since September. Many of the questions that were dealt with on the part of this task group on thermal hydraulics were questions for which answers were in preparation for this ACRS Subcommittee meeting. So, I think it is appropriate for Brian to comment on that meeting which was held last week.

MR. MORRISON: Brian, would you comment, please?

MR. SHERON: Yes. We met with the ACRS Thermal Hydraulic Subcommittee on January 4th and 5th right here in Bethesda. Let me just give you a quick background of the genesis of the meeting. We met basically for the first time with the Subcommittee on the RELAP5 code and its application to the advanced passive reactors last March 4th and 5th I believe it was in Idaho Falls, Idaho. The upshot of that meeting was that during the course of presentations about various models in the code, particularly those that might have a strong influence on the AP600 type behavior, for whatever reason, the Idaho Staff, who are the developers of the code, quite honestly, did not do a very good job in responding to questions that they were getting from the Subcommittee, and particularly the consultants to the Subcommittee.

There were various reasons for that. I think some of it was that we were just not prepared. In other words we didn't have, for example, all of the right people in the room. We were not at the lab. We were in a hotel somewhere in Idaho Falls, so we didn't have people right then and there who could stand up and say I understand that and so forth. I think another part of the problem is that the RELAP code has been developed now since I think it probably started to be formulated back in the late '70s.

A lot of the models that went into it were

developed by people who were just no longer working on the program, no longer at the lab. I think there had just been a bit of a loss of corporate memory, in terms of why certain models are formulated the way they are, what assumptions were made and what the basis was for those assumptions. So, when the time gets up or someone to discuss a model in the code, they can discuss the model, but they are going to have a hard time sometimes trying to defend why it was formulated that way and what was done to justify it and so forth, without really going back and doing a lot of homework. I think that was what part of the problem was at well at the meeting. When they started -- when the Subcommittee and their consultants started digging into some of these questions of why is it this way and so forth, we just didn't have good answers. Obviously, that was not our shining hour, as a result of that Subcommittee meeting.

I had asked Professor Catton at the end of that meeting if he could prepare for us his -- the Subcommittee's concerns in writing. The reason was because many times, for whatever reason, they had reviewed the material, but they would remark, for example -- one which really confused us is someone -- one of the consultants said, your field equations are formulated wrong, you know, and that the end of it. So, the question was what do you mean they are formulated wrong? Why? Who? What for? There was no detail and no follow-

up, you know, so it was sort of like this accusation on the record, but we really didn't know how to respond to it. So, I would ask Professor Catton -- I said, I would really appreciate it if you could really detail what -- for each of these areas you have a concern, what is wrong, what is the specific problem you have? You know, is there something you think we should do to correct it, or what? I said, lastly, would you try and prioritize these? Because I know you will have a lot of comments and, if you could tell me the stuff you think is really important, versus stuff that is, you know, when we get to it that will be fine, that will really help us.

He agreed to do that. It took awhile. This was in March. I did not receive a letter from him with the concerns until August the 10th. Once we got that letter with the concerns and he -- the prioritization was -- I am sorry, let me -- the letter was basically a transmittal letter, which transmitted the thermal hydraulic consultant -- his Subcommittee's consultant's letters. Okay? So, there were letters from Dhir, Shrock, Zuber and Wolf. Basically, he put a cover letter on transmitting it, and he tried to categorize the questions not by specific question, but by subject matter.

We went the letter to Idaho and we asked them to start taking a look at these and assessing what it would

take in terms of response -- do we agree, do we not agree, and so forth.

We then decided that we would respond -- that the best way to respond to all of these concerns in this letter was to make a presentation at a Subcommittee meeting which was scheduled January 4th and 5th. So, that is the reason we had the Subcommittee meeting. The purpose was to answer the August 10th letter. So, we -- the whole agenda was structured around the issues that were raised in the August 10th letter.

The preparation was rather extensive because of the level of detail that the Subcommittee apparently was getting into. Idaho had several dry runs of the presentations by their staff. According to their manager, they had a number of their senior people put on ACRS hats and make believe they were the ACRS and try to shoot holes in the presentations and so forth to make sure that these things were technically sound.

My Deputy, Tom King, went out there with Dr. Shotkin and a couple of others and they had a -- we gave them a dry run as well out at Idaho, and then they came back in here later on in December, and we gave them a second review of their presentation.

The meeting I think went fairly well. There were some presentations that were better than others. I think we

had a better defense. Our one staff member, Joe Kelly, who has been working in the area of condensation for the past six months, gave a very good presentation. He was commended by the entire Committee because of the degree of technical depth and so forth that he went into.

At the end of the meeting I understand Professor Catton told Dr. Shotkin that this was the best Subcommittee meeting that they had in a long time with regard to the technical presentations and so forth. They were also anxious to start setting up the next Subcommittee meeting to review sour PIRT, which is the Phenomena Identification and Ranking Process we use for establishing where the areas are in the code that need to be focused on and so forth.

That pretty much summarizes where we are. There was a little bit of antagonism in certain areas between us and the consultants. There is -- quite honestly, there is a bit of friction between some of the consultants and the contractors.

MR. KINTNER: What kind of friction?

MR. SHERON: I can give you my opinion, okay. I think it has to do that there is a very -- the type of criticism that we get from them is very antagonistic and abrasive, okay. It is not constructive. It shows up in some of their letters. It is like, you know, the staff has done sloppy work, that type of stuff. It sets people off,

you know, and do forth.

MR. MOLZ: These are the consultants? The ACRS consultants?

MR. SHERON: These are consultants to the Thermal Hydraulic Subcommittee of the ACRS.

MR. BURSTEIN: Would this Subcommittee be issuing a written report of this meeting?

MR. SHERON: They normally -- it is not clear, okay. They did not indicate -- in other words, the Subcommittee does not send a letter to the staff normally. The Subcommittee has to decide if they feel that a letter say to the EDO or the Commission is justified based on say the results of them. In other words, if they have an opinion or if they have some guidance they want to give the Commission or the EDO, the Subcommittee will go to the Committee and make a case for why they should write a letter and so forth. Then the Committee has to decide if they want to agree with that.

MR. BURSTEIN: I understand. The reason I bring this up is that, as far as the formal record is concerned, the only document that now is there is this August defamatory thing, if you will. It appears to me that you want that loop closed.

MR. SHERON: Yes. And that will be closed.

MR. BURSTEIN: Okay.

MR. SHERON: I failed to say that Idaho has been instructed to document responses to the August 10th letter. That is supposed to be completed by mid-February.

MR. MORRISON: Neil has a comment. I think we want to perhaps defer the rest of the discussion on this till tomorrow when we talk about code maintenance, and address those issues that relate specifically to the Subcommittee report. Neil, perhaps you want to make your presentation.

MR. TODREAS: What I want to do is get us back to the parts that we can approve, up through page three. What you have heard the beginning of and what you could sit here and hear all day are a lot of the details of the interaction. I think the important thing -- if you look at our letter, page three, second paragraph, bottom of the second paragraph where it says "further, while the NSRRC and the in-house technical expertise..." things of this sort -- what needs to be done to resolve this area and get things on a firm technical basis is first the contractor has to be strong. My view has always been about bringing university expertise and things like this, is you don't want to bring in all of these other Subcommittee people, peer reviews, experts here, experts there, or else you have a whole plethora of things. What you want to do perhaps is get the contractor to be strong and get the contractor to develop

his technical capability. Either he hires people, he hires consultants, but he marshals them. The second thing, you want to get the NRC oversight to be strong technically. The third thing is you ought to try to resolve the working interaction among the groups.

It strikes us that, if you fix the first two things -- you have a strong technical contractor doing a good job, and you have strong, knowledgeable NRC people defending positions, explaining positions, you go a long way to diffuse all of the rest of the stuff because it won't have any basis to exist.

And the essence of the report is particularly I would say, as embodied in this bottom of the second paragraph, third page, doesn't lay it out in the specific detail I just did, but that is the message. You can certainly see that message in these words.

MR. KINTNER: A couple of questions. One of them is are any of these differences of opinion such as to question the validity from an overall safety point of view of the codes that are being used or are they peripheral to the real questions of safety from a thermal hydraulic point of view?

MR. SHERON: Well, we have kind of struggled. I don't know if you want to --

MR. TODREAS: Yes. Let me give a quick answer,

and then I can give you the long answer. I don't think anything really undercut the safety case now, but the code, as it exists, as it is documented, as it is presented, certainly isn't the basis on which you can lay the safety case upon and march forward yet.

MR. KINTNER: And the second question is, if ACRS is involved in this way in bringing in experts, presumably critical, raising doubts, how does the NRC in total ever resolve this question, and particularly, how could Research resolve it? I mean, you have got a dichotomy here. It is a sort of esoteric kind of subject anyway, which only a few experts understand. It is a little bit like earthquakes.

MR. BECKJORD: In my view it comes back to the experiments which will be run, for example, on AP600. The scaling and the design of that experiment has been reviewed. This Subcommittee has reviewed it. It has been looked at from many different points of view. Those tests will be getting underway. I don't know, they had some trouble with the loop. They should be -- have they resolved their start-up issue? They were --

MR. SHERON: Well, when they went to start it up they as usual found leaks, so they shut it down and they have to fix the leaks.

MR. BECKJORD: As soon as they fix the leaks they are going to be doing tests. I think in a month we are

going to begin to see the results of tests. To my mind, the large part of the answer to that question depends on, number one, what the tests show and, number two, what is the degree of goodness of the code prediction of those test. That is why we went into this program. If the tests show that the code needs fixing, then we will fix it. If the tests show that the code provides an adequate description, then I think we can have confidence in it. That is my view.

MR. TODREAS: I think that is right. That is the ultimate way to resolve it. I think we got into this problem because we have got a weak contractor. They weren't fully technically staff, and they weren't pushed to the wall. Things unraveled and the ACRS technical people just came in and ate into this -- some valid, a lot nit-picking.

MR. VOGEL: At the risk of getting a spirited defense from the academic side of the community, I note that that Committee is almost a hundred percent academic. Aren't there any thermal hydrologists on the industrial side?

MR. SHERON: I was just going to say that the only questions we get --

MR. BURSTEIN: Remember, we are gainfully employed.

[Laughter.]

MR. SHERON: Most of the Subcommittee members don't ask questions at the meeting. The only questions we

get are from Professor Catton and the four thermal hydraulic consultants. The other Subcommittee members do not really participate to any great extent.

MR. VOGEL: They are from a non-academic background?

MR. SHERON: No. I think -- well, Professor Catton obviously is from UCLA, Professor Dhir is from UCLA, Professor Shrock is from Berkeley, Wolfgang Wolf is from Brookhaven, and Novak Zuber worked for the NRC for the past 20 years, so it is a mix.

MR. MORRISON: Just one more comment, Sol, and I think we might wrap this up.

MR. BURSTEIN: I would just suggest, Mr. Chairman, that we go on too. This program or this problem of having different advisory groups like the ACRS competing with this group to see who can conquer RES the hardest it seems to me is a subject we ought to discuss at an appropriate time, but not now.

MR. MORRISON: I think we have that comment in this report on page three.

MR. BURSTEIN: At some time we have to address it.

MR. MORRISON: The Subcommittee is concerned that the overall net effect of the outside input be a constructive process, not an open loop for recycling criticisms and enhancing polarization. I think that is a

superb statement in the report.

MR. BURSTEIN: That covers a lot of things.

MR. MORRISON: We will have an opportunity tomorrow to again get back to code maintenance in response to the Commission's questions, which I think is another broader subject that we have been touching on. But, I think that that is a superb statement, insofar as the Subcommittee has made it, and if the Committee as a whole buys it. I, for one, am quite willing to accept it, unless there are some objections to that statement. I think that that is a really sterling statement on behalf of the Subcommittee.

MR. SPEIS: It should be underlined.

MR. TODREAS: Since you pointed that out, I want to say that Herb Isbin was the drafter of a great deal of this section. We particularly had better get the ACRS back to get a lot of insight as to come and help us.

MR. MORRISON: Herb, we compliment you for your statesmen-like abilities on that.

All right. Neil, let's move to the third point on the materials and components issues. Are there any other comments on behalf of the Committee members or Subcommittee members?

[No response.]

MR. TODREAS: I will just comment, it is interesting Larry has come back and said that apparently

there is a valve program that we will hear about.

MR. SHAD: Yes.

MR. TODREAS: At our meeting, which was in October, there was no valve program at that point, right?

MR. KINTNER: I think there was.

MR. TODREAS: There was a check valve reliability program. I was going to compliment our constructive interaction. He didn't tell us that there was one. I clearly remember that. The question we were discussing is should there be? What should its activities be? But, that would be very interesting to us all.

MR. MORRISON: Okay.

MR. KINTNER: In passing, there is a serious issue going on between the utilities and Westinghouse on check valves. Westinghouse wishes to use a check valve essentially off the catalog. The utilities are pressing this point as being so important that it deserves to be designed specifically for the function. That ought to change a great deal the question of whether the testing is needed or how much testing is needed.

MR. MORRISON: Well, insofar as this report represents the minutes of a meeting in October, does any change need to be made in this section of it?

[No response.]

MR. MORRISON: If not, let's move on to the

reliability of passive systems.

I perhaps missed it when we were going over it. I understand the workshop at BNL is being organized. Has it been scheduled? Is there a time for that workshop?

MR. TODREAS: They have been talking about it late February, early March. I would say that the RES I think, as I got it through Brookhaven people, if anybody on the Committee feels they can play a constructive role in the discussion, they would be welcome to participate in the activities.

MR. SPEIS: It's the first week of March -- the first few days of March. We did check them out with Neil to make sure that because of his previous interest, at least he would be available to participate.

Neil, if I may say something? We are putting together a kind of a charter for this meeting -- you know, what are the objectives, what we would like to accomplish, what are the issues. As you said, the bottomline is how does one go about evaluating the reliability of passive systems in a practical sense, because I think we have wasted a little bit of -- some of the taxpayers' money looking at this issue without having thought about it very carefully a priori. And we plan to send that charter out in a draft form, and hopefully we will get some comments and some ideas from others including the members of the Committee. So,

that is how we will go about it.

MR. MORRISON: I certainly commend you for recognizing the need for those criteria and organizing a workshop and getting as early on in the program as you can.

Any questions, comments on that reliability section?

[No response.]

MR. MORRISON: All right.

Well, let's move to the final section then on the severe accident issues. Herb, is there anything needed to be brought in from the Severe Accident Subcommittee that isn't covered in this write-up?

MR. ISBIN: No. I don't think so.

MR. MORRISON: Any questions or comments on behalf of the Committee members?

[No response.]

MR. MORRISON: I think that we can close the discussion on this Subcommittee report. And pending a minor surgical change that Neil is going to address during the day on the first subject, is there any objection on behalf of the Committee to adopting this Subcommittee report as a Committee as a whole?

[No response.]

MR. MORRISON: All right. Hearing no objections, we will then take this, with the minor change to be made by

Neil as a report from the Committee as a whole.

It is probably appropriate now to take a 15-minute break. We are 15-minutes ahead of schedule. I can't believe it.

[Brief recess.]

MR. MORRISON: Let us reconvene and move to the next Subcommittee report, which is the Advanced I&C and Human Factors Subcommittee. I will turn it over to Ed Kintner to chair this part of the meeting.

MR. SEGE: Excuse me, Mr. Chairman. I have extra copies of the Subcommittee report for Committee members who don't have theirs with them.

MR. BURSTEIN: This is the I&C?

MR. SEGE: I&C.

MR. MORRISON: Does anyone need an I&C Report?

MR. TODREAS: Do you have the Waste Report?

MR. SEGE: No.

MR. MOLZ: I have a copy. You can get a xerox of it. This is it right here.

MR. MORRISON: That is a good question. Do we have -- do we need copies of the Waste Report for other people? Just you, Neil?

MR. MORRISON: Okay. Can we get two copies made? Do you have extra copies?

MR. MOLZ: No, I don't. We can xerox this one.

MR. SEGE: I can take care of it during the lunch hour.

MR. MORRISON: All right. Very good. All right, Ed.

MR. KINTNER: We had a meeting on the 30th that was attended by Dr. Morrison and Dr. Todreas, Dr. Uhrig, as members of the Subcommittee. We had a very extensive presentation from the staff on all aspects of work that they were doing. We do not intend on this report to talk to the individual projects or pieces of work that are being done, but really talk to two very much more fundamental questions. The first one is what is the overall goal, what is the overall strategy, and what is the overall view of this new availability of modern instrumentation control, with regard to reactor safety? That we talked about and we thought about it and we wrote some words which went back and forth, had the input of the best brains in this Committee I think, in one way or another, in the subject -- in the report of about a year ago. So, we went back and looked at those to see whether or not -- what progress had been made from that time. We, in our judgment felt that not very much had happened. The individual projects are being carried out and individual pieces of data are being received and useful. But, in terms of this rather fundamental question, which we start out by saying, and I think everybody agrees, that this

is probably the single most significant technological advance over presently operating plants, and it is one that is going to be incorporated in the presently operating plants, as well as into advance plants and, therefore, is a major issue, a major question of research for the NRC.

Other areas of research are well along. They are not completed. There is much to be done. I am not arguing about that. But, in terms of this particular new and different technology to be applied to reactors, it is sort of unprecedented. In my view, you can talk about aircraft, you can talk about petroleum in the refining plants and so forth, and you still have to extrapolate from that, in some sense, before you can talk about the real meaning of this to nuclear reactors.

The question of instrumentation and control and the human performance associated with that, as it relates to the plant as a whole is quite obviously, if not the most important, clearly, one of the few most important aspects of reactor safety. And, if you look for a broad perspective on this, in the research program, and it is very difficult to find -- you find bits and pieces that are useful, but you can't find the broad perspective.

We are not alone in raising this question. The ACRS keeps raising it from a different viewpoint, and at a higher level with the Chairman, and saying you guys better

get your act together. I think part of the problem for RES, as we say in this memorandum is that the NRS, as a whole, has not arrived at a consensus strategy for this new set of technologies.

So, we go back and quote specifics from the previous letter, which we still think are valid words, and then we say that we don't see that those have been responded to. If they are wrong, if we are mistaken in our judgments in writing them this way, tell us so, and we will get off of it. But, if in fact they are valid or partially valid, at least then we think more needs to be done. That is that first page -- two-thirds, which is simply repetition of the most pertinent parts of the report of a year ago.

And we say that, in sympathy, there are several reasons in our opinion why it is difficult to arrive at this kind of a broad view of research associated with digital and modern control systems. One is the NRC is itself not quite sure what it wants to do with this subject. That is understandable too, but that does make your problems difficult. Secondly, as I think, more and more at least in my view and I believe others share this, we are recognizing that this reaction to user requests ends up in a series of individual kinds of questions and projects which -- each of which has value but makes it very very difficult to provide an overall, integrated plan and overall integrated research

program. That may be not the best in the world from some points of view, like aging, but from the standpoint of this question of integration of humans with machines through control systems, it is really needed. And these words about synergism here are Neil's -- that it is very hard to provide some sort of synergism in a research program of this kind unless you have got that overall.

Then one other point which we have said before and it is hard to say without being seemingly brutal or critical or whatever. We don't think in your branch as a whole you have got the capability at the moment to deal with these issues in the way they need to be dealt with. This lacking in two kinds. One is I think you have two people who have some experience, real experience in digital controls. That may not be enough. On the other hand, you need to have, from some point of view, a leadership -- a breadth of viewpoint that grasps this entire subject and squeezes the juice out of it until you get down to the question of what should be an over-arching philosophy from a research perspective of the application of modern control systems to this area.

So, that is one whole subject. I will leave it for the moment, and we will come back to it, because I hope you will want to talk about this at some length. I recognize and want to say right up front that this is a

draft and can be changed if we are wrong, or can be strengthened or changed. So, don't hesitate to criticize it. The second thing we tried to do is to look at -- well, I will back off one minute and say having made this kind of a statement, it seemed to us that the only honest thing to do was to try to make some suggestions. When you get down to the point of trying to make suggestions, it gets a little tougher. It is a difficult problem and very very hard to define a specific strategy, a specific program that you would get from here to there as this goal is defined. But, there are ways to do it. I think there are ways to start. And we have tried to suggest several of those in the last paragraph on page three.

And then the second major subject we discussed was the question of the life history of a research project. This was HPIP, influence of the aging process. I think the facts are here in the short form. I believe it is fair to say that. We concluded, and I don't think that this is a surprise to the people who have to do it every day, that there ought to be some way in which these matters could be handled more effectively, more efficiently, more precisely, more directly. We recognize that you are in a bureaucracy which makes it difficult to do things in an especially business-like way. But, we -- I quoted this before -- a Rickover quotation: "If you live in a pig sty long enough,

you think it is home."

There are -- there must be -- there have got to be ways in which the arrangements with which you do your contracting, your program management and so forth can be improved without violating regulation. This is just the beginning. We think the full committee ought to be thinking more of this too, with the idea of working with you to try to conclude some mechanism, some means by which the efficiency, both from the standpoint of time and money, of your research programs is improved. This is obviously becoming more and more important as budgets get tighter and questions aren't going to go away.

So, that is the broad outline of this report. I would then elicit comments on it or suggestions. I might say before doing that that what we suggested was two potential ways to get at this problem. One of them follows on the ACRS's recommendations, without specifically recommending it because we think maybe it is not the best. That was they said you ought to get the national academy involved to write you a goal -- write you a program and tell you how to do this. I guess many of us think, as members of the National Academy that that is probably not the right way to do it. But, there are people -- there must be people in the United States or the world who are broad enough, intelligent enough in this subject, if you got them together

for a long enough period of time, not just a one or two day workshop, but with the specific objective of writing an over-arching strategy for research associated with modern control equipment, what you know today about human performances, what you know today about the kinds of incidents that occur in reactor plants, you ought to be able to get some good out of it. I don't think that has happened. The workshop that NIST organized wasn't quite that. The ACRS said that. But, if you really thought about it, and I am going to get the finest people in this field, the broadest thinkers, the smartest people, a few of them, and give them a specific goal of answering this question for me and ask them to look until they did, something good might come out of it.

Now, the other is that, from the Water Reactor Safety Meeting, I heard of four different -- three different projects that are going on, which -- each of which has a seed in it of a possibility of coming to some overall insight, some overall conclusions on this subject. The first was the statistical analysis of the IPEs being carried out by Brookhaven. I mean, it is going to be a tremendous amount of information in there associated with what kind of accidents -- what kind of scenarios, where these things start, what is there course of action and so forth. That is from the plant point of view.

You have got a human error analysis research program, which tells you how humans react to various inputs, which is another part -- ingredient of this total equation. And the final one is the project that INEL can improve the understanding of human performance and PRAs.

Now, if you put all of this together and look at it from the standpoint of what is the total implication of a human mind over here and a reactor plant over here, and the interconnecting relationship, a very complex one, of an instrumentation control with computers and various other kinds of manipulators in between, from here to here, how do you design this from a total system point of view -- the human being part of this system, the machine being part of the system to maximize safety? That could provide, if you took just those three things and tried to marry them into some kind of an overall viewpoint, that might provide the kind of overall view of the matter which would be very very helpful, lead to different research, better research, and more importantly, it might be the factor that leads the NRC as a whole to a correct answer to the problems they are facing with regard to this subject.

So, do you understand what I am trying to say? I mean, it is a very difficult thing even to say it, let alone in a logical way. Is it understood what I am suggesting?

MR. MORRISON: Ed, I would like to add to your

comments and certainly will involve the staff as well as the rest of the Committee in these interactions. It was clear from the Subcommittee meeting and our deliberations afterwards to try to put together this report, that we don't want to enter into any kind of an adversarial relationship between us and the staff. I think we recognized that this was a very difficult problem. Unfortunately, it starts to have the dimensions of kind of the psychological aspects of science and the human interaction here which everyone is an expert, even though they may not have the right title associated with it. So, everybody has their own opinion. But, we do I think firmly believe that there needs to be some better organizing elements. We would like to search as a Committee as a whole to find out where they are and certainly have that input into these discussions.

MR. KINTNER: Not critical at all. I would say it is sympathy really, because it is an extremely difficult problem, and one which is unprecedented. Nobody else has to face it, only the NRC.

MR. BURSTEIN: Is it fair to characterize one of your comments, Ed, as saying that perhaps the agency, whether it is RES or NRC, in its broader sense, needs to do some research to establish that strategy? You call it a workshop. There may be some other techniques. Has that been done?

MR. KINTNER: I didn't call it a workshop. My answer -- I really called it a group of experts getting together with a specific goal. That is not quite a workshop. And the pieces are starting to be done, but the total has not been done. For example, take this work on summarizing the IPEs. It is a tremendous body of data that is going to show up in there. Taking that and analyzing it and extracting from it, the specific principles involved hasn't been done yet, and won't be for some time as I see it.

MR. BURSTEIN: I guess my question, Mr. Chairman, is whether there is a need or an opportunity for RES to actively undertake some short-term quick research to establish this strategy, this over-arching -- what you call a consensus strategy? Or is it a request that somebody on high make an arbitrary pronouncement or a policy decision that says this is going to be the strategy for this year and we will proceed from there? I am not sure how you get this if it is not there. I am asking whether we are asking for the Commission to make a policy determination or we are asking RES to undertake the program?

MR. KINTNER: Speaking for myself, that is the first, but it isn't the question of the normal way of doing business -- you ask what INEL or Sandia or somebody. You really reach out to get the most brilliant minds you can

find anywhere close to being on this subject, and you put them together in a room and lock the door.

MR. BURSTEIN: That sounds to me like some research activity.

MR. MORRISON: Well, whether it is research or not, I think my spin is slightly different than Ed's, but it comes to the same conclusion. I think we are dealing with a problem that has not been confronted by NRC before. It is not just having a technological component, but it is kind of a paradigm shift of how you get into really dealing with digital systems, lots more software and that kind of interaction. The Commission doesn't have a position on it or know how to articulate it. As it filters down through the various levels, it gets more diffused. So, I think there are two alternatives. One sits here and waits and does a lot of stirring around until the Commission makes a pronouncement, or you take the bit in the mouth and run with it and say it is up to Research, or it is up to this Human Factors Branch to define something and go forward and they, indeed, may set the overall regulatory guidance standards or whatever it would be in this particular area. That is where the suggestion that Ed just mentioned is maybe you get a bunch of experts in the room and you lock the door and you don't open it until they have come up with this strategy.

MR. BURSTEIN: Is it appropriate for this

Committee to articulate, through this Subcommittee report, an approach to achieving that strategy?

MR. MORRISON: I believe, if we want to be bold enough, we should. I think there ought to be a consensus among the Committee before we make the statement.

MR. ISBIN: I think we need to be very careful in how we talk about an effective approach. I wasn't at your Subcommittee meeting, Ed. But, I did listen to the BNL report on the statistical analyses of the IPEs. I didn't get that impression that this is going to be such an important aspect that is involved here. To me, it was an interesting way of looking at things, but it certainly wasn't, in anyway, a panacea for suggesting how you could consolidate these efforts. My only comment is that, in general, I think the Committee has to be very cautious in how we make these suggestions. That is the only one that I haven't figured out.

MR. KINTNER: Let me make a couple of points with regard to that. First of all, the BNL one is not far enough along yet to do what you say. But, if they follow through, they are going to have a tremendous body of knowledge and data. The second one is that we were very careful in how we suggested this in here. We say that we recognize the difficulty. Nevertheless, there are opportunities, and here are a couple of examples. So, we are not I think trying to

define what is done. Just having raised the question it seemed only fair that we make some suggestions. MR. ISBIN: At the Severe Accident Subcommittee meeting that was held months ago, the Subcommittee carried on a conversation with the staff, bringing up the question that you, Dave, had asked. What if you had 10 percent more money? What would you be doing? As I recall, the critical area identified was this particular human factors area. But, unfortunately, I don't quite remember how it was constructed, but there was some limitation on adding personnel, in that you couldn't -- you didn't have enough personnel to handle the projects that were already underway, and you weren't spending even the full budget that had been associated with these projects. As a consequence, that money was then diverted through other activities in severe accidents.

Now, I may be characterizing it improperly, and you should certainly correct me. But, somehow, I thought that there was some impediment in augmenting your staff and carrying forth the activities which -- the high priorities they were being associated with.

MR. MORRISON: Before we get a staff response to that, which I think would be very useful, I think there is another dimension that at least I as a member of the Subcommittee and the Committee -- and I am not sure it is shared by the others -- is that -- and maybe it is built

upon the fact that I have been sitting around here for about six years and seen things go. I think this program pretty much started with research, with some good ideas, then you can overlay them with many many user needs. You can answer Herb's question almost. Well, I have got more needs than I have people to respond to. On the other hand, has there been a real solid attempt by Research to say do you really need that bit of information, or have we rung out the needs? Are we dealing with the right subject?

When Ed talks about trying to get this together as a system, it is the Commission, it is NRR and it is Research that has to get together to make sure that we are marching in the same direction. I don't have a sense that you are. maybe you are and I haven't heard.

Ed? Does anyone else on the Subcommittee want to respond to that? I would invite comments from the staff on this.

MR. SHAD: I guess I am not overwhelmed with your suggestion of locking a bunch of experts in a room. It seems to me, if you have got one guy that knows what he is doing, it could lay out a program for people to shoot at.

MR. KINTNER: Well, that is a bunch of experts. If you have got that guy --

MR. SHAD: One guy. A bunch is too big a word. I wasn't thinking of a bunch. I was thinking about three,

four. That is only a thought. That is just an idea.

MR. KINTNER: I have a suspicion that there are people in the NRC who could sit down and do this if they sat down and did it.

MR. SHAD: Maybe so.

MR. MORRISON: Dr. Speis is anxious to make a response.

MR. SPEIS: Well, I will make a response. Let me talk about a general -- the subject of staff adequacy. I think that is becoming one of our big problems right now. I don't think any more money will help resolve or do any more research in some of these areas basically. That is becoming a real problem. We are going to address it tomorrow -- not only the numbers of people, but the right people, okay, especially in light of going downwards in the number of people. We will be losing more people in the next few years. So, that is a big issue. So, more money is not going to help us in any of these areas. What we have to do is kind of restructure -- I guess that is the right word that you read every day these days in the newspapers. So, we are going to have to kind of start from scratch in a number of these areas and decide which ones are the important areas, and put the few people that we have with us. But, we are going to talk about it a lot tomorrow. We would like to have your views and your ideas.

Going back into the human factors -- into the I&C area, this area has been kicked around and everybody has his own views, as you said, Mr. Chairman, already. We did have this workshop and the objective of the workshop was to get all of the knowledgeable people from hopefully the United States and the world to put all of the information down based on that. And we were going to come up with a coherent program starting with the top and, after we decide what the goals are, then we define what are the right projects to pursue. Unfortunately, some people didn't think that the workshop accomplished its objectives.

At the same time the ACRS was very forceful and very dogmatic about assigning the National Academy of Sciences to really get to this area and they thought that they were the only ones with the competence and the background to get all of the experts and put them together in a room and out of that the wisdom will flow and then we will decide where we will go from here. So, the Chairman, our Chairman has and the Commission has decided to go ahead with it. I will have Brian and Frank tell you what is going on, what planning, what the schedule and what type of effort the National Academy will undertake in this area.

I think we would like -- we will have some views about some of the specifics that you have here. I don't know if it is appropriate to talk about it, Mr. Chairman.

Let's talk about the workshop -- yes, Brian of Frank.

MR. MORRISON: Comments on the workshop by the National Academy, and especially their schedule for completion, which would be an item that worries me.

MR. BURSTEIN: When was this workshop held?

MR. SPEIS: The workshop was back in October of '93 -- September.

MR. COFFMAN: The proceedings we expect to have out by early in February.

MR. BURSTEIN: That was what I was going to ask next.

MR. COFFMAN: The NSRRC members are already on the distribution list.

MR. MORRISON: Would I assume, since you used the word "proceeding," Frank, that this is just a summary of what is said, not what you have internalized and decided to plan and strategize?

MR. SPEIS: Yes.

MR. BURSTEIN: And do I understand further, Mr. Chairman, that the NRC, in the form of the Commissioners, has determined to respond to an ACRS suggestion that they will ask the National Academy to do what Ed Kintner has suggested be done?

MR. SPEIS: Yes.

MR. MORRISON: As I recall that ACRS suggestion,

it predated your workshop, and then was reconfigured.

MR. SPEIS: Based on our experience with the National Academy of Sciences in the past or engineering, it takes long. We thought that we could get the same people or orchestrate the ideas and do it faster and more economically. But, I guess the ACRS thought otherwise, and they persevered. They have written a number of letters, and finally the Commission gave in. I guess some of you are members of the National Academy of Sciences and I am sure you have your own views about it.

Well, Brian can tell you where we will go from here.

MR. SHERON: Yes. I just want to point out that the workshop that we held which was not -- you know, I will be the first one to admit, was not a workshop. We originally intended it to be that way, but I think, through our discussions with the NRR people, they wanted it more along the lines of a conference. We had papers presented on various subjects.

I think one of the biggest observations I got from that was that the industry in itself is not of a uniform mind in this area. Correct me if I am wrong, Frank, but I think what we learned was that there was a lot of finger-pointing between the design engineers and the programmers on who is responsible for introducing errors and to digital

systems and the software and so forth, and how do you fix that. And the technical -- the programmers say it is the engineers who have to write the specifications better, and the engineers say --

MR. BURSTEIN: Excuse me. Are you saying the workshop was useless for the purpose of the Committee or the Subcommittee?

MR. SHERON: No, no, no. It did not address I think what the ACRS had in mind.

MR. BURSTEIN: Okay.

MR. KINTNER: What we had in mind.

MR. SPEIS: This letter has addressed.

MR. SHERON: I think it did accomplish in my mind putting out on the table the fact that this is not an area where there is any great unanimity of mind in terms of the experts, okay, and so forth. I think we --

MR. BURSTEIN: It depends on what questions you asked.

MR. SHERON: Right.

MR. BURSTEIN: And we are getting just a series of papers instead of trying to establish --

MR. SHERON: To my mind, this was merely a first step, okay? It was trying to find out what the thinking is out there among the experts in this area. There are various classes of experts, okay, in various different areas, okay?

I think what we learned is that, you know, it is not a very mature science, and that there is a lot of different thinking out there on it. So, you are not going to go out and find perhaps this group of experts that all -- you know, understands and knows all about this area. Okay?

MR. SPEIS: But, Brian, we did raise four or five important questions. Those questions were thought of very carefully, and we solicited the views of many people before we were able to finalize those questions. So, those questions were addressed, but the views that came were all over the place. But, I can say that a lot of information was developed at the workshop that, if five or six people sit down for two or three days, they will be able to distill the essence and come up with what it is like.

MR. SHERON: That need to be looked at.

MR. SPEIS: That hasn't been done.

MR. SHERON: That I think is going to be the next step.

I am going to let Frank talk to you a little bit about what is going on with the National Academy. We are putting together a contract -- a sole source contract.

MR. BURSTEIN: Have you written to the Academy? And have they responded?

MR. SHERON: Yes. We have already been in contact with them. They have agreed to do this and the like. We

have a prospectus for them with regard to what it is we would like them to do and how long it would take and how much it would cost. I will have Frank go through all of those details.

I just wanted to reiterate what was said. Part of our problem is -- right now it will sound like I am complaining -- right now I have two people in Frank's branch that I would consider to be knowledgeable in the area of Digital I&C and that is it, okay. They can only do so many things, okay? You know, I think what Herb said is that, yes, we had to turn back in money this year, over a million dollars I think in that branch because we didn't have enough people to manage it, okay?

MR. BURSTEIN: If we don't have a strategic objective, if we don't have program of where we are going and what it is we are trying to do, maybe we shouldn't be spending any money, if we don't know what it is we are trying to accomplish.

MR. SHERON: Well, I think we do. Maybe it hasn't been articulated very well yet.

MR. BURSTEIN: Well, what we are trying to get is the definition of that. Maybe we ought to get where we stand.

MR. SHERON: I think one of the major areas that has obviously been raised is -- the whole question in

digital I&C is software, okay, the question of diversity --

MR. BURSTEIN: How do you know that?

MR. SHERON: -- and reliability of software, okay?

MR. BURSTEIN: I guess my question is how do you know that? Have we done anything that tells me that that is the problem?

MR. SHERON: Yes. I think we have.

MR. COFFMAN: Do you want me to list a couple of things? I think, if there is a strategy I think it is to assure ourselves that we have defined all of the issues associated with the implementation of digital systems. So, the question has been focused on assuring that we have completeness on the issues. In January of '89 we held a workshop with that purpose in mind and the issues were identified -- a list of issues for assuring that we are addressing all of them in the research or in the regulatory positions. Subsequent to that there was a survey made under contract to go around to all of the vendors to determine what their plans were and to try and identify what were the regulatory issues that might come out of that. Subsequently, in the September of '93 work that was the workshop, again, the focus was on issues. We tried to summarize what the issues were and, at the end of that workshop we identified about 20 issues. And the staff response to that is, given these identified issues, are the

regulatory positions addressing them or is the research addressing them, or have we got any holes in it?

And then the next thing that is planned is the National Academy of Sciences. I don't mean to sound defensive. I am just trying to describe what we have done by way of working this question, are we identifying all of the issues and working on them when it comes to this question of digital systems.

The next thing that we have planned is to address the issues on the total system, because this -- the problem is broadly scoped, and we tend to think of it as the software aspects, the hardware aspects, and then the human aspects. And the workshops before -- some of them addressed all three areas and some did not. And even the National Academy of Sciences effort will not be addressing the human side of the issues. So, the one thing we have planned --

MR. BURSTEIN: Why not?

MR. COFFMAN: Because the focus has been on the software and the hardware. Those appear to be the new elements in the --

MR. BURSTEIN: But you have already determined the strategy haven't you? And you are just asking somebody to implement or give you guidance for what you call issues or portions or programs of that strategy?

MR. COFFMAN: That is the personal way I would

look at it.

MR. BURSTEIN: Can you define what that strategy is for us?

MR. COFFMAN: The strategy is to assure that we have no unaddressed issues that should be considered for a safe implementation of digital systems into nuclear power plants.

MR. KINTNER: This is very very hard to define. But, nevertheless, Sol's question and my reaction is I think the same. When you talk about addressing the issues, that is what is happening now. You are addressing the issues. the broader question of the implication of these issues within a broader perspective hasn't been addressed. There is a total revolution here available with regard to reactor operations, made possible by modern equipment. It is the most important single potential for additional safety beyond what is already being done in terms of systems design of hydraulics and so forth. And it does start with human, and it does end up with the machine, and all of these other things in between contribute. When you cut them up into individual issues, you may answer some of the questions. But, the overall subject of the safety goal, not just we will make them safe like they are today safe, but that we use this opportunity to make reactors far safer than they have been before because of this technological capability -

- looking at that from that broader over-arching perspective -- and the term "over-arching" is Neil's term -- is what is missing. And it isn't going to be addressed by looking at individual issues, right, Sol?

MR. BURSTEIN: It seems to me that we have passed that question of an over-arching strategy. Somebody has made an assumption, if I may, Mr. Chairman, that we are going to have digital I&C systems, and we have made an assumption we are going to have humans. Now, those are what somebody calls givens or some other thing like that. And, with that as an aside, we will deal with the regulatory paragraphs in detail about how we are going to oversee that they fit into an existing system without impairing the safety.

MR. KINTNER: That's right.

MR. BURSTEIN: As I assume it, from what I hear, it seems to me that your question and the Committee's question is a much broader one. The question is, first of all, how do you think, or should these systems be encouraged? Should they be provided with the opportunity to do things that the existing systems cannot? Are we going to substitute simply what is commercially available for a hard-wired analog system that we have all agreed is safe enough?

MR. SHERON: Sol, I just wanted to point out that

we are approaching this along the lines that we are not -- we don't look upon it as our job to develop and to tell the industry what they should do to make their plants safer.

MR. BURSTEIN: You have been doing it every day that I know of for the last 50 years that I have been involved in the damn business.

[Laughter.]

MR. SHERON: We have been trying to be handy, that is all.

[Laughter.]

MR. SHERON: Being serious, I mean, the question we are really facing right now is there are utilities that are coming replacing analog systems with digital systems.

MR. BURSTEIN: Do you know why?

MR. SHERON: Because they can't find replacements.

MR. BURSTEIN: Exactly. That is inevitable.

MR. SHERON: Right.

MR. BURSTEIN: Now, that is the reality.

MR. SHERON: Right. And what we are being asked what the regulators -- what NRR is being asked is to approve those. And everybody would say, you know, well, you know, if we did our homework and we were smart, you know, five years ago, we would have come up with the criteria. But, because we didn't know at that time what the thinking was on the part of the utilities and what systems they wanted to

apply this to -- I mean, if they want to apply it to a non-safety system, you know, the NRC really is not going to get too excited about it. If they want to come in and replace front-line safety systems, yes, we are going to get more excited.

But, the question we are being asked right now is what criteria are you going to use to approve that system, which is -- the amendments are already in and in front of a reviewer over in the NRR side. They have to write something up and do it and get it out. What we are trying to do is help them in developing the criteria that says, you know, if this system meets this, this, and this, it is acceptable. That is about as far as we are trying to go on this in terms of helping them. We are not trying to give them some -- or the industry some broad, big guidance. The industry has not --

MR. BURSTEIN: I don't want to get into a dialogue separate from the Committee, but it seems to me that what you have just defined is very helpful. It also establishes the strategy. It tells me exactly, and it should tell the Subcommittee exactly what the RES approach is. I think the answer will come back, although I don't want to put words in Ed's mouth, I never could -- that that strategy is lousy. It is short-sighted, it is narrow, and you ought to rethink it.

MR. SHERON: Thank you.

MR. MORRISON: Brian, while you have the floor, maybe we will come back to Brian. In trying to address the question that you are raising, what is the National Academy being asked to do that is going to help you to do that? Can you add some insights into the dilemma or solve the dilemma or come up with an answer?

MR. VOGEL: What are you going to do if you get an answer you don't want?

MR. KINTNER: Let me answer it. I quote from that first letter the ACRS wrote. "A fresh start was called for in developing an effective approach to this new and difficult subject." A fresh start.

MR. COFFMAN: The objective of what we are asking the National Academy of Sciences to do -- and let me just read it to you as we are responding to the ACRS and the Commission in a draft response, which neither Themis nor Brian have seen yet. But, I think through the discussions with Mr. Beckjord, and with the NAS and with these other directors, that I think we are rather converged. But, the objective of the study is to plan, conduct and document a study and a workshop on the safety of computer-based I&C that will -- and this is hardware and software that will give advice to the NRC on the framework for a coherent and effective regulatory program and criteria for the review and

acceptance of computer-based safety system. It covers both implementation in current plants and advanced plants. In fact, the timing, which looks like it would be right now on the order of 14 months, would be such that it could be input to the Westinghouse AP600 and the GE SBWR design certification reviews.

And it was decided that the problem for the NAS is big enough already that we don't need to include -- or not include at this time the aspect already mentioned plus other uses in nuclear applications, like medical uses of computers for treatment, planning and for procedure control. So, we are phasing that.

The problem is very broad in scope. The NAS is addressing what we think is a major chunk of it. I don't think that we are ignoring the broad scope, which includes the human, because that was one of the aspects that came out of the workshop in September. It reinforced what we had already --

MR. TODREAS: Is human mentioned specifically in these words? I got the impression from what you said earlier it is excluded.

MR. COFFMAN: From the National Academy of Sciences it is excluded. But, we have, in the planning stage, a subsequent project to look at the total system, which would be -- which would include the human.

MR. KINTNER: Is the plant included there?

MR. COFFMAN: The plant?

MR. KINTNER: The plant. In non-instrumentation control plant, is the plant included? You have the three elements -- the human, the plant and the connecting link through I&C. Is this limited to the I&C section of that?

MR. COFFMAN: The plant is included in the sense that that is the process that you are making the application of the control to. In order to perform the control and display functions on the plant, then you use I&C systems. So, when we talk about total system, we are talking about the total I&C system as it performs its role in the plant. But, then we break the -- we have in our discussions broken the I&C system down into the human hardware and software, or some people say the hardware, the software and the skinware.

MR. BURSTEIN: Could you tell me, if you know yet, which part or which board of the National Academy this may fall under as the engineering?

MR. COFFMAN: Yes, sir. It is the Commission. It would be led by the Commission on Engineering and Technological systems, headed by Arch Wood.

MR. BURSTEIN: And that would probably be the EEB -- the Energy Engineering Board?

MR. COFFMAN: Their review board? I am not that familiar with their internal workings. I think that is the

board that has to review the proposal before we receive it back.

MR. BURSTEIN: There are, of course, people who would tell you that, both the equipment on one side and the role of the operators, the humans involved in these things, may be different or have some effect or be effected considerably by this instrument and control system. It would suggest that without a total integrated review you would be missing some essential ingredients of what you need to do the appropriate regulatory tasks. That is my word of caution only. The criticism will come later.

MR. COFFMAN: I don't want to be too defensive, but I think I should mention that this is just one project. We have other projects within the research program that are addressing the human element of it in the design of the interfaces.

MR. TODREAS: No, but that misses the point in a sense. You know, once you go to the National Academy, and say the -- you have thrown the ball to them, you are expecting them to help you in a broad front, and you exclude what for two years, in all of the discussions was the fact that humans, hardware and software are all integrated together in a ball, you can't just come back and say well, we are picking humans up through another set of projects. You have really cut asunder the real unity of hardware,

software and humans that we all talked about for a long period of time. I think we all thought we were agreeing to that it ought to be kept together. I am kind of flabbergasted that in the discussion the NRC was able to reach that judgment. You are kind of the messenger for it, and so you take the thrust of the criticisms. But, I am just trying to be constructive in talking to you. It just seems so much a reversal of a unifying trend in understanding I thought we reached. I am really surprised.

MR. COFFMAN: The ACRS has focused in on the software and hardware aspects and this -- and have focused in on the National Academy of Sciences. So, there has been that focus. I think, in the Agency, there has been a trend toward more consideration of the whole instrumentation control system -- all aspects of it -- as an entity because there was a reorganization in NRR where they brought those two branches that were in separate divisions, brought them into one division. And I think there is -- in our discussions with them there has been interest in the total system approach. We just haven't been able to address it all.

MR. MORRISON: I was going to say, commenting on this from the positive side of the National Academy, as many people know, is a several-step process. You have tabled your request to them, so to speak, and you think you have an

early discussion. I suspect that it is likely to happen even in the proposal that you get back that there will be mentions of the humans, and that will be pulled in as the system, or at the first Committee meeting when the Committee decides well this is the scope I have been given, that this is not the scope we are going to work on, it may be totally different. So, there are some things that may come out of this at the end that -- it is not a controlled process.

MR. TODREAS: Yes. But, to me that just means, hey, somebody else is going to fix it. What really bothers me is that the office here that we have been dealing with for awhile, they are not recognizing and addressing it front-on.

MR. BURSTEIN: I think, in defense -- if I can play this role possibly -- of the Agency, I see two potential issues here. One is -- the one that it faces immediately -- and that is the replacement of an existing portion of a plant I&C system with digital apparatus or software and hardware systems, because, as Brian said a few minutes ago, we can't get the old kind replicated. So, here you have an immediate problem of a particular fashion that is unique to an aging phenomena that we discussed in some prior meetings.

The other is the overall opportunity that advanced I&C systems offers for things like the advanced reactors and

for people who are going to replace wholesale their data acquisition systems for example and find, in the process of doing that, that they also can and should do other things.

Now, I don't know which is the higher pricrity to the Agency, but it is conceivable that these two different needs might suggest some splitting up of this thing, but it shouldn't, in my view, if I may add. It shouldn't I think have an effect on the need to establish this overall strategic approach to the real world.

MR. KINTNER: One simple question. I think it is just -- maybe it is not properly worded -- but, in my mind, the question is how can overall reactor safety be maximized by the use of modern instrumentation and control systems?

MR. BURSTEIN: And that applies to future plants, not the present ones.

MR. KINTNER: Yes. But, as you say, Sol, it is going to come to present plants when they more and more replace present systems.

MR. BURSTEIN: If you start ordering me to replace -- if I were a plant owner -- my existing I&C system with one of these new God damn digital systems, you haven't begun to hear my response.

[Laughter.]

MR. MORRISON: Themis, is there any other comment you want to make?

MR. SPEIS: I think this has been a useful discussion. We will take your comments and your concerns regarding the note asking the National Academy also to look at it in a totally integrated way, including the human side. So, I think we will have to go back and think about it and re-read the ACRS letters and talk among ourselves. I think it is a very useful comment. I don't think the subject is closed. We will take that under serious advisement, okay?

MR. MORRISON: Let me state my view as the Chairman. I thought the intent of our remarks were not necessarily to say don't do the thing with the National Academy.

MR. SPEIS: I understand.

MR. MORRISON: But, the other side of that, don't wait for the National Academy. You have got to do something on your own.

MR. SPEIS: No. In fact, as I said, we had this workshop. I think we thought hard about what are the right questions. We raised the questions. Even though we got 50 different views, they are on the table, okay? As Frank said and Brian, you know, we have been thinking about this area. Maybe we have to put something very coherent, like the Bible, where we can explain it from top to bottom. But, we have all of the information on the table, and we will proceed to do what has to be done. Okay? We are not going

to wait for those guys to tell us how to proceed.

MR. MORRISON: Unfortunately, your analogy is rather poor, because that subject has been up to interpretation and has been for many years.

MR. SPEIS: Okay.

MR. MOLZ: How much did the utilities study these kinds of things? I mean, is it -- I gather it is not much of a planned changeover. It us just happening because of forces outside?

MR. BURSTEIN: For assisting plants?

MR. MOLZ: Yes?

MR. BURSTEIN: I think the answer is yes.

MR. SHERON: We are not aware of any coherent or extensive research program in this area, or in a part of the industry. There are some programs. For example, we have a joint program with EPRI, which I think we told you about, which deals with coming up with criteria for verifying and validating software. Okay? So, there are some programs that EPRI has in place, but there is no counterpart you might say to what you are looking for from us which is this big integral -- you know, what is the impact of this, and how can I maximize safety with digital systems. We just don't see that going on with the regulated industry right now.

MR. KINTNER: Let me tell you right now, one thing

that worries me about this, and it goes back to the beginning of nuclear energy designs -- the instrumentation and control systems were, to some degree, independent. The I&C guys were the only ones who understood what they were doing, and it ended up with a kind of I&C complexity and difficulty which you have got in modern control rooms.

MR. UHRIG: It is worse than that. You have that being attached on there as an after-thought. The plant was designed, and then the instrumentation was put on it.

MR. KINTNER: And, as far as I can -- I have some very close relationship with what is gong on in the ALWR program with the vendors. They are doing the same thing again. They are building these beautiful models that can do all sorts of things. You push one button and the whole feed system goes on the line and so forth. I don't know whether that is safe or not. I don't think it is. I would much rather have a lot more human intervention at that point. There are all sorts of questions of that kind which are not going to be addressed. If what you do is look at the system when it comes in and say, yes, that is okay or it isn't okay, because the vendors are going to show that, yes, it works. But, the safety implications and the totality are not going to be there.

And we did try in ALWR in the passive plants to simplify the system, simplify the control rooms, make them

easier to understand by first glance. That is -- to that degree that it is being attempted, from the utility perspective, but it is very very hard to get the Westinghouse's and the CE's to look at it that way.

When you try to do what you are supposed to do, they aren't particularly easy to operate with.

MR. SPEIS: Mr. Chairman, I think the EPRI is in the process of developing some type of a program with the focus on both software, but primarily hardware reliability. I think you were briefed -- did you brief them?

MR. KINTNER: I think it was delivered also at the RES Safety meeting. It is starting in the right direction -- something useful.

MR. SPEIS: Hopefully we will be able to participate with them in the future, but it hasn't been totally --

MR. KINTNER: Mr. Chairman, after all is said and done, what do we do with this report?

MR. MORRISON: Well, that is a good question. I just wanted to ask Tom Boulette, since he is the only owner here that is faced with these questions on a day-to-day basis, whether he has anything to add to the discussion.

MR. BOULETTE: Not too much. I was whispering in Sol's ear that the utilities have been principally reactive to this whole issue. To my perspective, there is no

comprehensive strategic initiative going on in this area within the utility business.

MR. UHRIG: There is the EPRI program to upgrade at least a few pilot plants that would be the forerunner of others to come along afterward.

MR. BOULETTE: That is being reactive to what is in place -- trying to accommodate the issues with obsolete parts and what have you.

MR. UHRIG: I don't think it is unrealistic to talk about ripping out your control room while you have got the plant shut down for two years to replace the whole thing. With this generation of plants, the ones in existence -- this is the only option you have -- is to replace it piecemeal or some pretty integrated component of it. You can't go back and talk about the things you can talk about with an AP600 or small boiling water reactor.

MR. BURSTEIN: Excuse me. May I ask whether the utility requirements document that governs future plants covered this area?

MR. UHRIG: For the Chapter 10 in that requirements document, which is sort of left open in the sense that by the time we get there, everything we are talking about today is going to be obsolete. That was the one exception to the original criteria, whereby it was to be proven technology. Am I right on this, Ed?

MR. KINTNER: Yes.

MR. UHRIG: There was a lot left open on that that is still to be determined.

MR. KINTNER: It talks in principle that these questions are simplicity and margin, operational capabilities. But, those --

MR. BURSTEIN: Not any new grounds --

MR. KINTNER: No.

MR. BURSTEIN: -- that Tom has just --

MR. KINTNER: It is all evolutionary.

MR. UHRIG: Mr. Chairman, let me make a few comments here. We talked about a lot of things at that meeting, very few of which really got into this report, because we were concerned with getting an overall picture here. In a sense, I understand the dilemma that the Commission is faced with here, because they have got an immediate problem, and then they have got the long-term problem. And what we are talking about is basically the long-term problem -- those associated with the new designs, the overall safety. There is nothing much we can do and go back and impact the overall safety of the existing plants. That was pretty well cast in concrete at the time that the plant was designed.

There are issues such as the role of the operator. What should the role of the operator be in the future?

Should he be an operator, or should he be a manager of systems? This is an issue that -- it is not clear whether this is a Commission decision, or whether this is an industry decision. There is the issue of objective criteria. Five years ago in this survey that was made, we came up with the critical issue as far as the utilities was concerned is they need to know the basis on which these proposed systems will be judged. They are still basically being handled on an ad hoc basis. A design comes in and it either gets approved or disapproved. It generally had been approved. There are a number of them in operation today. But, they are still, to the best of my knowledge, and you can correct me, if you want -- there is no specific set of criteria that says this is what you have got to do if you want to get it approved. That could very well be a focus of this study, or the academy study, or it could not be. I don't know. I don't know whether to include that are not.

There is the issue that Ed has alluded to of the complexity versus simplicity. For instance, the Canadians have elected to go to a more complex system where there is a checking every other cycle to make a measurement and a check and a measurement and a check. And they believe that this complex system is more safe than a simpler system that does not have that checking involved.

I do have a reaction to the September workshop.

As Brian said, you get all sorts of views there, but it was sort of split up into two camps. One was the people over in the fossil side saying hey, what is the problem -- we are putting these things in every day and they are working beautifully, to the theoretical people over here who were saying this problem of software validation is so complex that it is going to take 10 years to solve it. The issue has not been resolved. That could be an issue that could be addressed here -- to try to pull that dichotomy together.

Well, I am not sure I added much to it.

MR. BURSTEIN: An important question, Mr. Chairman. If, indeed, as I think we have said, there are two problems, we are looking at both the short-term, the replacement for existing systems and the needs that NRR has to deal with those issues, and this longer-term broad opportunity that the new advanced I&C systems give, should our letter differentiate between those two and indicate that there is a different -- perhaps a different approach needed for each of them?

MR. MORRISON: I think that is a very reasonable question. I am not certain that that subject was discussed explicitly at the Subcommittee meeting, since I was in and out of it.

MR. KINTNER: I don't know if it was either. Bob, you are going to talk about it too. My assumption is, and

perhaps wrongly, that that is going to resolve itself on an ad hoc basis eventually, having it clarified, and it is not nearly as important an issue nor as difficult to deal with as this broader issue.

MR. UHRIG: It hasn't been to date. The reason it hasn't been is almost everything that has been done has been flood-compatible system -- exactly the same function, some additional refinements perhaps, but fundamentally performing the same function that the analog system did, in the same physical case with the same plugs, tied in with the same beta channels. If you go into a total revision of a major system, which EPRI is talking about, then the issue is no longer that simple. It is not a case of --

MR. KINTNER: Very good point. Our report of a year ago did differentiate between these problems. I think, maybe to go back and look at that and make a differentiation would be very helpful.

MR. MORRISON: I was starting to think we could add a paragraph at the end referring to that or try to factor something into the middle, if the Committee so feels that that would be a useful addition to the report.

Fred, you were going to make a comment or raise a question?

MR. MOLZ: Yes. It is related to some of the statements that were made. But, if you look at this problem

in its most potential complexity, it really is very difficult, because you -- in these kinds of systems, you have contradictory things to a certain extent. You have human control, because if "something goes wrong," you want a man to be able to do something or a woman. But then, with these internal systems, people that design those, try to anticipate problems, and we don't want a person to make a mistake and do this and do that. So, if somebody says this, we are going to automatically override that and so -- and all of a sudden you might find yourself in an emergency cut off by your own systems from what you know needs to be done. And so it seems like it is something like that. The answer, especially in retrofitting, is to stick with simplicity and not bring in the complicated fancy systems, and just go with what you were describing. Maybe some kind of a poli y along those lines would be something that would provide guidance while people develop experience with the full potential of modern instruments and control systems.

MR. MORRISON: Well, to try to move toward closure, does -- is the Committee satisfied with the report as written, with perhaps an addition on this near-term/long-term issue?

MR. ISBIN: I am still having difficulty with the top of page four, with the three specific projects mentioned. I like the way Neil characterized what you are

trying to do, and I like the way Ed characterized it in words; but I am not as happy with the three explicit projects.

MR. KINTNER: Can I try to explain it a little further?

MR. ISBIN: I suggest that you do this in words, rather than finding out the three.

MR. KINTNER: I find out the three, because already there is work that they are doing which is individually going to be useful, but could be used in a -- if it is combined and digested together, could come up with some very important insights. On the one hand, these IPEs are going to show, from a number of different plants, the scenarios, the probabilities, the places where errors can come, the places where accidents can begin. That is going to be a far better understanding in total, a far better body of data on that subject than has ever been available before.

Then, to go down to the third one. INEL is going to try to look to see what effect does human performance have on PRAs. How is it factored into the PRAs, good or bad, and under what circumstances? Now, you have got this set of data or the scenarios, and accidents and so forth that can happen, things that go on in the plant and, on the other hand, you have got an understanding presumably coming out of this of what a human performance reaction does in a

PRA to those scenarios. Then the human error analysis is does the human do this thing right, or does he do it wrong? Now, if you put all of those things together, you are going to get some insight.

Let me give you a very simple stupid answer. This is a very selfish thing. It is my view that simplicity -- that is to say, you limit the functions to those that are specifically associated with safety -- and when I say safety, I mean the reliability of operation of the plant on the part of safety, and it is combined with margins, that is more time to work with not nearly so close to the borderline of something serious taking place -- that those contribute a great deal to the totality of safety of the plants. A study of this kind would then show how that relates through the I&C system into reaction times, into what information should be presented, to what degree, as Bob points out, should the operator be expected to do these things for himself, as compared to pushing a button and it happens.

I have told this group before, and I hate to go back to sea stories, but I almost got killed by a modern control system in the operation of Mark I, the very first nuclear power reactor. The design was such that -- and we thought this was a brilliant thing -- it was designed so you could shift to the various propulsion modes of the shift, from a battery propulsion to diesel propulsion, to turbine

electric propulsion by pushing a button. And when you pushed the button to each one of these systems, then four or five valves changed, switches changed and so forth, and all it took was one guy pushing one button and it all happened.

So, this was being tested one day and there was a dumping condenser, where we were dumping steam from -- that wasn't being used in a turbine, when such an operation was being tested, and one valve failed to open, and the condensate failed to be pumped out of the condensate condenser. I walked across the platform above the condensate condenser, down the ladder and through one door and the thing exploded. It blew the whole top off and so forth. And the reason was that here was an automatic system dependent upon somebody else than humans and the valve didn't open. From that instant, that day, and this was a lesson I will always remember, that whole system was abolished from then on. It is still true of every reactor plant in the United States Navy. People who do these things by human intervention, open valves, close valves and so forth, and the automation of the computer operation of the thing --

MR. BURSTEIN: Yes. But, that was an old analog system.

[Laughter.]

MR. BURSTEIN: We are not talking about that

anymore.

[Laughter.]

MR. KINTNER: Well, it was a long story. But, the point I am making is that things -- the question as to what degree this kind of a decision versus that kind of a decision comes with total safety when you integrate it with these modern systems -- how much computer control, what kind of presentations.

MR. UHRIG: It is in existence today though -- that the Canadians are starting up from source level to full power automatically.

MR. KINTNER: I don't know.

MR. UHRIG: There are holes in there where they check things out. But, fundamentally it is a --

MR. BURSTEIN: I think we have got to get back, if I may, Mr. Chairman, to Professor Isbin's concern about the use of those three specific projects and how we are going to deal with them either in words or in specifics or what words we add to make them palatable.

MR. BOULETTE: Well, what is the concern? Can you amplify on that?

MR. ISBIN: I am only telling you what I believe, and it isn't based upon extensive knowledge. I did hear the IPE presentation in the Severe Accident Subcommittee. I did hear the statistical analysis of IPE's carried out by BNL.

I am not at all convinced that this is a key project. That is my assessment from two simple presentations. I would -- I like what you are trying to say in words -- what you and Neil have said in words, but I don't think that the study has been sufficiently in-depth to list this specifically as a project to be integrated with other things. That is my gut feeling. I am just reinforcing it.

MR. HATCHER: Could I ask just a clarifying question? In terms of these statistical analyses, human error analyses, and others related, is this being done in the context of any kind of risk analysis and deterministic or probabilistic risk and that sort of thing?

MR. KINTNER: There is certainly some broader view of why they are doing it. I think they are individual projects specifically done ad hoc for themselves. I mean, the IPEs were done. A tremendous amount of information was provided. Now the BNL has been assigned the question of computerizing it and putting it into readily available data. Maybe somebody else wants to question it.

MR. ISBIN: See, part of the problem is that you are talking about operating plants. We are not talking about the advanced reactors. There are severe accident issues which are an aside from the IPE which have to be furnished by research to tell the individual owners what they need or need not do in terms of severe accidents.

There is a whole question of accident management, which sort of gets lost in all of this. One utility I know has tried to see how their personnel can effectively interact. That was included in one of the IPEs. But, this isn't done generally. I just have a great deal of reluctance of seeing that go in as one of the three major projects.

MR. TODREAS: Could I add a point? My intuitive feeling being stimulated, stirred up by what Herb was saying is that he is probably right. The whole IPE activity had a bit push behind it when it started. There was a lot of effort. But, in terms of the real utilization of it by industry itself in any cohesive manner, by the NRC, pulling the lessons learned and recycling it back, these were the accident management response by the NRC on top of it, it is an engine that is running slow, maybe out of gas, or may be in neutral. I don't know. But, it probably isn't, as it exists now, a strong framework.

By our including this in there we kind of confer on it a mantel that there is more emphasis --

MR. KINTNER: Let me back off and say I agree. When the IPE study is finished, it seems to me that in the best of all worlds, the NRC is going to do just what you said hasn't been done yet.

MR. TODREAS: We could say that it has the potential -- let me now word it generically. I mean, it has

the potential for a lot of mischief too, because there are so many people involved, so many issues, and I mean, you could stir up, from a regulatory side and get into a lot of very specifics that aren't productive. On the other hand, you could stand back, integrate it and do a very good service. So, there is a lot of potential there, but it is not an example of a really productive prcject, and that is the change.

MR. KINTNER: Now, having said that, let me back off and say forget what is said here. What I was trying to do and I think the rest of the Committee joined, was to be helpful by suggesting some way that existing work could be put together in a synergistic way to help answer this broader question. That was what we were trying to do. Now, if these are not the right ones, are there others that someone should suggest, or should we just drop the whole thing?

MR. SPEIS: Can I take a stab at this one? I am not sure I can make a recommendation. Some of these examples, to some extent they are apples and orange. I think what is important is to push for the goal. Throw at us -- we have a number of projects in this area, and force us to think how do they fit in a broader umbrella, okay, or how do they finally fit into a triangle all the way to the top? So, throw it at us and I think that will be much

better.

MR. BOULETTE: I think it was thrown at you in the previous paragraph.

MR. SPEIS: Okay. But, the examples kind of take it away.

MR. BOULETTE: You scratched that part. The point was still made with the previous text and the previous paragraph. This is just another example or another opportunity.

MR. TODREAS: Okay. But, in terms of throwing this away, I mean, I want to get specific, because I kind of like to include it. You might just say another opportunity is in consolidating projects underway, not under three.

MR. SPEIS: Right.

MR. TODREAS: Drop the three and then still leave the paragraph, and keep the specific request on them, but not list those three, rather than drop the whole part of page four.

MR. BURSTEIN: I would so suggest, Mr. Chairman, as well. I think that is very easy to do.

MR. MORRISON: That will make it --

MR. KINTNER: Absolutely. Now, the other thought that I had from what we already talked about was to at least refer to the fact that they are proceeding with a National Academy request, which -- I don't know whether they want us

to say that or not.

MR. BURSTEIN: I think the paragraph on the short-term/long-term might deal with that, because you are not addressing the short-term on this report at all.

MR. KINTNER: Right.

MR. BURSTEIN: And the NAS study would.

MR. MORRISON: Ed, do you think you can have the revisions perhaps for us to act on either by the end of the day or tomorrow, or do we want to go away and think about this?

MR. KINTNER: I can have it done by tomorrow certainly, in long-hand at least.

MR. MORRISON: Okay. I think that would be satisfactory, just to read to the Committee. I think that we are close to consensus on what should be in the report. It is just a matter of record to make sure that we have these three or four sentences added. It is not much more than that -- maybe half a dozen.

All right. Let's then leave the final approval of this until tomorrow or until Ed gets his words out. And I think now is a very appropriate time to break for lunch. I would suggest that we reconvene at 1:30. That will give us ample time for lunch.

MR. SPEIS: Mr. Chairman, this workshop that we were discussing this morning is going to be March 1 and 2.

MR. UHRIG: Is it the one on the computer codes?

MR. SPEIS: That is on passive reliability -- the reliability of passive systems -- how you go about evaluating the reliability of passive systems. It is going to be in Harpers Ferry.

MR. SHERON: Oh, it is?

MR. SPEIS: It is an hour's drive from here.

MR. KINTNER: Dates?

MR. SPEIS: March 1 and 2 -- the first and second of March.

MR. ISBIN: And that is the historic site?

MR. SPEIS: Yes. We will give you more information later.

MR. KINTNER: What is the title of the workshop?

MR. SPEIS: Passive reliability -- passive evaluation of reliability of passive systems, components.

MR. BURSTEIN: This is the reliability question that we raised earlier.

MR. SPEIS: Yes, yes. I think with what you did, you have justified your existence for the last five years.

MR. BURSTEIN: That is where you are going to repeal the laws of gravity and other things.

MR. KINTNER: A lot of very famous things happened in Harpers Ferry, you know.

MR. MORRISON: All right. I think going to

Harpers Ferry, you ought to find out how Senator Byrd feels on passive reliability in that context. With that, let's adjourn.

[Whereupon, at 12:12 p.m., the above-entitled meeting was recessed for lunch, to reconvene at 1:30 p.m. this same day.]

AFTERNOON SESSION

[1:31 p.m.]

MR. MORRISON: I would like to call the meeting to order.

The first item of business -- George Sege wants to say a few words about the schedule or scheduling. Is that correct? Go ahead.

MR. SEGE: This is off the record.

[Discussion held off the record.]

MR. MORRISON: Let's go back on the record.

Ed Kintner informs me that he has written a set of words that will amend the Advanced I&C Subcommittee report. So, let's go back and pick that up before we start with the Waste Subcommittee. Ed?

MR. KINTNER: Okay. If you go on page two, there are a number of quotations from the previous report. At the end of the last paragraph, I propose to add another paragraph which reads as follows.

"The important safety questions of application of modern I&C systems fall into two timeframes: first, the system-by-system replacement of analog with digital equipment in presently operating plants, and second, the design of modern digital I&C systems into the next generation of reactors."

I think it replies to the questions you've raised

about pointing out that there really are two of these things.

MR. MORRISON: That's simply a statement of fact. Did you want to add anything as the direction to research based upon that?

MR. BURSTEIN: I would like to suggest you add the words that the Subcommittee report or this report is directed toward the latter, because it seems to me that you need to make that distinction, and if you do that, I think it answers a lot of the questions that our dialogue had earlier.

MR. KINTNER: The second point had to do with this meeting with the National Academy, and here you may have some real quibbles, but anyway, I said, "The full Committee was advised during its meeting on January 13th that the National Academies are being requested to organize a 14-month study on this subject, this general subject of safety goals. The Committee recommends that the charter for this National Academy study be broadened to involve the entire system of human operators, the I&C software and hardware, and their combined relationship to plant safety."

MR. MORRISON: Ed, is that in addition to what we have in the report, or does that replace something?

MR. KINTNER: Yes.

MR. MORRISON: Yes, yes.

MR. KINTNER: Yes.

MR. MORRISON: It's both.

MR. KINTNER: Yes. I thought we'd leave in the fact that we're in the process of setting up a group and so forth, leave that in. If it's not needed anymore, it's not needed, but some of us felt -- I feel, too, that something could be done before the National Academy, and it would be worth a try.

MR. BURSTEIN: Could I ask that that be repeated?

MR. MORRISON: Would you please repeat that again?

MR. KINTNER: Yes. "The full Committee was advised" --

MR. MORRISON: Could we have some quiet, so that we can hear this sentence?

MR. KINTNER: "The full Committee was advised during its meeting on January 13th that the National Academies are being requested to organize a 14-month study on this subject" -- "this subject" being this overall safety study. "The Committee recommends that the charter for this National Academy study be broadened to include the entire system of human operators, I&C software and hardware, and their combined relationship to plant safety."

MR. MORRISON: Does anybody have any problems with those words?

[No response.]

MR. MORRISON: All right.

MR. KINTNER: Then, there was one other comment and that had to do with the three projects which should be synergized and so forth, and I changed that to read as follows.

MR. BURSTEIN: This is at the top of page four?

MR. KINTNER: The top of page four. "Another opportunity is for RES to consolidate several projects already underway with the specific goal of achieving such 'an effective approach to this new and difficult subject.' Insights gained from synergizing several selected individual projects could provide the bases for better understanding" and so forth.

Then I added something which you did not hear already, and we'll see whether you have any objection. Right at the end, we'll say "The Subcommittee appreciated the considerable effort of the RES staff in preparing and presenting extensive information during the meeting on the 29th and 30th," and they really did -- there was a lot of information covered, a lot of areas, as far as presentations were concerned.

MR. BURSTEIN: I have no problem with that.

MR. MORRISON: Is there anyone that disagrees with the report as amended by Ed's comments?

MR. SPEIS: Can I ask a question?

MR. MORRISON: All right. Go ahead.

MR. SPEIS: On page three, item C, where you talk about the branch -- "The branch does not within itself possess the requisite technical and executive capability" -- that's a broad condemnation of the branch.

MR. KINTNER: It's a what?

MR. SPEIS: A broad condemnation of the lack of both technical and managerial ability in the branch. Is that what you mean, or are you talking about sufficiency? It's just a question -- you people can say what you want to -- but I'm just trying to clarify what you are trying to say.

MR. KINTNER: I thought long and hard about it. I know that that's a tough statement. I think, from our experience over the years, it's true. I really believe that Eric and whoever else ought to think very, very hard about not just changing the names or changing one or two players but somehow finding additional technical and executive strength to put into that branch.

MR. SPEIS: You're talking about additional -- you just used the word "additional."

MR. BURSTEIN: Are you suggesting, if I may, Mr. Chairman, that we add the word "sufficient" after "capability"?

MR. SPEIS: I am trying to understand what this

sentence means. I don't think I can tell you what to say.

MR KINTNER: "Requisite," I thought, was a better word than "sufficient," although they are very close to the same.

MR. SPEIS: I know we have problems as far as having enough.

MR. KINTNER: It fits unless there's some specific changes of this nature made, period, and the sooner that is recognized, the better. I think we should say it and say it that way.

You know, Brian, this morning, said the same thing. They've got two people that he considers very technically competent in this area, and yet, here is the -- what I keep repeating, and I think most people agree -- one of the most difficult, because unprecedented, subject areas for the NRC to deal with.

So, that's the background and the basis for this, and the fact that, again, we, the Committee -- and Lord only knows we're not that smart; if we were, we'd do it ourselves -- have felt for so long that something fundamental had to be done with regard to a raw strategy for this branch.

MR. BURSTEIN: There is the implication that, no matter who the agency assigned to this job, they would be technically and executively incapable.

MR. SPEIS: What I'm told is that the only person

who could lead such a branch had to be a psychologist.

MR. BURSTEIN: Well, the question whether the statement is a statement of fact as the Subcommittee and this Committee find them or whether it is meant to say that the responsible branch has not assigned the requisite technical -- it may have them -- we don't know. We haven't seen the rostrum of all the people in RES and whether they have the capability to do this or not, but the people who have been assigned to it are not -- do not possess the technical and executive capability. Is that the difference that I denote between the concern expressed and what the statement says?

MR. MORRISON: I thought Ed covered that last point within itself.

MR. BURSTEIN: I think so.

MR. MORRISON: I don't think we as a Subcommittee have met often enough with the branch to look at all of RES or all of NRC.

We will assume that the report is approved by the Committee.

Ed, with your changes, then, we'll pass it on as a Committee report, and I thank you for your efforts over the noon hour.

MR. KINTNER: Do I address this to you? I do, don't I?

MR. MORRISON: Yes, address it to me, and then I will get the appropriate transmittal letter saying that the Committee has deliberated and accepts this report as its own.

MR. ISBIN: And on the first page, you ought to include who the members were that attended the meeting and who the chairman is. We've sort of been following a format with previous reports, and I think you should have some consistency in carrying this out.

MR. MORRISON: Let's move then to the Waste Subcommittee, and we'll ask Fred Molz to take over.

MR. BURSTEIN: The report is too short.

MR. MORRISON: The waste one is too short?

MR. BURSTEIN: Yes. It doesn't have the required eight pounds.

MR. MORRISON: We didn't want to get into the mixed waste problem.

MR. BURSTEIN: Oh, I see.

MR. KINTNER: Do you have an extra copy, George?

[Pause.]

MR. MOLZ: I thought, at this time, since the Center is finally -- is rolling along and it's really the first time we've had kind of an exhaustive overview of the high-level waste research, that it would be worth going into a little more detail about the projects and things like

that, and that's why the report is thicker than most, and I apologize for including a memorandum in there. Some of you may have noticed there's sort of an extraneous page. You can just ignore that.

MR. BURSTEIN: You're just testing to see whether we read it or not.

MR. MOLZ: Yes. I know that Sol read it. So, we'll give him a plus.

I guess what I'll do is kind of review over it one time and then go back and talk about it, and the Committee really has only had one review of this. So, it's not, by any means, a final report, and it may very well be that some of our Committee members will have some suggestions for additional changes.

The first part, on the front page, dealing with the introduction and the DOE overview, more or less is for context. The subject matter there is not directly in the purview of this Committee, but we thought it would be interesting to review that.

And then, on page two, we get first into an overview of the High-Level Waste Research Program, and even though we were at the Center, included in the overview are projects that are administered through the NRC directly, without going through the Center.

And the overall procedure for coming up with

projects and identifying research is to come up with these so-called KTUs, which stands for Key Technical Uncertainties.

We didn't review these Key Technical Uncertainties in any kind of detail, but based on the perceived uncertainties, then, there are 12 major projects at the Center, and you can group the projects in several different ways.

In order to get a feeling for the overall program, we grouped them into tectonics and volcanism, geochemistry, hydrology, and then waste package studies, performance assessment, and seismic rock mechanics, and if you look at the funding, about 23 percent goes into the tectonics and volcanism, 20 percent into geochemistry, 25 percent hydrology, and then something fairly close to 10 percent for the last three areas.

Briefly going down here, the actual 12 projects: volcanic systems of the basin and range, field volcanism, tectonics -- that's one grouping, and then we have what is called the geochemistry research project. As noted, that particular project is going to be phased out, but there's lots of other geochemistry in the program. So, in no way can that be viewed as a phasing out of geochemistry.

Sorption modeling -- and that brings up one of the questions that the Committee had, or concerns, and that was

related to the use of uranium as a major element for studying transport, and I guess the Committee, in general, questioned whether or not we're over-emphasizing uranium-type isotopes, and so, that's something that we probably will want to talk about a little bit more.

Then there's the seismic rock mechanics project; integrated waste package experiments; the geochemical natural analogs, which is an area that the overall Committee has been positive on for some period of time, and we discuss that further, and we'll come back to that, also.

Performance assessment research, stocastic flow and transport -- that number 10 is also due to phase out -- for phase-out in '94, and in the past, it has been oriented a lot towards modeling in the computer, and in this case, it does appear that it's part of a gradual shift towards more field-oriented types of research, which in general the Committee endorses, and we will discuss that some more, also.

And then there is the regional hydrology project, and we note that that seems to be a rather important project from a performance assessment viewpoint because of the big picture that is meant to develop partly from that project, and finally, the formal hydrology research project, and since DOE is continuing their study of what you might call exceptionally high-temperature storage or long-term high-

temperature storage, that adds more importance to the thermohydrology end of things.

That completed the 12 projects at the Center, and in the next year, one or two additional projects are expected. You may have noticed that, in the one table that I included, the fiscal year '95 funding was lower than '94, but that will probably be eliminated by additional projects that would be added.

MR. KINTNER: What was the total funding?

MR. MOLZ: The total funding was $4.7 million in '94 and $4.5 million in '95, but there probably will be more than $4.5 million. What is in the table is just what is known at present.

In addition, then, to the projects at the Center, there are two projects administered directly by the NRC.

One, at the University of Arizona, is entitled Validation Studies for Assessing Unsaturated Flow and Transport Through Fractured Rock -- most of that project is field-oriented and appears to be making good progress -- and then a project at Cal Tech dealing with measuring the offsets, tectonic motion, using the global positioning satellite that we have in orbit.

So, that pretty much covers the main projects that are involved, and at this point, the Committee -- actually, in the presentations, what I'm presenting now was more or

less at the end, but it seemed to fit in between here pretty well.

So, the Committee also looked at what we call the overall program, meaning not looking at any particular project but viewing the program particularly within the constraints that the Commission had in our last meeting: Is the program itself doing what it's supposed to do?

I think it's pretty accurate to say that the Committee was quite impress with the overall organization at the Center, and I noticed, personally, a large difference between the first meeting that I had there, when we really got the impression that a lot of people were, to a certain extent, rediscovering the wheel, but when you start a new center, obviously you have to go through that stage before you can really start to make new contributions, so to speak, and so it appears to us now that they are really well organized and that you could almost consider the Center to be an example of the way a Federally-funded research and development center ought to operate, and so, our overall evaluation is that the money being spent is being well spent.

We saw no problem with including university research within the overall program, but as far as having an organization that coordinates things, maintains knowledge, updates knowledge, the Center seems to be a superior

organization for that sort of thing.

MR. TODREAS: How many professionals are in the Center?

MR. MOLZ: I haven't added them up.

MR. TODREAS: Somewhere around 50, though.

MR. MOLZ: Yes. I think they have four positions yet that are --

MR. RANDALL: Their approved project level is about 54 positions, and I think they're within one position of that.

MR. MOLZ: So, yes, right around 50.

MR. TODREAS: Of those, what is the number of professionals engaged in research versus engaged in regulatory assistance?

MR. RANDALL: If you do it by the budget, then it's roughly two-thirds to one-third.

MR. TODREAS: Which way?

MR. RANDALL: Sixty percent regulatory support, technical assistance; forty percent, roughly, of research. However, it's somewhat misleading, because some of the folks who are working on the sixty percent -- some of their time, in fact, will be used for research, but it's roughly sixty/forty.

MR. TODREAS: I just wanted to get a ballpark figure.

MR. MOLZ: I guess our evaluation of the overall program is very positive. There is good morale, and people act like they are part of a research organization. At the same time, they don't have their heads in the clouds. They seem to realize that they are different from a typical research organization in that there is an overriding problem that they need to focus on, and so, there seems to be a good mix there.

So, the rest of the report, then, deals more with an evaluation of the research, and the Committee was pleased to see increasing emphasis in the tectonics/volcanism area. If you go back a number of years, I guess there was much more emphasis in hydrology, and certainly, the tectonics and volcanism is of a major concern there, and so, we think that work is well balanced.

In general, the Committee felt that leaning towards field-type studies, as opposed to highly theoretical studies, at least in the immediate future would probably be a good prejudice to have. We might want to discuss that a little bit more. And we like the idea of using the Geographical Information Systems to manage and display the accumulating data. Certainly, that will be very effective and should add order to the overall process over a period of time.

In the geochemistry area, I already mentioned the

concern about placing too much emphasis on uranium chemistry, and we'll come back to that again, I'm sure, and it's one of the areas where we are requesting that there be a written response to this concern, and we mean that constructively. We'd like the people involved to sit down and really analyze why they're studying a certain isotope, so that we can all agree on what the reasons are and if they are reasonable, and we tried to list a few of the potential reasons here in the report.

MR. KINTNER: Why should there be an interest in uranium isotopes in this area?

MR. MOLZ: The reasons we heard were, one, it's easier and it's safer and cheaper to work with these, and the uranium chemistry dominates a lot of things. What that exactly means, I am not sure. You could say it dominates in the sense that there is a lot more of it, and yet, if you're walking around outside a chemical plant that's poisoning the soil, you're not going to be concerned with the salt, you'll be concerned with the cyanide. So, even though the salt might dominate, if you pick up -- well, I don't want to go into my analog too far here. Sometimes I can get carried away with these things.

MR. ISBIN: There also seems to be another point of view, and I am no expert in this area, but I tried to listen to what they were saying.

There are various minerals involved with uranium, and these undergo various changes depending upon what the environmental conditions were, and I got the distinct impression that this is part of the historical development in looking at the uranium deposits to see the nature of the changes, progression of the changes, and to get some feedback as to what the conditions were that produced such changes, because there is sort of an evolution of these changes, so that it isn't -- wasn't simply uranium isotopes, but it dealt also with uranium compositions, and this seemed to be a focus of part of their discussion. That's my impression of it.

MR. VOGEL: I was not comfortable with that explanation, because I think it's important to study the real problem, rather than a second problem, which is what I view uranium as. What we want to study is the migration of the toxic materials.

MR. ISBIN: I certainly agree, and this was stated during the meeting, and there were discussions of that during the meeting, and there were -- I know you weren't satisfied with the answers, and that's why -- we never really got into any detail on migration of isotopes, and we never got into any detail on sorption.

We talked about colloidal properties and how this might affect the distributions and the movements and the

transport, but we never really got into any depth of discussion in these areas.

MR. KINTNER: Of uranium.

MR. ISBIN: Well, of specific isotopes.

MR. MOLZ: Well, do I want to continue the review here?

MR. ISBIN: We'll come back to it.

MR. MOLZ: We talked a fair amount about the natural analog studies. I think we got, as a Committee, an appreciation for the tediousness and the difficulty of natural analog studies and the potential complexity that makes it very difficult to use that information to validate mathematical models, and so, we might want to talk about that a little more.

We kind of came up with the idea that the natural analog studies were most valuable in a natural way in providing a big picture of how a transport process around an emplacement might occur and that you get most out of them by approaching from that point of view rather than trying to explain every detail of a distribution of something around one of these sites.

MR. ISBIN: And there is another important point which you have included in the text of the Subcommittee's report, and that deals with here you have a group of highly professional trained people, you have more than a critical

mass of them, and obviously, you're going to have differences in points of view, and importantly enough, if you look at their reports that they issue, where you have a difference in point of view or dissension from majority, it's written out in the report, and we thought that, boy, this is the first time we've seen anything like this, and the staff is to be congratulated at the Center for doing that.

It was instructive for the rest of us to explore what these differences were, and I think it pretty well convinced the Subcommittee that these differences are so profound that the use of analogs can only achieve a very limited objective, and you have to be very careful in how you use analogs in order to do this.

If I may say one more thing, Mr. Chairman -- and this is a general statement. We talk a lot about codes, and we talk about verification, and we talk about validation. I think we need to be extremely careful, and I would urge the Committee to adopt a more general term of assessment.

That's all we're doing, is assessing these codes. We're never validating them. We're never really verifying them to the extent that other people interpret these terms, so that we have to be careful in how we say that, and this, too, is embodied a little bit in this report, but it carries over in the advanced reactors, when we talk about codes.

I think the research has pretty well adopted the position that assessment is probably a more appropriate way of saying that.

MR. MORRISON: At sometime later, either in this discussion or later this afternoon, I think this point about dissenting views is one that we need to address as the Committee, recognizing that this is a regulatory agency that's doing research, and obviously, there's a tension between trying to explore the end limits of science versus what you truly need for regulation, and so, are dissenting views useful in trying to bring you toward the credible regulation? And I don't think we need to answer it now, but that's a somewhat philosophical question, though, but it's a fundamental one as to how one spends one's budget.

MR. MOLZ: I think those are very good points that you've made, Herb, and under the hydrology research, this question of validation or assessment or calibration came up again, and we discussed that in a little more detail, and it's my personal opinion that, in a lot of fields, we're actually trying to change the definition of validation, and it's a form of lying, in a sense, and you have to be --

MR. KINTNER: How do you spell that?

MR. MOLZ: Validation?

MR. KINTNER: No, the lying.

MR. MOLZ: L-Y. Not telling the truth. You can

just plain lie, or you can change the definitions of the words so that people don't understand what you're saying. There's two different ways of doing it, and in trying to make models work, we're pushing up against a wall, so to speak, in that area, I think.

MR. TODREAS: The point that you were referring to that Herb brought up I think is very important for us to keep that distinction. I would say, though, in the thermal hydraulic area relative to RELAP, I think we're trying to validate the code against reality, and we should push in that direction tomorrow.

MR. BURSTEIN: You being the NRC.

MR. TODREAS: The goal on the RELAP development I think is to come out with a code validated against physical data that represents the reality.

MR. ISBIN: But the difficulty there is that you may talk about a very explicit scenario, and unfortunately, you need more scenarios. You will never really accomplish that overall purpose for which you would like to use the code.

MR. TODREAS: A lot of the individual pieces may be validated against individual experiments, but the code as a whole may only be validated against a particular scenario if you're successful, but what this says here, though, is what they were doing on a particular study was not

validation at all in that sense, was a calibration. So, this definitely falls shorter than the objective in the other area.

MR. MOLZ: We can bring out another point here. I assume that, in the request for proposal that went out, the term validation was in the title of the subject.

Now, the university people looked at that, maybe a number of them said, well, we can't validate it, but if we don't say we can validate it, we're not going to get funded. So, they write the proposal and they use the term validation just like it was used.

Then, when they get to present their first research results, they're thinking to themselves now we've got to get out of this, because we know we can't validate it, even though we said we could.

So, they say, by the way, we're not really validating it, we're calibrating it, and everybody sort of goes along with it, because everyone kind of understood that's the way it was to begin with, but the public won't understand it that way. If they see it and we say it's validated, they go back to the old definition in the encyclopedia or whatever or the dictionary.

MR. TODREAS: Yes, but it's the staff here on RES whose feet we ought to hold to the fire on that. If they started it off that way, that was not in the best direction,

the right direction.

MR. MOLZ: Yes. If you agree that validation really can't be done in the strict sense, then the term shouldn't be used, and that's where Herb's point of view, I think, comes out. If we use some of these other terms -- and in all honesty, you'll get people that will disagree with that, but I don't think there's too many that really, really disagree with it.

MR. HATCHER: I just had a question about the categories that have been defined here, or loosely defined perhaps. I was going to ask, in the general sense, if at some point there is a plan to bring these things together and have cross-fertilization, integration of all the ideas, such as in the research related to hydrology, which bears on geochemical, transport phenomena.

Seismology -- again, going back, there have been arguments about the effects of seismic pumping on the hydrologic system at Yucca Mountain and other places. Is there a general plan for this sort of thing that sort of overrides this entire program?

MR. MOLZ: The way I understand it, that would come in under -- probably under performance assessment. Now, there's some of that done all the time, informally, but the performance assessment project is supposed to integrate everything and use all that information to actually assess

what's going to happen.

MR. HATCHER: I guess my other question you've already answered and that is that these people are communicating back and forth all the time anyway.

MR. MOLZ: Yes.

MR. BURSTEIN: This particular group has the advantage of working all together rather compactly. So, I suppose there could be cases of miscommunication, but I would imagine that they'd be rather small.

MR. ISBIN: And the term iterative performance assessment is used because you go back, you learn what you did, and you go through the cycle.

MR. HATCHER: All right.

MR. MOLZ: Okay. The corrosion research seems to be on a firm basis. That's one I remember when had our first visit there. It seemed like it was kind of shaky, but they have a firm idea of what they're looking for now and ways to go about it and also seem to have good facilities there for the research.

MR. KINTNER: For the waste package?

MR. MOLZ: Yes, under waste package research. And they also are considering microbial mediated corrosion as one of the sub-areas that they're studying

And then this next-to-last subject I mentioned here, the performance assessment, here we use the term

iterative performance assessment, and one of the things they do is they come up with disruptive scenarios, and four of the prominent ones are volcanic events, climate change, seismo-tectonics, human intrusion, and then within each of those areas, you could have various types of disruptive scenarios.

Obviously, climate change could go either way. so that you could have two types of disruptive scenarios, one associated with warming, one associated with cooling, and things like that, and then, all the information from the other research is brought together here and used to try to evaluate the performance of the potential repository under the various scenarios.

I guess that kind of is a quick overview.

MR. ISBIN: With reference to the disruptive scenarios, the Subcommittee was impressed with the presentation of the performance assessment, but the difficulty is what scenario should you include? I mean if you leave it to your imagination, you can destroy anything, and it was pointed out that, by EPA requirements, all scenarios are to be looked at, but we got more of a rational approach from the presenter, and it's important that you determine what this rational approach is.

What you do now is going to be the focus of attention by others who will be reading it at a later date.

So, it's important that the documentation be made on justifying the kinds of scenarios that you choose to examine and have a basis for that. This is going to be important in terms of public acceptance of what you do.

MR. MOLZ: So, how do you do that?

MR. ISBIN: Well, they're doing this in severe accidents.

We thought that the Center might learn something from what is being done on severe accidents in how you approach the subject, because it can be completely open-ended, but you are finding closure, you are getting to closure on some very significant severe accidents, and you've done this through a process, a process which involves an open discussion of the events that you are going to consider and why you're considering it and why you think that it should be restricted to these set of events.

So, there are some lessons, hopefully, that can be learned from severe accidents which can carry over into what you're going to handle in disruptive scenarios for the repository. This is the best I can give you.

MR. KINTNER: Is this probabilities?

MR. ISBIN: The whole performance assessment is based upon probabilities, but these probabilities that have to be interpreted, and this is where Turcotte was making his points some time ago in that you have to make it on a basis

that is understandable by the public, as well.

You're talking about events which can occur anytime through 10,000 or so years, and this needs to be written in such a way that it's understood, understood not only by the scientists involved but understood by others who are going to look over your shoulder.

MR. MORRISON: Sol Burstein, you had a question or comment?

MR. BURSTEIN: Right now, it seems to me that we're involved in a program that seeks to provide the regulatory commission with expertise in this area.

We've talked about these key technical uncertainties, and I'm not sure that those technical uncertainties are to help the DOE make an application for the repository, for the EPA to write regulations or criteria from which regulations will be written, or for the NRC to resolve questions of fact, if it can, but it seems to me we're at the threshold of getting some basic information in the hands of the people who are going to have to use it.

We're not writing a Part 60. It's been written. And we're not here to create scenarios, because we're not quite at that stage yet, because I don't think we know enough to do that. At least the NRC, in my view, is learning how to do that.

So, I guess one of the questions I have for the

Subcommittee is have we defined things like KTUs, and have we looked at the program from that point of view, from the point of view of providing that technical capability, that expertise that this agency has to have in order to do its jobs, or is there something other target to which we are addressing the capability of this Center and the staff?

MR. MOLZ: I think we're targeting the Center to support -- on the basis of supporting the NRC in their role of approving or disapproving the license for the repository that we expect.

MR. BURSTEIN: My question would be, for example, whose job is it to find out what the geology under Yucca Mountain is? Is it DOE's?

MR. MOLZ: It would be DOE.

MR. BURSTEIN: What's the role of NRC in this relationship? Are they duplicating what DOE is doing, and if not, is there a different purpose, and I think there is a justifiable reason for this research, but I'm wondering whether we're getting away from focusing on that towards something else, and I guess I'm asking are we? I don't know.

MR. ISBIN: The paragraph on the bottom of page one attempts to give you that answer. The NRC -- Research and NMSS have established these key technical uncertainties in order to be able to establish their information base and

their expertise to judge whether or not the license for this repository will meet the '96 requirements that have been set forth in 10 CFR Part 60. This has been done.

There are specific requirements that have been set forth. Research and NMSS have gone through these requirements to determine where are the missing gaps. These missing gaps are called key technical uncertainties.

Uncertainties is a word that they chose, which may have been -- could have been different, but it's a very broad-based approach, and we're cautioning them later about how you handle these key technical uncertainties, but this presents the format upon which they can judge whether or not the license application has met the Federal requirements.

MR. BURSTEIN: Who has the responsibility for defining these uncertainties? Is this the DOE? If they come in and say I've read your list of uncertainties and here's my answer to it, I've done this work, I have it --

MR. ISBIN: These key technical uncertainties involve a broad range of work. Some of these key technical uncertainties the staff recognizes that they themselves cannot do and will need to depend upon DOE. In other cases, these are independent evaluations.

All of this has to be restrained by the kinds of budgets that they have. So, we tried to explore with them, in a fair amount of detail, how they went about doing this.

This is the beginning subject. We haven't, by any means, attempted to complete it, but we recognize some of your concerns, Sol, and this will be part of the ongoing project.

MR. BURSTEIN: But remember, the word you use -- and it scares the hell out of me -- is independent evaluations.

Now, I have been on the soapbox before, and I will continue to fight that is not the NRC's job to create independent evaluations. If it is a means to educate the staff then I think it is worthwhile, but if it is to independently verify the science that somebody else comes in with, I have problems with that.

MR. ISBIN: This wasn't really said that way, Sol.

MR. BURSTEIN: Independent analysis is one thing, and independent research of fundamental phenomena is something else, and let's get with it.

MR. VOGEL: These key technical uncertainties, of which there are some 59, were informally given to the Subcommittee, and we have not discussed them as a group.

In my perusal of these, it seemed to me that quite a number of them were pretty general and that many of them could be combined one with another and so on, so that I think that that's a flexible list at this point.

MR. MORRISON: I think that's a pretty good point that you make, Dick, and maybe there's an issue we have to

address of why we couldn't get access to these, but I'd really like to have an expression from the staff with regard to these key technical uncertainties, who is charged with solving them.

MR. COSTANZI: The key technical uncertainties, right now, is a preliminary group. It is under review by the staff, both the Research staff and NMSS, and your observation is quite correct. Many can and should be combined, and there may be a few that should be split off one from another, but it's certainly something in a state of flux.

But having said that, when the list is finalized, at least to the extent that it will be before the next review of the list and any subsequent review, it is going to be -- it is now and will be ultimately the responsibility of the Department of Energy to address those key technical uncertainties.

The NRC's role is to determine whether or not DOE has adequately addressed those uncertainties in its license application.

The role of the Office of Research with regard to those uncertainties is to assure that the NRC staff, the NRC as a whole, has the data, tools, and expertise to be able to assess DOE's compliance with the regulations, a step to which is review of DOE's addressing of the key technical

uncertainties.

We are not going on our own. We are not designing a repository. That's DOE's job.

We do do research that, in some cases, confirms the techniques and methods used by DOE to characterize the site or design or assess the performance of their engineering, including the waste package, but again, we don't characterize the site for DOE. We don't design the waste packages for DOE.

Our research is confirmatory in nature, and it is kept that way. It's also very selective. We don't have the resources -- and it wouldn't be a good use of them even if we had -- to do everything. We can't. It just wouldn't be a good idea to go everywhere.

So, we select those things which are most important, most bear on the overall performance of the repository over time, the KTUs, and those are the things which we spend our resources on, but we're not duplicating the DOE program. It wouldn't be useful, and we don't have the resources.

MR. KINTNER: DOE and its laboratories must somewhere be doing something on every subject you've got in your KTUs.

MR. COSTANZI: They are or will have to at some point, yes.

MR. KINTNER: Right. Secondly, I'd just guess that their total research budget is a factor of 50 higher than yours.

MR. ISBIN: Ten.

MR. KINTNER: Ten? Is that all?

MR. ISBIN: In terms of research.

MR. KINTNER: They're only spending $40 million a year?

MR. BURSTEIN: You can talk about characterization or exploration as not necessarily research.

MR. KINTNER: I was trying to just say research, not digging the holes or whatever, but they must be doing far more than you in these areas.

MR. COSTANZI: Yes.

MR. KINTNER: And so, what you're saying is you're essentially confirming or doing enough to be sure that they're not totally erroneous in their conclusions.

MR. COSTANZI: I'm sorry. I couldn't hear you.

MR. KINTNER: You're doing enough to be sure that they're not totally erroneous in their conclusions on fundamental points.

MR. COSTANZI: That's exactly right. That's exactly right.

MR. RANDALL: Those areas which potentially are critical, that could lead to areas of potential

noncompliance, those that have the highest risk.

MR. KINTNER: To what degree do you exchange with them this list?

MR. COSTANZI: We have periodic meetings with the Department. NMSS is the contact with the Department of Energy. The Office of Research feeds into those meeting, and often, we attend them.

MR. KINTNER: Not only the subject but the results, the data is exchanged.

MR. COSTANZI: Everything. Everything. The flow of information from the NRC to the Department of Energy as to what we're doing, what we're seeing, how it's coming is completely free.

The Department of Energy, for reasons which I think are fairly obvious, generally gives information more formally. It is from published reports and papers and the like.

However, at various meetings, international meetings as well as national meetings, workshops, and the like, there is a lot of staff-to-staff exchange of information as well, in a much less formal way, but I should caution that all the meetings between -- official meetings between DOE and NRC must necessarily be public meetings.

The international meetings and symposia, professional societies, and the like, where staff talk with

one another, of course, are also public meetings, but those are not DOE-NRC meetings. Those are professional meetings, and that's under a different regime.

MR. KINTNER: Let me ask you another question. How do you explain that they're doing so well? Here is this new organization that gets set up, start out rather quickly. How do you explain that? Is that Mel's fault? Did he do that?

MR. MOLZ: I think it must be Mel, yes.

MR. COSTANZI: I think that's right.

MR. RANDALL: I think it's the people in my branch.

MR. MOLZ: Well, Wesley Patrick, who is now the president of the Center, he is extremely capable, and their technical director, Booty Sager, is another person who is widely respected for his honesty and non-game playing when it comes to models and that sort of thing. He's done a lot of modeling work in his time, but he basically is a scientist, not a modeler, and there is a difference, fortunately. One time I heard a scientist say we can't leave the natural world to the euphoric modelers.

MR. TODREAS: There must be some interaction between whatever Bernero's group is and Eric's group in terms of RES. Somehow your two groups must have come together, decided how to interact with this organization and

make it work, because you both have different objectives for the same group.

The players in the Center are interactive, in a sense, across the board, to some extent, and that was a potential issue at some point and somehow must have been constructively resolved here to make it work there.

MR. COSTANZI: We took what could have been a real problem and made it a real plus.

The fact that many of the Center staff do both research and technical assistance has been a boon to both programs, because there is a much more ready exchange of insights and ideas and a better understanding of the needs of licensing as a result of that.

They interact virtually on a daily basis with the NMSS staff. We know what they're doing and they know what we're doing.

This exercise of defining the compliance demonstration strategies and compliance demonstration methodologies and the KTUs themselves was a tripartite effort of NMSS, Research staff, and Center staff.

MR. TODREAS: Let me just make one other comment which is relevant to Ed's.

The success here and then in Idaho relative to putting a team together with very a different success path in it has to do with a commitment to get very good people,

an ability to hang tough, and don't hire unless you've got them, and then when you recognize them, really go out and grab them and make it attractive to them, and I have some sense here, through some of the contact I had, that that's done in the Center, and I suspect there was a lapse relative to the thermal hydraulics activity in Idaho over the past few years.

MR. MORRISON: Is it a COTR or a program manager or whatever it is within NRC to whom the Center reports, not the contracting officer but the contracting officer's technical representative?

MR. RANDALL: Project manager.

MR. MORRISON: Project manager? Where is he? In NMSS?

MR. RANDALL: The project manager for the research program resides in my branch. For each of the individual projects that you have listed in your report, there is a corresponding project manager in my branch that monitors that program, directs it, assesses it, and works directly with it.

MR. MORRISON: So, in reality, though, the request would come from NMSS.

MR. RANDALL: NMSS would, in effect, refer a user need, but that, in effect, is done after many mutual discussions with us.

Once NMSS has, in effect, established a user need area, then my staff develops a statement of work, and that statement of work is then reviewed with NMSS, so that NMSS feels that it is meeting that.

Then that statement of work goes down to the Center, and about 30 or 60 days later, the Center sends back a project plan which then is looked at both by our staff, NMSS, collegially, and then my staff has to, in effect, agree that, yes, it's doing it and then Bill Morris says fine, I will give you the money for it.

MR. KINTNER: Who is the Center director? NMSS?

MR. COSTANZI: NMSS is the manager of the Center.

MR. SPEIS: But in all areas of research, we interact with them directly. We don't go through NMSS.

MR. COSTANZI: NMSS is something like the function of the DOE office to a national lab. They take care of the administrative things.

MR. MORRISON: I'm confused, because I thought the Center reported to Research, and you tell me it reports to NMSS.

MR. COSTANZI: The report of the research work and the direction of the research that will be done at the Center is from the Office of Research alone. The administrative details of the management of the Center is NMSS.

MR. MORRISON: Now, what's puzzling me -- and maybe I'm not entirely correct -- is Idaho National Engineering Laboratory FFRDC?

MR. COSTANZI: Yes, it is. It's the Department of Energy.

MR. MORRISON: With the two different responses with regard to hiring people, is management within the agency or within the FFRDC?

MR. VOGEL: I would suspect it's a matter of different traditions. Idaho goes back over many years, and I imagine that they've developed some bad habits.

MR. MORRISON: But one of the purposes of establishing FFRDC is to maintain capability over a long period of time and be able to attract the best and brightest.

MR. MOLZ: Well, isn't Idaho sort of a political football being bounced around all the time? Isn't Idaho a politicized organization, basically?

MR. BECKJORD: Idaho has been part of the old AEC and a part of the Department of Energy's national laboratory system, and in fact, if you want to go way back, they tested the ordinance for the battle ships. It was a good firing range.

The work there -- there has been -- if you look at it over a long period of time, there's been financial

stability, but there have been periods when programs declined.

Idaho became the -- for a long time, it was called the National Reactor Testing Site -- I think that was approximately the words -- and that was where most of the test reactors were built.

As that period came to an end and there was less of a need for the experimental and demonstration plants that were built there, they went through a period of decline. So, naturally the politicians in Idaho have always been interested in seeking means of continuity for maintaining the operation.

There have been a lot of changes over the last 10 years. For a while, the Star Wars program was a big part. Well, that has disappeared, and there is less reactor business now than there used to be.

So, I think, generally speaking, their reactor side has been in decline. The waste program has taken up some of that slack out there, because there are activities both in waste disposal and reprocessing, and I think there are still some Naval activities that are underway out there.

Another change that has taken place is that, in the early part of that system, the site -- there tended to be one or very, very few contractors that managed the whole site. It went through a period where it became a number of

contractors, and now I think what you can say about it is that there are still several contractors in Idaho but that the Department of Energy is tending to open these for competition at the end of every -- almost at the end of every five-year cycle.

The contracts are five-year contracts -- for example, EG&G in Idaho -- and I have heard that that will be an open competition again, and of course, at Albuquerque, there has been a big change down there recently, as well. So, there's quite a lot of flux in the national laboratory scene.

There's a point to make about the Center for Waste Regulatory Analysis, which is it just didn't grow up in San Antonio all by itself. I mean the Southwest Research Institute has a very firm leader, and he has been in charge of that place. I think he began -- Golan began the Southwest Research Institute, and he's still very central in the management of it, and I think that the practices that this FFRDC follows in terms of personnel and their other policies are policies that were laid down by Dr. Golan, and so, it didn't just happen. I mean he gave a great deal of -- he and some of his senior people gave a great deal of thought to the decision of whether to make a proposal for that facility, and I think that he has been -- I think he still plays a role in the laboratory, his oversight of it,

Southwest Research Institute's oversight of it.

MR. MOLZ: So, I think you can see the reason there. We're dealing with sort of a pristine organization that still exists because of its main reason for being creative, and maybe it won't have the same kind of fate as Idaho being that the Southwest Research Institute.

MR. BECKJORD: Well, it's a different situation, because it's -- I mean compared to Southwest Research, it's a rather small -- it's a very small part of Southwest Research Institute, and if, for some reason, there was a lack of funding continuity, they would figure out a way to deal with it, and they probably could deal with it, and it's more difficult in the case of an Idaho.

MR. MOLZ: But it seems like their environment right now is good, and so, that's something that should be given a lot of thought, so that they do maintain their effectiveness and they won't start to get pulled in different directions and things like that, and I think that's something to keep in mind.

MR. VOGEL: I did not detect among the staff a tendency to play games with budgets and to get distracted by the game playing, and I think that this disease inflict itself upon other national laboratories, to the detriment of the program.

MR. KINTNER: Up to this point, have they

discovered anything fundamental, significant, new, exciting, leading into some new directions? Is there anything that's going to help or hinder the whole question of Yucca Mountain from the work done up to this point?

MR. COSTANZI: There have been a number of things that have been learned in the research that's been done that have a direct bearing on DOE's -- the way DOE is characterizing Yucca Mountain, particularly in the area of geology.

In some of the work that we're doing there in volcanology, we expect that it will, before very long, have some useful information to provide to DOE about how it's looking at the question of volcanoes or potential for volcanoes at the site.

MR. ISBIN: I have a question as to how you conduct corrosion pitting for a long range.

MR. RANDALL: In other words, looking at corrosion mechanisms as opposed to general corrosion. That insight happened a number of years ago, but that focus has continued at the Center, and that message continues to come out from the Center, that you can't just consider the thickness of a container but the fact that it may locally corrode.

MR. COSTANZI: Also, in the area of rock mechanics, the fact that -- with regard to the stability of openings, that the effect of small seismic events seems to

be cumulative and that, over time, the effect of a number of events would tend to weaken the openings.

MR. KINTNER: Everything you've said so far would seem to be in the direction of throwing greater question with regard to Yucca Mountain.

MR. COSTANZI: No, I don't think that's the right way to look at it.

What it is is making sure that the set of information that DOE eventually comes up with and submits in its application is complete and that they have looked at all reasonable possibilities and that things that need to get addressed are addressed and there's nothing laying under a rock or under a wall to surprise us.

So, I think that the work that we're doing is very critical in that sense, to make sure that, when the application comes in, it is complete and there aren't -- there is nothing that's under a rock someplace that's going to come around and bite us.

MR. VOGEL: We have to be careful in discussing the San Antonio laboratory in that we're painting a picture that the only way they can go from here on in is down.

MR. MORRISON: Let me suggest a means to proceed to try to get to get to some closure on this particular issue, on this particular Subcommittee's report.

I will assume the pages one, two, three, and most

of page four are a statement of fact and there is no argument on those statements of fact. We will take the Subcommittee's report as an accurate statement.

I think beginning with the overall program examination at the bottom of page four and carrying through page eight that we need to as a Committee determine whether these evaluations fit the Committee's mold of what should be the report.

MR. ISBIN: I know Fred has been extremely patient with me, but back on page one, I would feel a lot better if you would omit the statement dealing with the Government Accounting Office and the concern that we missed the date by 5 to 13 years.

This is not really in our purview. There are a number of other organizations that are looking in detail as oversight on DOE.

This just sort of adds fuel to critics who think that Yucca Mountain will never be realized as a repository. I don't think it really adds anything to the Subcommittee's report, and I would sort of suggest that, if you don't mind.

MR. MOLZ: Yes. I knew that you were concerned, and it's the kind of thing that I don't mind putting in, reading it, and then taking it out, but I think it's a very relevant piece of information from a research point of view, because if you have 20 years to do something versus 10

years, you do it differently. So, it's certainly something that is necessary to keep in mind, and if it's the Committee's feeling that we don't need to have that in there beyond just talking about it, that's fine with me.

MR. KINTNER: What is the Center doing with regard to scheduling? Is it scheduling on the earlier schedule or on the later schedule?

MR. MOLZ: Well, there's actually three there. There's 2001, which if you asked them, they would probably say that's what they're scheduling on, and then there's 2006 or 2014, so -- depending on who you believe and which extreme. That is a little bit of a problem.

MR. TODREAS: That might be the way to deal with it then, put a sentence, instead of the "however," saying that the Center is scheduling work based on the 2001 date, and is this date under review or has NRC been notified that there may be a change, are you adjusting yourself to it? Just whatever the reality is.

MR. ISBIN: Well, I think it's a decision by Research and NMSS as to what you're going to do, and I think, if I understand things correctly, you recognize there may be some slippage, but you can't really include that in your formal planning. You're going ahead on the basis that this is an assessment date and changes will be made, if necessary, at some other time.

MR. COSTANZI: I think it needs to be recognized why there may be a slippage. Characterizing the Yucca Mountain is just a lot harder than I think originally thought, and it's just going to take longer to do.

MR. RANDALL: The National Academy of Science report in 1990 recognized -- without getting into the details of that report -- recognized that, in fact, it could take longer, there could be surprises, and they would know as they go along but that the program should be flexible enough to accommodate what they learn during this process at Yucca Mountain and deal with it.

MR. KINTNER: Well, you know, as a dumb blacksmith, 20 or 30 years and $6 billion to characterize that mountain is just obscene, but you guys know lots more than I do.

MR. MOLZ: Well, the trouble is you can't characterize it. Everything is tied up. You know what I mean? It's regulations and rules.

MR. KINTNER: It's sufficient to decide whether or not you can put this stuff in there.

If you can't decide without $6 billion and 30 years, then you'd better forget it, go figure out something else to do, because at the end of this time, you'll spend $6 billion and it will take 20 or 30 years and the same arguments will still be there, the same ones -- volcanism,

human intrusion -- you are never going to work those out, and no matter how much research you do, it isn't going to change it.

MR. MORRISON: I think the question is, is the program at the Center being planned around 2001?

MR. KINTNER: Right.

MR. MORRISON: If that's a statement of fact, w should make that fact. If it's planned around 2014, that's something else we've got to state, but if it's 2001, let's state it that way and not recognize that there's going to be any slippage and that at least NRC will have all of its package ready to go in 2001.

MR. ISBIN: That's what the second statement says.

MR. MORRISON: No, the second sentence doesn't say that. The current planning is for DOE to submit its license, but it doesn't say that NRC is planning on that same schedule.

MR. MOLZ: So, we'll take the 5 to 13 years out, and we'll put in the fact that NRC presently is planning on the 2001 schedule.

MR. TODREAS: That's the research program at the Center --

MR. MOLZ: Right.

MR. TODREAS: -- under RES direction is based on the 2001 year.

MR. BIRCHARD: I would simply say it's based on where the program -- the DOE national program is today, not on a specific date. We're focusing on how the program has developed, the stage of the program with regard to site characterization and so on.

MR. MORRISON: What's your name?

MR. BIRCHARD: George Birchard.

MR. COSTANZI: I think that, you know, while it is certainly true that we're looking very closely at DOE's activity and, obviously, site characterization is, at this point, the name of the game and we've certainly focused on that, we do have recognition that there is a schedule set by Congress for the development of the repository, and we are planning to that schedule.

MR. MOLZ: And the schedule set by Congress right now is the 2001?

MR. COSTANZI: Yes.

MR. MOLZ: All right.

MR. BURSTEIN: No. There is no Congressional action that I know of that specifies 2001. There is DOE saying that we can't make it sooner, but there is no Congressional mandate other than 1998.

MR. COSTANZI: There was a request by Congress to DOE to come up and tell us when they're going to get this done, and that was DOE's response.

MR. MOLZ: Well, maybe we should say that DOE is planning to submit its license at 2001, there is a possibility of slippage, and research at the Center is --

MR. BURSTEIN: I would just leave that speculation, as speculation, out of this report. You're trying to state a fact, and the fact that I understand from all this discussion is that RES is proceeding to do its work so it will have -- it will be able to accommodate the application that DOE is planning to file by that time.

MR. COSTANZI: There is a part of the schedule which is set by the Congress and that is that we have three years to review the application, which means when the application comes in, we have to hit the ground running.

MR. BURSTEIN: That's your internal business, but the research program that is this Committee's business is geared to this 2001 date and not to anything later or earlier.

MR. KINTNER: One thing that gets lost in all this is that used fuel, spent fuel is building up day after day, week after week. The storage capability is running out in almost every plant in the United States. A great deal of money is going to be spent and is starting to be spent to find a way to head this off.

Sometime there's going to be 80,000 tons of this stuff that has to be put somewhere, and the longer that's

delayed, the longer -- the more it costs and the more the uncertainty exists for the whole subject.

So, there's a time constant associated with getting this resolved that really matters, and you can smile about it and you could shovel every shovel full of that dirt and put it through a sieve for $6 billion, I think, in 20 or 30 years.

MR. BURSTEIN: I think the gentleman's point is well taken.

MR. KINTNER: When you talk about $6 billion for that kind of analysis, something is wrong. Either that's not the right place to put it and you ought to start looking somewhere else or $6 billion isn't the right number.

MR. BIRCHARD: That's not our problem.

MR. MORRISON: There's nothing that NRC can do about that.

The staff informs me that we've got some problems with the numbers on page two.

MR. COSTANZI: The total budget for the high-level waste program in FY '94 and '95, I believe, is $6.2 million and $6.3 million, and something in the neighborhood of $500,000 or $600,000 is earmarked for the Center. I think it is incomplete, and I would like to get back to you with more accurate figures.

MR. MOLZ: Okay.

MR. COSTANZI: Also, I want to point out that we actually have two projects at the University of Arizona.

MR. MOLZ: I knew that, and yet, the presented it like it was one.

MR. BURSTEIN: Did you present these numbers to the Subcommittee at the time of their meeting, or did you present different ones and they copied them wrong?

MR. COSTANZI: I think these were numbers presented by the Center, but I don't think that they are complete.

MR. MOLZ: I actually phone them back after the meeting and got as much information as I could on this. This is what they gave. And then I called the NRC to get the information on the Arizona stuff, but I was interested in dollars, not -- I don't care if you call it one project or two projects, you know.

MR. MORRISON: Let me interject for a moment. On this whole paragraph, let's take it off line, because I am informed by Eric -- and this is something we've always adhered to in this Committee -- that we can't discuss next year's numbers. We can only discuss '94 numbers. We cannot discuss '95 numbers, because '95 numbers are not known. We can't have them in there, and I suppose, when you take this off line, you have to look at your percentages, as well.

MR. ISBIN: I remember that you did give us

something like $6 million, because then we asked you about the DOE research program, and that was $60 million, so that was where the factor of 10 came in.

MR. MORRISON: Let's not argue about this. It can be satisfied very quickly in terms of the numbers.

Then we go to page four, on the overall program evaluations.

MR. BURSTEIN: On page five, in the second full paragraph, beginning "The Subcommittee . . .," it says the methodologies have to be thoroughly evaluated and documented to achieve public acceptance.

I have a little trouble with the idea that the whole purpose of this is to get public acceptance. It would seem to me some scientific credibility would help, too. So, I just wonder whether that's really what you meant to say.

MR. MOLZ: To be able to get public acceptance, I think, is what we're -- it's not that you're striving for it, but ultimately you need it, and if you don't have things documented, you won't get it.

MR. BURSTEIN: You can say for scientific and public credibility or understanding, but it's not just the public, it is a whole group of people, including the regulators and the regulatees and the scientists who are involved, the judges and the lawyers who are going to earn their retirement funds on this program, as well as other

members of the public.

MR. ISBIN: Yes, that's a point well taken. So, you would include scientific. All right.

[Pause.]

MR. MORRISON: Anything else on page five?

MR. BURSTEIN: I assume that, when we get to look at the percentages of dollars, such as in the third line from the bottom, that those will be checked in light of the previous comments on the budgets and their divisions.

MR. MORRISON: Let us assume that that will take place.

MR. MOLZ: There will be minor changes on a percent basis.

MR. MORRISON: Moving on to page six.

MR. ISBIN: I am reluctant to make some comments here, but I feel obliged to do so, and again, I appreciate the patience on this.

I would hope that a report of this kind doesn't really lecture to the Center. We have discussed these points very clearly with all of the staff there. The points were made and understood.

For example, to refer to the book by Benedict Pickford, I think that's the kind of comment that we don't need, and I would respectfully ask that it be simplified in what you say here.

MR. MORRISON: We'll strike that paragraph then.

MR. HATCHER: I found a comment at the top of the page about using the example of models, theoretical models here. That's a valid comment to make about theoretical models. The one we choose may have a direct bearing on understanding the potential for volcanic activity.

MR. MOLZ: What I mean is, if you start getting into modeling processes, where you're doing model-based studies, as opposed to some kind of a database, if you started doing that at the expense of gathering the basic information at this stage, I think it would be a mistake.

MR. HATCHER: I agree with the concept of what you're saying. Perhaps you would want to choose a different example.

MR. MOLZ: Well, what would be an example? What would be the basis of actually modeling something like that?

If somebody started to develop studies of how these plumes might start and just got into the computer end of it, as opposed to looking for data, like heat flow anomalies or something like that, that would support the contention that there is a plume developing there or something like that.

Again, I don't view that as an important statement. I think the Committee was trying to just give some substance to the idea of the -- at this stage,

especially -- the field work, as opposed to models, meaning computer models.

Maybe we should just say highly theoretical model-based areas and not say anything beyond that.

MR. HATCHER: Okay.

MR. MOLZ: Let's just do that.

MR. BURSTEIN: Mr. Chairman, in this general regard, there have been a number of places where the Subcommittee has identified work being done to develop and construct models.

Now, we have found, I think, in other disciplines within RES, the need to develop independently modeling or models and the capability for modeling, because some of the things that vendors threw at the RES were not adequate.

It seems to me we do not yet know that the same justification for modeling, independent development of models by RES, prevails in this case, and I am wondering why we are already developing models for the phenomena or the analyses that we're talking about independently.

What is the justification for doing that outside of training the people and providing them with the capability of dissecting and analyzing somebody else's presentations?

MR. ISBIN: Well, several years ago, I attended an American Nuclear Society meeting in which performance

assessment was being discussed, and there were about five or so different performance assessments made by various groups, mostly supported, I believe, by DOE, and it turns out that the Center did not make a presentation. However, everybody there pointed out that the Center was the expert in performance assessment, and if that impression is correct, the Center --

MR. BURSTEIN: Which center? The Center didn't exist five years ago.

MR. ISBIN: I didn't say five years ago.

MR. BURSTEIN: I thought you did.

MR. ISBIN: I said two years ago or something. Whatever it is, it's within the past two years.

MR. BURSTEIN: Okay.

MR. ISBIN: But the point was that this is really correct, and the performance assessment started, I guess, at Sandia, didn't it, and was taken over by the Center, and the Center apparently may be the leading experts in performance assessment.

MR. BURSTEIN: I would challenge that right off the bat, right now.

Remember why the Center was created. The Center was created so that we would have an independent area of experts, because DOE had already usurped all of the national laboratories for its own use, and we couldn't employ the

same guys. That would be a conflict of interest. When the Center started, we had no experts there.

MR. ISBIN: Well, let me defer to the NRC and see whether or not perhaps what you say about performance assessment and the Center -- aren't they the leading group in this area?

MR. COSTANZI: I think that the role of the Center is to make sure that the NRC has not only the experts but the expertise to review DOE's application. That's what we're all about. A critical element of DOE's application will be performance assessment.

We believe -- we have concluded from other areas -- licensing activities in which the NRC staff has been involved -- that if you're going to review a performance assessment, you better have done one yourself, you better know what it's all about, and certainly, that's the direction of our performance assessment work at the Center, but there's no point in -- since you're going to be doing that work anyway -- not to look at what insights it may give you in doing performance assessment as to how a repository should function and what might make it not function, so that you can be sure that DOE has addressed those contingencies.

MR. ISBIN: Additionally, as I understand it, one-third is done by Research, one-third is done by NMSS, and one-third by the Center. So, here, Sol, you have a combined

group that's developing this expertise and doing, apparently, a very good job.

MR. BURSTEIN: I am not suggesting they're not, and that really wasn't my question. I am concerned about the need to develop models.

Now, doing performance assessment does not mean the same to me that says we develop, produce, construct, and create models.

MR. COSTANZI: Not as an end in itself, no, but sometimes you need to develop a model or to take a model in the sense of an abstract view of a physical process and translate that into equations with which you can then do calculations, typically with the aid of a computer, and that exercise, going from the abstract picture of the physical process to the formulation of equations to the writing of an algorithm to grinding out numbers, is something which gives you part of what we're after, this expertise.

MR. BURSTEIN: I cautioned my remarks, again, before, as you heard, related to the training and the development of the capability, but again, I am trying to avoid the duplication of effort and the assignment of scarce resources to the people who don't have the responsibility for doing the performance assessment. That is DCZ's job. Yours is to check it. And all you need is the capability to check it, not the capability to create it.

MR. COSTANZI: We are not creating DOE's models.

MR. BURSTEIN: You're creating your own, and I asked you whether you had yet gotten to a point in this evolutionary stage that you already determined that you needed independent models.

MR. COSTANZI: There is a document which was written a number of years ago -- I don't recall exactly how many, I think about seven or eight years ago, when Part 60 was first published as a final rule -- which outlined the strategy that the Office of Nuclear Materials Safety and Safeguards would use for licensing, for reviewing the license I should say, licence application of the Department of Energy, and included in that strategy was a document called the modeling strategy document which outlined the use of models, and it determined in that document -- and as far as I know, that position has not changed significantly -- that there would be some independent modeling by the NRC of certain aspects of the repository performance, and it was acknowledged at that time that, to a certain degree, there would be some independent models developed.

MR. BURSTEIN: That's the first I've heard of that. I'm not sure whether the Committee knows of it or whether it was included in our review of the budgets.

MR. COSTANZI: These models are to be able to look at alternative interpretations of the data which we

anticipate DOE will develop in characterizing the site. Again, it's the completeness question.

DOE is going to develop a model for the site which will presumably assess what they expect and how they expect the repository to behave, and that model will look at the data that they develop and it will present one picture.

The models which we are exploring -- and which, to some degree, we are developing -- look at the possibility of other pictures from the same data. Then the question is are those reasonable pictures or not?

Presumably, the answers that will come out in the final analysis is no, they are not, but we do need to be able to ask the question, and that's what the models are being developed for.

MR. KINTNER: As of today, with so many uncertainties, it must be very difficult to make a performance assessment that's meaningful at all.

MR. MOLZ: The reality is that you pretty much have to use models to check models, because the computation -- there's so much computation involved that, if you let somebody else do all the modeling and then give you the results, you stand a chance of having the wool pulled over your eyes, you really do.

It's -- you know, these wads of output and 10 billion years of fluid computation gets flashed up in front

of you, and it probably is more efficient in the long run to actually have the independent modeling capability if nothing more than --

MR. KINTNER: I agree. You used the magic words, and we'll give you the prize, "independent modeling capability" versus production of working models. There's a difference.

I don't mind -- I think it's necessary that you have that capability, but at this stage of the game, in year three on a 20-year program, you're going to start producing, creating models.

MR. MOLZ: And developing the expertise.

MR. BURSTEIN: I've exhausted my argument and lost. I'm willing to give up.

MR. MORRISON: I'm back to page two. Under item number one there, volcanic system of the basin and range research project --

MR. BURSTEIN: That's exactly where it starts.

MR. MORRISON: -- and we don't make any comment when we get back to pages five and six whether we should construct a model or not. We talk about mantle dynamics and don't jump quickly, but it's still in the research program that they will construct models.

MR. MOLZ: What is meant is there -- that's directly what Turcotte suggested as a strategy, and I think

he probably used the term "models," if I remember right. Model, you know, means a lot of different things, and it just has to be balanced, I think.

MR. ISBIN: What page are we on now?

MR. MORRISON: Page two. The comment at the top of page six that was amended, that we caution against moving directly into highly theoretical computer model areas, covers it. Would that satisfy you, Sol, that we have deflected 1(c) on page two?

Now I guess we're either at the bottom of six or on seven.

MR. MOLZ: We're coming back to uranium.

MR. BURSTEIN: On page six, in the middle of the page, you decided to take that reference to the --

MR. MOLZ: Yes. The reference -- I had that crossed out.

MR. BURSTEIN: Okay.

MR. ISBIN: Would you mind looking at the first sentence of the paragraph below that? "Particularly in the United States, where many regulatory requirements must be met . . ." -- do we need that?

MR. MOLZ: Well, it's extraneous information. At one time --

MR. VOGEL: We thought it was good to make the point.

MR. MOLZ: At one time, we actually mentioned the idea of subcontracting with Canada. So, we took that out, and this served as sort of a hint of that kind of thing.

But one of the things I would be interested in identifying -- and it may be the best way to do this is to wait for this written discussion, but if everybody kind of agrees that uranium chemistry is not the most desireable one to study, then why are we studying it? And cost, safety, regulation may be -- if that's the reason, it's important to know that, I think.

If we have regulations that are preventing us, practically, from doing what we think is the right thing, then at least somebody ought to know that.

MR. BECKJORD: Can I comment on that? I agree with Fred on the importance of this thought. I don't know whether this is -- maybe it clearly identifies it to the experiment, but I know that we are in some other areas having problems doing experiments in the desert country of New Mexico.

A case came to mind recently where some boiler water, some gallons, several hundred gallons, I guess, of boiler water were spilled, and this turned out to be a major problem with the state regulatory -- environmental regulatory agency.

MR. VOGEL: What on earth was in the boiler water?

MR. BECKJORD: Nothing. Boiler water is not -- apparently, the regulatory agency -- there's a difference between water from a tap and water from a boiler.

MR. BURSTEIN: One is purer than the other.

MR. BECKJORD: Yes, the boiler water is purer.

I think it's a valid point. The question is whether it is specific enough. I mean, if we were going to use it, it would need to be rather specific.

MR. VOGEL: People at the laboratory level are just tied up in bowknots, for example, in trying to work with plutonium. They essentially can't.

MR. MORRISON: Is the inference that they can't do it there at the Center -- could they do it in some plutonium facility somewhere, if they could use someone's facility, whether it be at Idaho or whomever has another facility that's not being used? There's enough plutonium facilities around the country. I'd think they could find one.

MR. VOGEL: If they wanted to really study plutonium migration through soil, I think that probably there's no place in the United States where you could do it.

MR. MORRISON: You mean in honest-to-God soil outside.

MR. VOGEL: Yes.

MR. MORRISON: Bring the soil into the lab, into a facility.

MR. VOGEL: Maybe.

MR. MOLZ: You lose a lot of value when you do that.

MR. MORRISON: Well, somewhere you have to compromise. Do you use the wrong element or do you use the wrong medium?

MR. VOGEL: Well, if, indeed, the argument for using uranium is as weak as I think it is, it means that we're really working on the wrong problem. It's like losing your dime in the dark and looking for it under the street light.

MR. ISBIN: And in discussing this with them, you also pointed out that working with trace amounts of radioactive material doesn't resolve the problem, because you have difficulty just with using such low, low concentrations.

MR. VOGEL: Those losses were occurring in the analyses, and if the people doing the analyses are aware of the problem, there are ways of controlling it.

For example, with uranium, they were working the 50-parts-per-billion region, and if you just have uranium alone like that, yes, you'll lose it, have difficulties, but if you have a known uranium isotope in with it and do your analyses by mass spectroscopy, then you can handle the problem, but one of the things at this point that you bring

up leads to is that I think, at the Center, there are a number of people -- with geochemists, I think they're very strong in geo, but you look at the backgrounds and so on, and I think they may be a little inexperienced in chemistry, and I think they need to hire somebody with fission product and uranium and plutonium chemistry background for one of their new hires.

MR. MOLZ: But if they can't afford to study it, then it doesn't make a lot of sense.

MR. VOGEL: Well, that's another problem. We've got two separate problems.

MR. MOLZ: Well, I think the request for a written response will probably clarify this. It's probably something that it's worth sitting down and thinking through.

MR. VOGEL: They knew that this subject was going to come up, and the defense against the criticism was not very convincing, in my opinion.

MR. HATCHER: I think the paragraph at the very bottom, that goes on over to page seven, is really a very good one, because it does state the problem quite clearly, and it says that you really can't mathematically model this.

If you stop and think about the numbers of variables that are involved at the Yucca Mountain site, you're dealing with the chemical constituents and the isotopic constituents of the ground water, and there are

also variables involving the specific rock types and then also the geometry of the plumbing system that you're dealing with, as well, and it becomes an immense problem to even define the variables.

MR. BURSTEIN: What happened to Alligator River?

MR. COSTANZI: The Alligator River project is completed. There is a follow-on project which is primarily dealing with questions of low-level waste disposal.

MR. BECKJORD: The transport of radionuclides for high-level waste is completed? Is that right?

MR. COSTANZI: The high-level waste portion of that, yes.

MR. MORRISON: Hearing no overriding objections, it seems to me page six stands as it is.

MR. BURSTEIN: Except for that reference to the --

MR. MORRISON: Strike the reference. We'll leave the chauvinistic comments in there.

MR. VOGEL: We'll give MIT a break.

MR. MORRISON: You're just trying to foist off these experiments on these poor undeveloped nations. That's what you're trying to do. Environmental equity is a very important criterion nowadays, especially in the U.S.

MR. ISBIN: Greg, may I ask you, on the top of page seven, where you refer to the big picture, it all

depends upon what you mean by the big picture.

I got the impression that there are two natural analogs that the Center believes that they can get some useful information, and one was in Greece and the other was Blanca Pena or something like that --

MR. RANDALL: Pena Blanca in Mexico.

MR. ISBIN: -- but it limits the set of conditions in which you can get some useful results. So, when you talk about a big picture, it's really a very limited set of ideas that you can follow through on. Maybe you could change "big picture" to something --

MR. MOLZ: I mean at a given site. I'm talking about a specific site.

I think there are many sites where they could get useful information, and another point that we possibly didn't appreciate as much a year ago is the cost associated with these field analog studies. You talk about big dollars -- put people out in the field and collect the samples and maintain a meticulous coordinate system and all that sort of thing -- it's very expensive.

So, I think it's not so much site limited as it is cost limited.

MR. KINTNER: When I went through this before, it seemed to me there was a sense that the analogs were a very important part of the learning process, that here was a real

natural experiment that nature had made that represented, to a large degree, what we were trying to understand and that they were important to follow through and understand, whatever the cost. Is that wrong? I mean I sense that, in the year intervening, there has been less interest in analogs, it's become something of, well, we'll look at it a little bit, but what really counts are these models.

MR. MOLZ: No. Actually, we're going exactly the opposite.

If you go back and look at the report from last year, we mention specifically using analog data to validate models, and we want to remove that and say that we don't -- we no longer view that the validation of models is a major motivation for doing the analog studies.

The motivation is developing the global understanding of how these processes developed and how far things went and what were the limiting distances over which you can see this and that.

I think, if you can afford to study them, you can get some good information.

MR. KINTNER: You can't afford not to study them.

MR. MOLZ: I think they should be studied.

MS. KOVACH: Linda Kovach, Research.

Most of our analog projects that we're working on -- and we have several that are outside of the Center, as

well -- are international studies. So, I think we utilize our money very well, and we get a lot of information for the money, for the dollars that we have.

MR. SPEIS: Can you summarize the information?

MS. KOVACH: The information? Well, we're collecting information, for instance, at the Oklo site on source term, migration of other nuclides other than uranium. We're looking at plutonium, neptunium, technetium.

We are also looking at the thermohydrologics of a natural reactor system, migration of these nuclides over various distances, and it's a very large effort. It's in its third year of work.

MR. MOLZ: Well, it may be that we've missed some of that information. Now, being at the Center, perhaps we got overly focused on purely what they were doing.

MS. KOVACH: Right.

MR. MOLZ: It might be that you also ought to supplement me on that, besides the money.

MS. KOVACH: We're also trying to internationalize that Pena Blanca site, which would then enable us to have a lot more studies done. The French are interested, the Spanish. We talked to the French, the Spanish, CEC in terms of helping to support that project. The Mexicans are interested in doing some studies, as well.

So, there's a lot that could be done in terms of

biological uptake and environmental studies at that site that we aren't currently doing and that other countries might be willing to work on.

MR. TODREAS: When you use the term thermal hydrological, what --

MS. KOVACH: The Oklo site was a natural reactor. It's a two-billion-year-old site, and it underwent a nuclear reaction, steam nuclear reaction for 100 million years.

The point is that they're studying the thermal -- the fluid -- hydrothermal fluid interaction around these reactors, and one of the other things that we're looking at there is there are dolorite dikes that cross-cut the reactor zones, and we're looking at the thermal effects from these dikes on migration of radionuclides from the reactors.

So, we're not only looking at the hydrothermal effects from the reactors themselves, but we're looking at effects of an outside heat source on the reactors.

MR. TODREAS: And what was the outside heat source?

MS. KOVACH: They're dolorite dikes. They're basically basaltic dikes. So, it's a very good analog to some of the volcanic scenarios that we envision at Yucca Mountain.

MR. TODREAS: So, it's hot magma?

MS. KOVACH: Hot magma that has been intruded,

right, at temperatures of 1,000 degrees.

MR. TODREAS: Okay. Thanks.

MR. MOLZ: I've tried to include in here not just the work that was being done at the Center but also the related work that was back here. That may be how I missed some of the money, because I thought we got presented on the whole deal. So, a little bit more information updating us on the natural analog work would probably be worth putting in here, so we have a complete document.

MR. MORRISON: All right. Are we ready to move to hydrologic research or hydrology research, page seven?

MR. MOLZ: The main point here, I think, was the validation, calibration, assessment idea that we've talked about already, and I don't know if we need to say anymore about that or not.

MR. MORRISON: Okay. Waste package.

MR. BURSTEIN: Professor Hatcher and I were wondering what alloy A25 is. Is it a steel?

MR. RANDALL: Incoloy.

MR. BURSTEIN: Incoloy comes in all kinds of varieties.

MR. RANDALL: A25 is a variety of incoloy.

MR. MORRISON: We're on to performance assessment research and seismic rock mechanics.

MR. HATCHER: I have a question just about the

nature of what is being done, although I know there is a table farther back that provided some of the information. Would it be appropriate to add a sentence or two saying specifically what the nature of the research? From the table, it's probably in here somewhere.

MR. MOLZ: Under the waste package research?

MR. HATCHER: No, seismic rock mechanics.

MR. MOLZ: Okay. Actually, the seismic rock mechanics -- they seem to think they have that in pretty good shape, and I don't know a lot about seismic rock mechanics. I'm not sure just how important it is in some senses. I mean if the repository collapses, is that such a big deal? It's going to collapse sooner or later anyway.

MR. BIRCHARD: It's a big deal if it's open and people are in there.

MR. MOLZ: Yes.

MR. COSTANZI: The question of the importance of keeping the repository openings open really depends on DOE's particular design and whether or not their expected performance of the waste package requires the openings to be stable.

Now, we don't know the answer to that question, because we don't have the submission. So, we necessarily have to look at what are the limits or the bounds of stability.

MR. MORRISON: I would like a suggestion from the Committee as to how to proceed. I think we have two options.

One is to delegate the responsibility to the Subcommittee Chairman to repair the report in the way in which we have it -- have discussed it, and assuming that that is done, we will accept it as the Committee's report.

If that's not acceptable, we'll circulate it again and then perhaps send it in as a second response, send the two that we have approved plus this one after the Committee has had a chance to review it again.

Does anybody want to review it a second time?

[No response.]

MR. MORRISON: We'll assume that, Fred, you'll take care of everything and keep us out of trouble.

MR. MOLZ: May I just say one thing to the Committee members? How about making one more pass over it and fax your material to me, and then I'll make it final?

MR. MORRISON: Neil?

MR. TODREAS: If you were planning to go back to the Advanced Reactor Committee, I have a change in the sentence stimulated by Ed Kintner's example that could wrap this one up.

MR. MORRISON: All right. Let's go back and get that change, then.

MR. TODREAS: This would be on the Subcommittee report, page two, the top paragraph. I'll go just a little slowly, because I see people are turning to it.

The existing sentence that I think needs change says, "At this time, no additional topics for research applicable to advanced reactors were identified," etcetera, etcetera. The changes I would propose are two.

Instead of "At this time," I would say "For the present," to emphasize the fragility of the conclusion. "For the present, no additional topics for research applicable to advanced reactors," and now I would add "in the areas of thermal hydraulics, engineering materials and components, and severe accidents, where identified," and that reflects the actuality of the areas we really drew that conclusion in and definitely leaves open the passive reliability area, which might come in. That's my understanding of how we resolved what came up this morning.

MR. MORRISON: That's what I believe we needed to have in there.

I would like to take a break for about 15 minutes, maybe reconvene about five after four. We're amazingly back on schedule.

[Recess.]

MR. MORRISON: Let us reconvene.

Before we get back to the agenda items, I want to

bring to the Committee's attention something that has happened since our last meeting and let you know what I've done as a result of it.

In one of my other activities, in sitting a meeting, there was a comment made that -- and it was attributed to the electric power industry -- that this Committee is captive to NRC, and further, the individual who made this comment said you don't have any industry representation.

Well, fortunately, I was able to deal with the latter right on the point, saying you're misinformed; there are a fair number of industry people on the Committee, and even some of the people that are active in the utilities now, as well as those who have retired from the utilities.

But I thought you ought to be aware that there was a question that the electric power industry was mentioned in this, and the source of this comment went back and it's the people at EPRI who think that this is the case.

So, immediately, I talked to Eric and to John Taylor, the nuclear guy from EPRI, and both Eric and John -- and I think Eric talked to John, as well -- said, hey, it didn't originate with us out here in Palo Alto. In fact, the comment is that there are periodic meetings between Eric and John Taylor and Eric's staff and John Taylor's staff.

And I took advantage of the opportunity -- and

George, if you'd pass out that this handout that I prepared here, but I visited with John and his staff on the 21st of December, and I found it a very informative meeting, and certainly, the bottom line out of that particular meeting, I didn't sense that there was any substance to the comment; in fact, that there were very positive statements made with regard to the research program being conducted by NRC.

I thought I would just highlight a couple of things that I'm sure many of you are aware of. I was not aware of -- before I went out to EPRI -- but there is a very nice document that I can pass around, and you can have any -- copies of this or we can make copies of it. It's the Executive Summary of the research, development, and delivery plan, and this happens to be the 1993 to 1997 issue on it.

EPRI goes through a very elaborate planning process. It's a very extensive and, I think, very exhaustive planning process. It starts basically with four issues, and I think, if you go to the second sheet of this pile, you see at least three of the issues on the lefthand column that are really issues agreed upon by the board members through considerable discussion with the members of EPRI itself.

The first issue that EPRI deals with is one -- let me see if I can -- talked about electricity value, which is the one that's not listed on this particular item, and

that's where EPRI addresses that customer expectation and end use technologies are changing, making it increasingly important to enhance the value of electric services.

Then the second issue which you have here is environmental health and welfare and safety, and the plan is based upon environmental health, welfare, and safety as a national and international priority providing opportunities and challenges to the electric industry.

The third deals with sustainable energy future. New alternatives are needed to assure long-term sustainable energy future.

And the fourth is cost control. Utility costs are increasing at a time when competitive pressures are increasing.

The planning process starts with those issues, those four issues, breaks them down into a number of strategies, and I think the strategies number about 30 -- I didn't count them all up in this particular document -- but the one that would be of interest to this Committee is the one under the sustainable energy future, where it deals with expanding future energy options and deals with the nuclear side in 3.1, and in the safety and economic aspects of the nuclear power plants, it breaks down to the third-digit level, 3.1.1, safety and economics, which talked about reestablishing the nuclear option by enhancing safety and

economics of existing nuclear power plants and providing a licensable new plant design.

Now, at that point, their Research Advisory Committee begins to take over in the planning process and works down from these objectives into individual strategic targets which then are further broken down into individual projects, and I think you can see the five strategic targets on this one chart here of advanced nuclear systems, nuclear license renewal, nuclear instrumentation and controls, innovative nuclear concepts, and corrosion research, which are the five areas that EPRI is devoting its efforts to.

The total EPRI budget in those five strategic targets for '93 is $15.2 million. So, a reasonable amount of their effort is going into this particular area.

This document shows the planning process, and it's a year-long planning process starting from the Research Advisory Committee and going down into various division committees and then into particular areas of project interest and then comes back up through the chain to the Research Advisory Committee. So, everything is sorted out fairly well in their process.

In each of these items, as you'll see on the next sheet, which looks very much like the first one, it identifies what are the planned results in a given year and what are the stretch goals in a given year for the research

projects, and one, for example, can look at the nuclear instrumentation and controls, which is about the middle item on the page, and it was to complete -- in '93 -- was to complete guidelines on generic methodologies for I&C communications architecture, and the stretch goal was then to get NRC approval of the licensing guide for I&C upgrade for utility use.

I'll pass this document around for those who would like to thumb their way through it. This is the document that was prepared, the guidelines on licensing for digital upgrades. It's a fairly exhaustive document that was put together, and let me start it over here and you can send it around the other way.

While I was out there, I got a briefing on this football-type chart, which breaks down the nuclear safety technologies into four major areas -- risk and reliability, safety assessment, instrumentation and control, and corrosion integration -- and I was very impressed with the work that was underway. I think it was a fairly thorough briefing on some of these things.

The particular one on -- it's described -- if you're really interested in a bunch of briefing charts in this document, there is the risk and reliability workstation project and the process involved in that, which I thought was a very impressive thing, to get a workstation that

looked at risk and reliability onto a -- on a PC-based system, and it seems to have quite a bit of acceptance by the utilities, building on probability, safety assessments, and tying together common cause failure rates, human errors, fire events, and initiators all within a given workstation.

It seemed like a very good piece of work that EPRI was doing, and I'll just circulate this around for what it's worth. I don't plan to give you a briefing on it, but let me send these other two documents around, that you have a feeling for what EPRI is doing.

I thought it was a very worthwhile morning that I spent with John Taylor and his staff.

MR. KINTNER: Did you get any sense at all of what problems there were that people were referring to?

MR. MORRISON: They had no sense at all in staff that I met at EPRI. They were very surprised that such an issue even had come up. I guess I'm cautious, and where there's a little smoke, there must be fire, and I didn't find the fire at EPRI, at least, with regard to their research programs.

MR. VOGEL: Was the source that was criticizing this Committee a reputable one?

MR. MORRISON: I think it's a reputable one. I'd rather not go on record to identify the individual.

MR. VOGEL: I'm not asking you to.

MR. MORRISON: I was very surprised at the comment. I think I also caught the individual by surprise to say, well, I know what's going on. But I didn't want any of you to get surprised if something may come up in a conversation somewhere that there are some attacks on this Committee.

MR. ISBIN: Now, Taylor is retiring, isn't he?

MR. BECKJORD: Yes.

MR. BOULETTE: Bill Conway is taking over for him.

MR. ISBIN: Conway is already there, isn't he?

MR. MORRISON: No. He'll be there sometime, I think John said, in September. He's tied up, I guess, until September.

MR. UHRIG: EPRI is going through an intensive reorganization right now.

MR. MORRISON: Downsizing, I gather.

MR. UHRIG: Well, they're changing the structure of their program to where there will be a fundamental program, and then there will be various options that the utilities can choose. If you have a nuclear power plant in your system, then you can choose the nuclear option. But the anticipated end result is probably less total money, which means downsizing.

MR. MORRISON: Is there any sense of how that might affect the quality of the research that EPRI has been

doing?

MR. UHRIG: I think the expectation is that they would do less.

MR. KINTNER: Well, the total budget is going down, is it not? It was up to the last year or two. Sol, do you have sense of that? Their total budget was going down, members were falling away.

MR. BURSTEIN: Some members, like Commonwealth Edison, for example, decided that they could not afford to stay in the organization.

MR. KINTNER: Commonwealth and Virginia Power.

MR. BURSTEIN: And I think now they've come back, but the same is true with Philadelphia and Virginia and others, and I think this breakdown, which is to allow utilities the opportunity to choose some of the programs they want to be in is designed to seduce -- to induce them back into the program again.

MR. UHRIG: The fundamental problem here is that public service commissions were disallowing parts of the program. If a company did not have a nuclear plant, they were disallowing 30 percent or something of this sort, the budget that was going to nuclear research.

MR. BURSTEIN: And companies like AEP, who have never been members of EPRI, might be prone now to choose those areas from which they might benefit more directly. We

wish them luck, because I think they are an important force for research in this country, particularly as it relates to the utilities, just when they need it.

MR. ISBIN: Do you have any handouts with reference to the radioactive waste disposal? That's the first item in this chart -- by 2000, provide technology for high-level radioactive waste -- and then there is a section on severe accident technology -- by 1996, complete the delivery of severe accident technology for regulatory closure. Do we know what all that is?

MR. MORRISON: I have no handouts on them, and that was not discussed in detail. Maybe, Eric, you've got some feeling on that from some of your conversations with EPRI.

MR. BURSTEIN: With regard to the waste disposal area, I have seen some reports issued by EPRI on an integrated cask. They have developed an analysis and some approaches to design that would allow for a cask to be used both as a transport and as a repository canister, a multi-purpose spent-fuel storage cask.

There have been some other papers that they have put together that I have heard about but not seen, and I think they can be obtained by writing to EPRI. I'm sure there must be a list of their publications around somewhere, perl , in one of those references we just saw, and we could

get those documents.

MR. MORRISON: You can get those documents -- EPRI documents have become very expensive.

MR. BURSTEIN: Oh, really?

MR. MORRISON: Oh, yes. They used to be free.

MR. BURSTEIN: That's what I thought. That shows you when I asked for one last.

MR. MORRISON: If you're a non-member, the nominal cost is at least $100 per document.

MR. BOULETTE: Some of us are members.

MR. MORRISON: Well, members can ask, but I didn't want anybody to be surprised if they called up the EPRI publication office and got a rather substantial bill.

Well, that's all I intended to say about this. I wanted to alert the Committee, and based upon my observations, there's nothing out there that's counter to what we're trying to do here.

MR. UHRIG: You would not expect that this issue would come up again?

MR. MORRISON: I didn't expect to come up to begin with.

MR. BURSTEIN: Was this the matter that you had referred to in a written communication to us once?

MR. MORRISON: No. That was another matter.

MR. BURSTEIN: That was another matter.

MR. BECKJORD: Did you mention a document on instrumentation and control?

MR. MORRISON: Yes. It should be coming down the table. It's that gray-covered document.

MR. BECKJORD: I guess we can't copy that, actually, can we?

MR. MORRISON: I don't know. Is there a copyright in the front of it?

MR. BURSTEIN: Probably.

MR. BECKJORD: We ought to mention the document to this group at the National Research Council that's doing the I&C instrumentation and control project.

MR. MORRISON: All right. I'd like to shift gears, then, and have a very open discussion and try to get a sense of how we want to proceed over the next several months, I believe, although if we can do it all tomorrow, that would be great, but I suspect that that won't quite happen, is to try to respond to the questions that were proposed -- that were posed to us by the Commission, and I think we ought to start with our understanding or at least our recollection of what the Commission asked us, and that may be somewhat different than was in the staff requirements memorandum, and I think George has provided you with copies or everyone has a copy of this staff memorandum of the 21st of July 1993. It's a two-page memorandum. George has some

copies that he can pass out.

MR. BURSTEIN: There's nothing in here that says you can't reproduce it.

MR. MORRISON: Oh, okay. Good.

MR. BECKJORD: Would anybody like a copy of that?

MR. VOGEL: Yes.

MR. BECKJORD: Okay.

[Pause.]

MR. MORRISON: I guess everyone has a copy of these questions that came from the Secretary to the Commission, and the first one dealt with keeping track of broad questions, the second one dealt with code maintenance, the third general area was any sacred cows, and the fourth area was the technical disciplines one.

I have with me a copy of the transcript from the meeting, if anybody wants to take a look at that or if there's some questions about how these questions were derived. They don't necessarily read one to one on the transcript, and perhaps your recollection may be as good as anything else, as well, to take a look at these.

Certainly, tomorrow we're going to have another discussion on the codes, if I can find the agenda. Tomcrrow morning, we want to talk about code maintenance, and there will be a brief staff presentation, and that may help refresh our memories and give us some feeling as to what we

need to do with regard to the code problem, and I think, at least in two of the subcommittees, code maintenance had been a topic, in the advanced reactors, and Herb, was it also in your subcommittee that you had dealt with the code maintenance issue?

MR. ISBIN: There wasn't any substance in the discussion. In other words, there was a dilemma. The Commissioners wanted a world-class maintenance operation with these codes, but there wasn't the plan to achieve this.

MR. TODREAS: There wasn't -- what was the word you used?

MR. ISBIN: There wasn't a plan. In other words, the research staff heard what the Commissioners wanted, but there hadn't been any substantive discussions on how to achieve it.

Now, I'm sort of making a very blunt statement there, but that's the essence of it, and I think our Committee report, the full Committee endorsement, has that. We want to have a worldwide, a world-class set of experts for these codes, and we need to program it, and we need resources, and these resources haven't been identified.

MR. MORRISON: One of the questions I think we need to deal with as a Committee, when you talk about code maintenance, how much of that needs to be done by the NRC staff versus maintaining it through contractors, not that we

have to try to resolve that issue today, but it seems to be a basic one.

MR. UHRIG: Could you define what you mean by code maintenance? I think I understand it, but I'm not sure. Does it include upgrading, for instance, to new machines? Is that code maintenance? Or do you talk about adaptation to new reactor designs? What's the scope of code maintenance?

MR. ISBIN: There has to be some challenge there to have good people stay involved. It isn't simply just upkeeping the code and making changes as people suggest changes, but if you're going to maintain the expertise, you need to stimulate them in some way in order to be on top of the subject.

MR. UHRIG: So, it isn't just the traditional maintenance.

MR. ISBIN: No.

MR. MORRISON: Well, it's probably even beyond that now. I think Neil touched on it this morning with regard to RELAP in INEL, that the corporate memory was lost.

MR. BURSTEIN: It's a question of how do you maintain maintenance? How do you maintain expertise? What is the vehicle for doing that?

We talked a lot about developing models and getting involved in the actual working challenges that Herb

just identified. Is that the only way? Do we farm people out to a university or to a contractor? Is that a way of keeping them up to date and pull them back only when we need them?

What are the methods that have been demonstrated and are appropriate? Do you have to fly the airplane every 30 days in order to retain your proficiency?

MR. UHRIG: There's been a historical pattern in certain areas.

For instance, at Oak Ridge, for many years, there was a cadre of people who dealt with noise analysis that was supported fundamentally by the NRC at a certain level almost independent of specific projects. They had goals to accomplish, but it was basically a cadre of expertise that was available to the Commission when they needed it, and they did need it on several occasions.

With the Palisades core problem, when Three Mile Island came along, there was noise analysis measurements made by the people that had been supported over the years by this program, and that kept the interest there.

I think that's the kind of thing you're talking about here, I suspect, is a group that is continuously working at the forefront of the technology. Whether it's in a lab or a university or what is less important than the fact that it exists and that there is a critical mass there.

MR. KINTNER: Let me ask a dumb question. The codes we're talking about deal with plants that exist and are not going to be changed in any significant way. Why should the codes be changed in any significant way? In other words, why aren't the codes static now so they don't need to be changed.

MR. UHRIG: To hopefully obtain better results than they've been able to obtain to date.

MR. KINTNER: In what way better?

MR. UHRIG: Agreement between experiment and code results.

MR. KINTNER: I mean is enough research going on in these areas that say the code wasn't quite right, we'll make it right?

MR. BURSTEIN: There's a lot of operating data. You just referred to some of it earlier in these IPEs. There's a lot of information that's coming up that's as good or perhaps better than some specific one-shot experiments. These are hosts of years and years of operating data.

MR. KINTNER: These would influence the thermal --

MR. BURSTEIN: I don't know whether it does or not, but it could.

MR. MOLZ: I think we're getting a little bit off the subject.

MR. KINTNER: We're talking about codes only.

MR. MOLZ: Code maintenance.

MR. KINTNER: Code maintenance.

MR. TODREAS: If the plant is static and there are no new questions, there's no new code developed. What I think happens is a new question comes up about an old plant, like the BWR instability issue, which actually involved physics, not thermal hydraulics, a new question comes up.

So, the group that you go to -- I think we've called it a code maintenance capability, an analytic capability in a laboratory which is centered on code activities, but you give them the code maintenance job to hold them there. You hold them there, and they're ready to jump on a complex question, and they do it, and then you start to manipulate the code and change the code.

So, the idea of a static code is not the reality. I think the code is always being twisted, pulled in one direction or another, because new questions, operational questions, are coming up on old plants.

Finally, I would say code -- this is a really good question, actually -- code maintenance activity probably puts an intellectual damper on what you really mean. We mean a technical analysis capability that's centered around code analysis.

MR. MOLZ: I think another way to say it is that

the codes are not independent of the people that run them and interpret the results and formulate the problems, and so, that's the problem with codes and also the strength of them.

So, you have to have the operators there, and if the code is sitting somewhere for 10 years and an important problem comes up and you take one of your software people and say get that code up and running and give us an answer to this, the guy might not be able to do it.

So, I guess the question is how do you maintain that capability at a reasonable level with less money?

MR. KINTNER: Well, who said less money? This doesn't say that at all. It says -- the way I read it, the Commission was quite anxious that there be an expert group that could be depended upon, and it didn't say less money or whatever. It says capable of responding to future safety issues as they arise.

MR. MOLZ: Well, if I remember the context, wasn't it within the context of a lot less money being spent on codes than was spent during your main development period?

MR. BURSTEIN: The reality is there is less money.

MR. BECKJORD: Yes. I think the historical perspective on this is that, eight years ago -- up until about eight years ago, a very large part of the research budget was going into code development and, in effect, code

maintenance, because it was -- it was keeping a lot of people active in the area, and it was a lot of money. It was between $20 million and $30 million, annually, and at that time, the research budget was being cut year by year, and the -- some other problems were looming on the horizon. The severe accident research was the largest single item but also human factors, and it was necessary, in a declining budget, to fund some of these other areas, and in order to fund it, the thermal hydraulics budget was cut, and in effect, the development of the RELAP and the TRAC codes was very significantly reduced, and then, as we got into the advanced reactors, which you talked about this morning, in particular the passive systems, it was clear that there was a need to do more work in that area applicable to the conditions that would -- for which these passive systems were being designed, and so, we're in the -- we're kind of in the middle of that development now, and the question is whether -- as I read it -- is the effort adequate, or should it be modified in any way to achieve the desired results?

MR. KINTNER: Neil just went through a good look at this question with your Subcommittee. How do you answer that? As I read your report, it says yes.

MR. TODREAS: Just before I answer that, the specific question that says yes to?

MR. KINTNER: Number two.

MR. TODREAS: Which part of number two?

MR. KINTNER: The whole part, that there is a critical mass and that there is sufficient capability to respond to future safety issues as they arise.

MR. TODREAS: Okay. The reason I say that -- I guess I'd say no in the sense that I don't think RES has contractors or a contractor in place out there with the strength to do this job. That's why my answer to two is no, because there is no one specific question written down here, right?

MR. KINTNER: No. There's capability but not quite enough.

MR. TODREAS: I think it misses by a long shot, but I'm a little influenced by the fact that I don't think the contractor has a leader with commitment -- I don't know about intellect but with commitment to take ownership that this is my job, this is my lab, this is my name, and I'm going to do this damn thing right.

If you don't have that, then it doesn't matter how many people under you you have. So, I think you're missing the leadership and then you're missing some of the horses, too.

MR. ISBIN: I would go even a step further. Research is involved in trying to improve codes currently for advanced light water reactors, and they have been

subjected to a number of outside reviews, and this is what's embodied in this Subcommittee report.

What this question is asking is, beyond that, is there a program that's been established by the research to maintain and continue world-class codes, and I would say there is no such program if I understood what I was being told, that the Commissioners have asked something of Research and have not provided any additional resources, and Research, therefore, hasn't yet formulated a plan to achieve this. Is that a fair statement?

MR. BECKJORD: Well, I think there are two views you could take of it, Herb.

My own view has been -- and it may be right, it may be wrong -- is the following. Let me go back just a minute.

When you talk about maintaining the capability to respond in these areas, I think Neil gave a very good definition of what the necessary conditions are.

You have to have some resources, and you have to have problems that are important and challenging problems which engage the attention of people who have the skills in that area, and that's why I wanted to ask Bob a question. Maybe we can come back to it.

He mentioned the noise analysis capability at Oak Ridge, which was maintained there for many years. I would

like to know -- I'd like to hear him say a bit more about that, as to -- I know this was for some length of time. I don't know how long it was.

MR. UHRIG: About five or six years.

MR. BECKJORD: Did they have -- were the problems there and the challenges to keep that group engaged?

MR. UHRIG: Yes. They were out taking measurements on commercial reactors. They had a lot of data out of a number of problem plants. A BWR thimble vibration -- instrument thimble vibration problem was dealt with.

MR. BOULETTE: Thermal shield vibration.

MR. UHRIG: They were using the technology that they had developed. That technology has dissipated at this point. The people involved are off in different jobs. One is over in the environmental department. Another one is a group leader. Another one is -- the other two or three are off on totally unrelated projects, not that they've forgotten everything, but they aren't working in this area anymore. That capability is no longer there.

MR. BECKJORD: Do you think that the challenge of the problems is an important part of maintaining the capability?

MR. UHRIG: Certainly.

MR. BECKJORD: Yes.

MR. UHRIG: Certainly.

MR. BOULETTE: I would just add to that example. The reason I raised thermal shield is because I'm close to that, having worked with Maine Yankee. There is an organization in Tennessee called TECH. Are you familiar with that?

MR. UHRIG: Yes.

MR. BOULETTE: My point is that he does have a problem that he is working on for the industry that keeps his expertise.

MR. UHRIG: You're talking about Jim Robinson.

MR. BOULETTE: That's who I'm talking about.

MR. UHRIG: Jim is a UT professor.

MR. BOULETTE: At Hanford, for example -- I worked there for about 12 years, but unless you have a series of projects that really call for people to be working on it essentially daily, you're going to lose it, and you can take the code and put it on a shelf, but 10 years from now nobody is going to know how to operate it.

MR. MORRISON: Isn't there another dimension to this question? Is it that essential that NRC maintain that capability?

MR. UHRIG: Well, what has happened here is that the technology got transferred out of the laboratory to these two or three groups there. There's another company in that area -- it's a spinoff of TECH, when TECH got in

trouble financially -- who also has people still capable of working this particular area.

So, there is some capability still around, but it's no longer at the laboratory. It's presumably available to the NRC, but more likely the industry has already dealt with these people on -- if they've got a problem, the industry will go to an organization like that.

MR. BOULETTE: I think the question is a valid question. I'm not sure, in some of those cases, that the expertise has to be within the NRC, if that's what you were asking.

MR. MORRISON: That's what I was asking, yes. Do you really have to have it within the Government? Can't it be outside in the private sector?

MR. UHRIG: Sure. It can be outside. There's no reason it can't be outside. But again, there has to be continued stimulation of it or it's going to die away.

MR. TODREAS: I'm not sure it's so easy to decide what can be outside and what inside.

When there's an operating reactor question, the issue comes before NRR, and then they go -- I presume they come into Research, ask for some help, there's some group put together, and they've got to respond.

So, it's capabilities to respond to unknown questions associated with reactor operations that you've got

to protect yourself against, and if you do spin it out to private industry, it's a question of whether the regulatory commission can go out and grab that.

I think they've got to have some defined level within their staff. You've got to be self-sufficient.

MR. BOULETTE: Well, I guess I would challenge that. It's one thing to have code expertise, somebody who knows how to run the actual code. It's another thing to have expertise that understands the results of the codes and the models and can talk intelligently about it.

MR. TODREAS: I think you've got to have the capability, but they don't have to be an expert on running the nth detail.

MR. BECKJORD: Well, it seems to me that the question at hand or at least a big part of the question at hand is what is the requirement, what should be expected, and what level of effort is needed to satisfy this question for the advanced reactors, and I'm talking about the AP600 and the SBWR.

I think that to look ahead to a level of expenditure that is commensurate with the effort that was put into the thermal hydraulics over a 20-year period, from let's say 1968 to -- '68 to '88 -- is probably not realistic.

Now, I could be wrong about that, and I'm thinking

about the NRC's budget at this point, because I see continuing pressure on the budget. Anywhere you look, the industry is declining in numbers, and so the charges on the license holders are going to go up unless NRC expenditures come down.

So, there are going to be pressures from many sides, and the question is not only for thermal hydraulics, but what the key areas of technology that the NRC and NRC research should stake out for itself?

Now, I see -- certainly, thermal hydraulics is one of those areas. I see the pressure vessel -- the total of technology that's require for pressure vessel -- maintaining that expertise to know what the limitations are, in particular the limitations through the life of a pressure vessel, and what the technology is for examining pressure vessels and assessing their condition.

I think that the instrumentation and control, particularly headed into this time of conversion to the digital systems, is an important area.

MR. BOULETTE: Isn't it a question of independence? GE, Westinghouse, and CE are continuing to upgrade their models to look at reactor pressure vessels. What does the NRC have to do to monitor that, to convince themselves that these results are, in fact, valid and the approach is proper. I don't believe they have to develop

their own codes, and they'd probably have to develop the expertise to run the codes.

MR. BECKJORD: Well, of course, the -- in both the pressure vessel area and in the thermal hydraulic area, there are codes. I don't think that the level of code development has been of the same order in the pressure vessel area as it has been in the thermal hydraulics.

There is certainly room for improvement there, because in the experience with Connecticut Yankee, there were a lot of code calculations that were done over the period of a year's time, and there was a great diversity of views between the industry and the NRC on what was the proper way to describe the condition of the Yankee Rowe vessel.

I think the views were more divergent than they were convergent, and there has been an effort now underway to attempt to resolve those differences, but I think that's going to be an important area where the NRC is going to have to maintain some capability.

MR. BOULETTE: I guess the point I'm trying to make is a divergence in view was not the result of independent code calculations as it was more, I believe anyway, a different view of fundamental concerns.

MR. BECKJORD: I think, in that case, that's correct. The codes were used to try to develop -- each side

was using code calculations to develop the argument, but the differences were fairly fundamental, that's correct.

I was just trying to enumerate the areas that I felt were important.

I think some capability in the human factors area is going to be important, and I think a capability in radiation protection is important, and capability also in what I'll call systems engineering, which is the kind which is important in the resolution of the generic issues which come up from time to time.

I may have omitted something, but I think --

MR. TODREAS: How about nutronics, fundamental nutronics? Is that omitted because it's a lower priority?

MR. BECKJORD: No. I think the importance of nutronics or the amount of skill that is needed there will depend considerably on the extent of introduction of new reactor concepts; for example, the CANDU reactor. There are a whole bunch of questions that require some capability. We have very limited capability in that area now.

There's one person in Research who is very knowledgeable on nutronics. There's still a couple of people in NRR, but it has not been a big specialty for a long time. I mean you have to go back, really, 10 years. Much of the capability in the physics area has been lost over the last 10 years.

So, the question, then, is given these areas -- I mean we could -- you know, if we discussed it at length, you might modify that list somewhat, but the question is then going to be what are the resources needed to maintain -- how much capability is needed in each area and what kind of resources are needed to maintain that, and the other point that I'd mention is that it's not just money, it's numbers of people.

The Research office, in fiscal '95, will have an authorized limit of 224 people. Following the President's directive, over the next five years, that number will decrease by another 15 or more percent as of now, I mean if there are no new directives that come forth. So, we're talking about a level of, you know, maybe 180 people, 180 or 190 people.

At the same time, the Commission has indicated that it wants more resources put into rulemaking.

So, what I'm telling you is that there is going to be tremendous competition for a declining resource base over the next five years or so. These are going to be really hard decisions that will have to be made.

MR. KINTNER: In the best of all worlds, if you could choose the people you want, you really could --

MR. BECKJORD: That would be enough.

MR. KINTNER: That would be enough, right.

MR. BECKJORD: Yes.

MR. KINTNER: So, it's really -- the limitations placed on you by policy is what makes it so difficult.

MR. BECKJORD: That's correct.

MR. TODREAS: That's exactly the university dilemma.

MR. MORRISON: Still, I think you're faced with the question -- even if you say that there's enough and I could choose all these people, what do you do with them to keep them current? What sort of occupation should they have?

I think that basically gets down to a science and engineering question. It's easy for the bean counters to count out 190 people, but I think it's up to those that are skilled in the art of science and engineering to say what do I need to do to keep my skills sharp?

MR. KINTNER: Can we go back to codes? And here I'm really speaking from ignorance. Don't you have more than one laboratory working on codes? Is it almost all Sandia?

MR. BECKJORD: Well, on the thermal hydraulic codes, it's Idaho, EG&G, but it is also Brookhaven. We are using Brookhaven for special studies at a lower level. Brookhaven did the work, for example, in the BWR stability questions that came up.

MR. KINTNER: Just thinking out loud now, again from what Neil said and what was said earlier about the San Antonio effort, if you picked -- pick one -- pick INEL. Focus the effort to provide a center of excellence there. They're responsible. Someone there is tagged with being responsible, and you feed them artificial questions to keep them alert over a period of time. Isn't that one way of solving this question of critical mass that's available when you need it at minimum cost, with minimum people?

Isn't part of the problem of the codes -- still just talking codes -- the fact that it's spread around a little bit, and is creating centers of excellence and really meaning you're creating centers of excellence and maintaining centers of excellence, is that one way out of this dilemma?

MR. BOULETTE: I'm not sure you can find a laboratory in the country that has high expertise in all of the areas that Eric was talking about. I'm not sure INEL has human factors expertise, for example.

MR. BECKJORD: Well, they do have, but that's a very good point.

MR. BOULETTE: Typically, Oak Ridge has always been good in nutronics. Nutronics is Oak Ridge. INEL is thermal hydraulics and those kinds of things.

MR. UHRIG: Is that bad?

MR. BOULETTE: No, but you couldn't get all of the expertise in one location.

MR. BECKJORD: I have to confess -- I have very mixed feelings on this point of whether you build a single center of excellence or whether you rely on one laboratory. My sense is and my experience has been that it is a mistake to rely on, you know, one single laboratory to do everything, because you lose a couple of things. You get complacency. You also develop an approach to things which has given me a great deal of difficulty in one particular area of research which is much better -- the situation is much improved now, but what it really amounted to was that the NRC did not have control over the activity, and people were off doing what they wanted to do, and that's not a good situation.

I think, myself, that it's okay to have a center of excellence, but you want to have somewhere else that you can take work to get it done. Competition is good for the system. I mean that's the plain fact of the matter. It works. I mean this is a -- this country is a competitive culture, and if you set somebody up who is uncompetitive, it takes very unusual talent to be able to sustain that.

MR. KINTNER: I'm not arguing that. I'm just throwing an idea out, which is that if your own staff has the technical capability to manage, check on, confirm what

that center of excellence does, then he is not nearly so dependent.

MR. MOLZ: That's pretty hard to do, though, because it's what done behind the scenes that counts, really. It's like going to a gym to make sure everybody is working out. When you walk in, boy, everybody is lifting weights and push-ups and all that stuff, and that doesn't mean anything. It's what's done every day that you're not there.

But there is a little bit of a conflict here, because when you look at this idea of spreading limited funding among a number of contractors, my impulse is to concentrate your money, because the old divide and conquer, if you put a little bit, little bit, little bit, it just kind of fades away.

Based on what you said, obviously there is an optimum there. You don't want to go and put all your money in one single basket. You want to kind of create a condition where there is some competition and yet concentrate it as much as you can, I would think.

MR. BECKJORD: I agree with that. I agree with that.

MR. MORRISON: I think you really haven't laid the whole problem out, Eric. It seems to me you're facing two questions that are rather confused, and one is the number of

staff that you can have and the other is the amount of money that you can have.

If you have a lot of money, you could still hire a lot of contractors, but weighing against that is the contracting policies and what you can do with regard to contracting and management of contractors. That is taking up more and more time, as Ed's committee found out, in just being able to let a contract, let alone try to manage it.

So, do you use these precious resources in managing contracts or do you use these precious resources in terms of maintaining an expertise? And they're very conflicting kinds of things, especially when the whole budget is starting to go down. It's terribly difficult.

You're not the only agency facing this. We at MITRE have just undertaken a project for the Environmental Protection Agency to try tc sort that question out, that lo and behold somebody woke up one day and said there's 38 EPA laboratories, are we spreading ourselves too thin? And it's a very fuzzy question, because they're broken up into more options than what you have here within -- in NRC, but it's the same kind of question.

The number of FTEs, the number of Government employees are going to go down, and the budgets are going to go down. The missions haven't been reduced. How do you do it?

MR. BECKJORD: Well, I don't know. I guess everything seems -- big things seem to happen by crisis.

In the current situation, with declining authorized people, what happens is -- I'm sure everybody -- you see this everywhere in a declining industry. You don't get to choose the attrition. I mean attrition happens by -- somewhat randomly in terms of skills, so that we've been -- the pressure on the authorized level of people has been going down.

When I came here seven-and-a-half years ago, the number of positions that were assigned to what is now the Office of Research -- I don't recall the exact numbers, but it was somewhere between 330 and 350, and it's down to -- the authorized level is 224. The actual level is in the high 230s. There is more attrition expected in the next year.

But my point is that, while that process is going on, you can't hire people in the areas that are needed, and so, I think what we will have to do and what we can probably get approval to do is hire, you know, a certain small number of new, very able people to work in an area, and we could do this, I think, in one area, but I don't think, from a practical point of view, that we could do this in five areas.

So, the question is going to be which one do we do

it in? And I think, probably, today, considering where the priorities are and where the capabilities are, we will probably do this in the thermal hydraulic area.

MR. KINTNER: Do you have any capability of reaching out into other parts of the NRC, picking people, plucking them and saying I've got a special case, I really need this person, it's crucial, and winning that one?

MR. BECKJORD: I'm trying to think of a case where -- there have been a couple of cases where we've been able to do that. The pressures -- at least from my point of view -- you know, you get to interpret things kind of personally. Usually, to me, it works the other way, and that was not a bad thing.

I mean, in my experience in industry, when somebody else came and hired your best people for another job in the company, that was not a bad thing, because it showed people that the organization where these came from was a good organization and had good people, and so, if you can, in fact, go out and bring other new people in, that's not a bad situation, but we haven't been in that situation.

MR. KINTNER: With the Commission asking this question, we could, if we wished, make that kind of a case.

Now, what we see is that Research activities are one of the most important if not the most important critical aspects for the long-term success of the regulation of

reactors in the United States and that, slowly but surely, these policies, reductions and so forth, are hurting it and that there should be some special kind of ad hoc authority given to get a few -- you wouldn't need a lot. I mean if you had 10 or 20 -- if you could pick 15, 10 people, absolutely the ones you want, bring them into your organization, you'd change the whole flavor of what you're doing, would you not?

MR. BECKJORD: I think that's right. I think that's right. I would like to bring some new people -- rather than engaging in this thing the way you've put -- your question was, I'd rather bring people in from the outside.

MR. UHRIG: There are some people available on the outside now.

MR. BECKJORD: Yes, I think there are.

MR. KINTNER: And that's really perhaps one way that we can help.

MR. BECKJORD: You can certainly have an influence on it, but I don't think we can do it in five areas. I guess that's my point.

MR. KINTNER: Why not?

MR. BECKJORD: I don't think -- we just had our senior management meeting, and the Research office is not the only place that's having problems. I don't want to

leave you with that impression. My problems dominate my thinking, but other offices are having, also, downsizing problems.

In a sense, it may be tougher for them, because they haven't gone through the downsizing that Research has already gone through. So, they're having their early experiences with it.

I think we can make a case for some limited targeted or vectored recruiting, as they call it, but I think it will have to be selective.

MR. MORRISON: Well, I think this discussion is moving the way that I hoped it would. It sort of sets the stage for not only tomorrow but for what I think we need to do at the next meeting, is to kind of gel our thoughts to take to the Commission, and the more thinking we can do between now and then in how to address these problems and the underlying problems that aren't stated here is going to be very useful to Eric and very useful to NRC.

One thing we ought to look at -- perhaps it's easier -- is to look at the number three question, since we've just finished three subcommittees worth of meetings, and have we identified any sacred cows out there that ought to be closed off?

MR. UHRIG: There have been some programs that have been closed off. The source term is coming to a

conclusion and being implemented. The BWR liner issue is pretty well put to bed at this point, is it not?

MR. BECKJORD: Yes.

MR. UHRIG: How about the severe accident experiments? I got the impression that those are pretty well --

MR. BECKJORD: I think that's going well. I think that a lot of progress has been made. The long work on DCH is in a -- it's in a situation now where you can't clearly see the end. There are disputes over the reports that came out, the drafts that came out last summer, but I think we're working through that, and I recall that, really, it took three years, in the case of the MARK I, to get that through peer review.

I'm hopeful that we can get the DCH through that process in a shorter time, but I think we're almost there, and the other areas are coming well. We've got a new facility at Brookhaven for the high-temperature hydrogen work that's coming on-line. We'll be getting data there.

There are still some questions in the severe accident area. I think probably the single -- if I were to single out a very important and very difficult one, it's the one relating to the debris cooling, which -- if some of you -- when we're done this afternoon, I'd sort of like to talk about that a little bit. It's not on the agenda here, but I

guess I'm feeling at this point that what came to light on the Three Mile Island and the so-called -- the slow cooling and the rapid cooling ideas that came out of that investigation -- I think they should be followed up, because I think we're on to something, and if we can pin it down and define some experiments to pursue that, that may give us the key that we need to finish off the current agenda on severe accidents.

So, I think that area has come a long way, and that's not to say that there won't be new questions in severe accidents, I'm sure there will be, but the agenda that we have has been around for a long time, and if we could get that behind us, I think it's --

MR. UHRIG: How about the TMI vessel investigation? That's pretty well wound down?

MR. BECKJORD: Yes. Well, I'd like to -- if some of you are interested, I'd like to show you -- I wasn't -- I have to tell you, I am not completely satisfied. I think the work that was done it was superb in some respects, particularly the metallurgical work and then the analytical heat transfer work that was done on the whole problem.

In terms of the vessel itself, I wasn't satisfied. So, I have done my own investigation on that, which I'd like to show to you if you can spend a few minutes on it, because I think that it provides some insight into why the vessel

didn't fail and what the limits may be and that type of thing.

MR. MORRISON: Unless I hear a strong objection from the rest of the Committee, I'll dedicate the rest of the agenda to that subject. I think we've accomplished what I wanted to do, was to start some of the juices and the thinking rolling toward tomorrow's meeting, and if you want to take up the rest of this -- the seed has been sown and let it fertilize.

MR. TODREAS: Can I make one comment on sacred cows, just to finish this off?

I think everything we've looked at we've been active in the subcommittee. We've found sacred cows that keep hanging on. But I just wonder whether the subcommittee coverage has been broad enough so that maybe the 35 percent of the program or the 30 percent of the program that we haven't looked at very closely for the last year or two, whether there's anything there. Maybe when we get to talking about this tomorrow we can clean that up, but I'm not convinced.

MR. MORRISON: A very interesting question. I don't know what 35 percent we may be missing, but that's probably a good number.

MR. BECKJORD: I guess what I'd like to say is I just want to try to convince you that I didn't come to this

meeting this morning with the intention of opening this up. If I had, I would have brought along some additional slides to summarize the work at TMI, and maybe I can try to do that in just a few minutes without slides, and I think that the work that was done there, as I said, in the metallurgical work and in the overall analytical approach to the problem was first-rate, and I can summarize, I think, what was found in the following way.

There were three major areas that this investigation -- the formal one that was just concluded -- looked into, and the starting situation was the end state of the TMI core, and you've all seen that, the picture of the reconstruction of what things looked like.

There was a large void where the control rod drives and the upper core structure -- when that was taken away, there was a large void in the upper part of the core, and then below that was a layer of debris, and below that was the core crucible of a ceramic material that was cooled on the outside by water, and the core crucible held the much hotter material, the molten core material, inside, and as long as there was enough water in the core to keep that cool on the outside, the crucible was acting as a crucible, but the water level was falling, because this time the final error that created the accident had not yet been rectified, namely that, for heaven's sake, turn on the cooling water.

So, the water level was falling, and this crucible failed at the upper corner, and the material spilled out, and I don't know if you've all -- have you seen the pictures of this? What I can do is I can bring them tomorrow and show you. There's some wonderful pictures which show where the material wound up at the bottom, what I'm going to describe.

So, the research program through 1987 had uncovered this, and it had gotten to the bottom of the core and found the material, and Ed knows a great deal about this, and he might want to comment.

The area which was left incomplete and which Ed and Neil both were very interested in was to find out, you know, what happened to the vessel, and so, we got into this project, and the three areas that I mentioned were the vessel itself, the nozzles and the two guide tubes and some companion samples of this core debris and then a hard ceramic material layer that was at the bottom of the vessel, and this is where our program focused its effort.

The samples were recovered, and through a series of the metallurgical examinations that Gary Korth and some others did at EG&G in Idaho, they identified from the metallurgical specimens that there had been a hot spot in the vessel.

It was about a meter in diameter, as we've said.

It reached temperatures of close to 1,200 centigrade, probably 1,150 plus or minus 50 degrees, and this finding is very robustly based on metallurgical findings.

There are six different properties of the material that contribute to this finding. The hardness is one. It's in the slides from the TMI work. That's the first one. The next one is the Austenite transformation when you come up to about 900 centigrade.

Then the next one -- there is -- the vessel material is ferritic, and there is an Inconel clad on it, and when you look at the micrographs of this interface of the clad with the ferritic steel, there is what the metallurgists call a dark feathery band, and that's what forms right at the interface of the weld of the Inconel with the ferritic steel.

Well, it turns out that that dark feathery band disappears in a time-temperature band which is about 900 centigrade. So, that was a second indicator.

Then, at a higher temperature, there is the growth of equiaxed grains, the as-fabricated structure of the TMI material which has some -- when you look at it, it's kind of a random, fairly long-grain material, and when you reach and exceed this elevated temperature, you lose that as-fabricated grain structure and it turns into kind of box-like equiaxed grains.

Above that, there is another indicator. When you go into the clad itself, there is a structure which is called delta ferrite, and this is a very small -- this is on a very small scale, a little kind of amoeba-shaped -- it's has the form of kind of a long amoeba or maybe a hot dog, and around it, there is a carbide band, and when you get above about 1,000, I think it was, or 1,050, this fundamentally changes, and the delta ferrite becomes spheroidized. It's like a drop of water. It just becomes a sphere. And then, at another temperature above that, the equiaxed grains that were formed at 900 centigrade are consumed, and they disappear, and then there's one more transition temperature. You have a new type of grain structure which comes in around 1,100 C.

So, here were all these independent methods, and Korth and some people working with him identified all of these indicators, and they had the TMI specimens, and they had the Midland vessel, which was never used but which was available to us, and we recovered -- we could have as much Midland material as we wanted, and that material was -- the vessel was made at approximately the same time by B&W, and it was virtually, as nearly as anybody can say, identical material, and so, they used -- they did the experiments with the Midland steel.

They made a lot of little samples, and they put

them in autoclaves, and they gave it this time-temperature treatment, and then they compared it with what they could observe from the actual TMI specimens that exhibited these changes in structure, and by kind of iterating on this, they were able to reproduce time and temperature treatments in the autoclave which finally produced what they saw in the TMI specimens, so that when they got done, they had essentially unique identification, and because there were so many -- half a dozen of these indicators, they could lay this out on a time-temperature chart and say, you know, sample E5, here is where it fits and so on, and the samples that were -- there were about a half-a-dozen of this recovered samples which were completely different from the samples outside of this area, and when you go to the samples outside of the area, metallurgically they look like the Midland material, you know, never irradiated, never -- completely as fabricated.

So, that was the first finding, and that's what I call a very robust determination of the temperature and the location of the hot spot.

The second thing was the nozzles. The nozzles are the nozzles that were welded in the inside of the reactor vessel through which it's something which is the shape of kind of like a big candle, about maybe an inch-and-a-half, a little bit bigger than that, I guess, maybe an inch-and-

three-quarters diameter at the outside. It was through these nozzles that the in-core instrumentation passed up into the core to measure neutron flux.

Well, at the bottom of the vessel, there was this very hard layer of once molten oxide fuel with some metal in it. This was a very hard layer. It was non-adhering. It was extremely difficult. Ed can talk to this, about how difficult it was. We finally broke it up and removed it by pieces, but it was not stuck to the bottom of the vessel, and it surrounded these nozzle pieces.

Now, you could look down -- after this material was broken up and removed, you were looking at the nozzles. So, we cut these out, and most of the nozzles were unaffected by all of this.

In fact, one of the ones that we have a picture of, you can identify on it the markings that the machinist made when he was tooling it. So, it looks like it's new.

Then there are a few that are not like new, they've been distressed, and one of them is a little bit distressed, and then another one looks like a candle that's kind of burned down from the top and looks like the candle wax sticking to the side. That was -- maybe a quarter of it was melted and burned off, and then there's one where there's only a little stub, and it was essentially all melted away.

And when you locate where these specimens came from at the bottom of the vessel, what do you think? They're all right about that hot spot region.

MR. UHRIG: How big is this hot spot? About a meter?

MR. BECKJORD: Yes. It's a meter out to 800 centigrade. The part that is at or above 1,000 degrees centigrade is about 8/10ths of a meter, roughly.

MR. BOULETTE: These nozzles are Inconel?

MR. BECKJORD: They're Inconel nozzles, that's right. So, they are the ones that are right above the hot spot.

Now, you go and look again at this hard ceramic material that was on the bottom and at the debris above it, and what you find is that this material at the bottom of the vessel was fairly evenly distributed except in one place, and where is that place? Well, it's over the hot spot, and it looks something like this.

Here is the vessel, here is this hard material, and right over the hot spot, it's very thin -- in fact, it's just maybe, you know, between one-and-a-half and three inches thick over the hot spot, and above this material, there's a lot of -- at the end, what was debris, and this material, the two kinds, came down within about three minutes, and this was going back to the DOE investigation.

The first material that came down was cooler when it came down, and that was the material that first escaped from the crucible, and it came down and sloshed from about three different directions. The main break was on the east side of the core, and it came down, flowed probably over to here, and then some came down from the other side, and either there wasn't enough material to make a complete layer here or when the much hotter material came down at the end of this three-minute pour, it may have melted down into the -- into this hard layer at the bottom. We can't be really sure about that sequence, but that is the explanation of the hot spot.

This material here was acting as an insulating material, because it was -- the nozzles over here were engulfed in this material, which came down and solidified right around the nozzles, but they never affected the nozzles, they look like they're new, and it was in this area here, where the layer was very thin, that the hotter -- the much hotter molten material which came down at the end of the pour, probably from the center of the crucible, and it was that material that gave off the heat which developed this hot spot here.

Now, the hot spot -- one of the very important findings of the metallurgy was that this hot spot was hot for not more than 30 minutes, and that was unequivocally

determined from the metallurgical work that has been done. If it had been hot for a substantially longer time, it would have looked different metallurgically.

The other point I want to mention, the finding that they did -- the people at EG&G then went to work on the question of the heat transfer here and how do you explain that the hot spot was only hot for 30 minutes, and what they concluded -- and this is all documented in the reports, and as soon as we -- we could make these available to you now. There are a few copies that were kind of -- they're draft copies. The final set is supposed to be published in January. So, we have them pretty soon.

But the question was how could this happen, and by doing a lot of analytical work on it, they finally concluded, well, there had to be two cooling mechanisms.

One was a rapid cooling mechanism, which was the one responsible for cooling the vessel hot spot down so that it was not hot for more than 30 minutes, and the best explanation that people have come forth with is that there were water channels and that -- remember now that the reactor at this point was at a pressure of about 1,400 psi. So, that's pretty high pressure.

The difference in the high thermal expansion of this ceramic material as it cooled would pull it away, and it would leave space under it, and the calculations -- I

think the spaces are, you know, maybe a quarter of an inch or something like that.

That's plenty big enough for water, because there was water up to the level of the bottom of the core. It could get down underneath. It could also come down through cracks which were observed in this material. There are a lot of small cracks in it, and that appears to be the best explanation of the cooling mechanism responsible for the rapid cooling.

MR. HATCHER: How did the alloy -- when it melted in that hotter area, how did they change the composition or the properties of the melt itself?

MR. BECKJORD: Well, there is a difference between the material here and the material, the debris which was above it, which was hotter.

MR. HATCHER: You said only the area over the hot spot itself was melted.

MR. BECKJORD: The nozzles melt at about 1,400 C.

MR. HATCHER: Okay.

MR. BECKJORD: So, that's the Inconel.

MR. HATCHER: So, when you mix those things, you get different melting temperatures.

MR. BECKJORD: Yes.

MR. HATCHER: I just wondered if that changed the properties of the melt then.

MR. BECKJORD: Well, it did, because this was quite a mixture -- oxidic material here. There was metallic -- this was a ceramic and metallic mixture here. Maybe that's related. I don't know enough about this.

MR. HATCHER: The metallic stuff was in the ceramic. That was another point you made.

MR. BECKJORD: Yes. And the other point is, down here, in this material -- excuse me -- in this material that was over the crust, they determined that the cooling -- there was a slow cooling mechanism which operated over a period of many hours to several days. They can't specify, but by identification of some of the chemical species in here, they have determined that this material did not cool quickly, because if it had cooled quickly, it wouldn't be what it is, it would have a different chemical composition.

I can bring some slides tomorrow which have all of this summarized.

MR. KINTNER: This flow came out through the side of the vessel -- it didn't go down -- it went out the side and down through a very complicated structure, sort of an egg-crate structure, and through one-inch holes and so forth and on down to the bottom, and didn't melt it. I mean it didn't erode it, didn't melt it.

It's very strange that that much material, that hot, flowed through this structure down into the bottom of

the vessel and didn't seem to have any effect on it. It was almost as if it was self-insulated from the steel.

MR. HATCHER: Was it being quenched in the process?

MR. KINTNER: At the beginning, when it first started through here, it was above the water level, and when it got down to the bottom, it was underwater, but it wasn't quenched. It was just this very hot molten material. I don't know what temperature. It must have been about 3,000 degrees.

MR. BECKJORD: About 2,800.

MR. BURSTEIN: Wasn't that the same phenomena at Chernobyl?

MR. KINTNER: Yes.

MR. HATCHER: In lava flows that are underwater, you get almost the same kind of phenomenon, I think.

MR. MOLZ: There would be steam in the atmosphere.

MR. HATCHER: They usually congeal themselves on the outside and they form a core through which the molten material continues to flow. So, it's self-quenching on the outside.

MR. ISBIN: But isn't that primarily associated with molten rock underground? I couldn't ascertain, from what I saw, that you actually form pipes in which you were piping the molten material under depths of water.

What you were finding -- there's many examples of such pipes which formed on the ground and in which you formed an insulation and a flow within it, but when it starts dispersing water, I didn't see that. They may be there.

I've tried to make a determined effort with the Mark I issue to see whether I can find anything in that regard. People talk about it. If you have some very explicit references, I would like to see them someday.

MR. HATCHER: There's a movie that's in common use in introductory geology classes, I think, that shows it. I've seen it shown on TV.

MR. VOGEL: What can you say about the temperature gradient through the bottom of the vessel?

MR. BECKJORD: I'll come to that.

The people who completed this project were focusing on the whole problem -- that is to say the vessel, the core material, the heat transfer -- and they were not able to arrive at a final conclusion on one of the questions which was posed, namely what was the margin to failure of the vessel, and there's some things that I get kind of single-minded about, and I continue to be very interested in this question, and there's a paradox that appears, and I'll show you what the paradox is.

This is the measured yield stress of the TMI

vessel material, actually measured, actual TMI vessel material. It's tensile stress and temperature centigrade. Can everybody see that?

Normally, the vessel operates -- the temperature is within this region here, and the stresses are -- well, code-allowable stresses are down in this region somewhere, with a lot of margin.

This is where the hot spot was, from here to here, and you can see that the yield stress is down to -- from 10 to 30 mpa. So, it's very low.

And the paradox is this: Bob Witt, whom you will remember well, is the guy who did the work on this at Wisconsin, and he did the calculations of the mechanics of the vessel and was looking for creep failure, and he did a whole bunch of cases, and there were two or three that were so-called global vessel; that is, the whole -- at least the whole hemisphere of the bottom head was at a temperature of 700 centigrade, 800 centigrade, and so on and so forth, and what you found is that at even 700 centigrade, you can have creep failure of the vessel, and he used the actual pressure traces to determine this, and here's the paradox that I have trouble with.

How is it that you can have a vessel fail at 700 centigrade when the whole hemisphere is hot, and we know that, because there was water in the vessel, when you get

away from the area where the debris was at the very bottom, that the vessel temperature was a lot lower. It was probably 300 centigrade, something like that.

But how can you have -- not have -- if you have vessel failure in this condition, when the whole hemisphere is at 700 at those pressures, how can you not have failure when you've got a great big hot spot down here where the strength is a lot less, and that's the question that engaged my attention.

MR. KINTNER: Didn't we do actual measurements to assure that there was no ballooning in that area?

MR. BECKJORD: There was discernible ballooning. I'd like to comment on that. I think it probably did balloon, but I think -- I've done some calculations. I'm going to try to go back and do them more carefully this weekend.

This is the same thing here, only it has the pressure limit on this side. For this vessel, given a 10-inch thickness and the ratings that it has at the hemisphere, this would be the pressure factor. This is the yield stress. The other curve is the same curve, but it has the -- it's the limiting -- it's the pressure that will take you right to yield internal pressure.

MR. ISBIN: This is pascals, right?

MR. BECKJORD: Mega-pascals, yes. A mega-pascal -

- 10 mega-pascals is about 1,500 psi; 15 mega-pascals is 2,200 psi.

MR. ISBIN: When you speak of a hot spot, you're speaking of a hot spot that's the entire thickness of the vessel.

MR. BECKJORD: Yes. I'll show you that. I'm coming to that.

MR. ISBIN: But you don't have verification of that.

MR. BECKJORD: Yes. The specimen -- the viewgraphs that I didn't bring show that they were able to determine -- taking the specimens that came from the hot spot, the difference in temperature at the inside surface diameter, which is one-third of the way through the vessel -- that was 100 centigrade. That was determined from the metallurgical investigation. In the hot spot, one-third of the way through the vessel, the temperature was -- it was 100 degrees.

If you have a 100-degree drop one-third of the way through, it's clear that there is -- if you're going to have a temperature drop, you have to have heat flow to go with it, and so, if you just project that, you get between 250 and 300 centigrade.

MR. ISBIN: Yes, but that's a lot of assumptions there.

MR. BECKJORD: There are a lot of assumptions.

MR. HATCHER: You know that the heat was there, and you know the temperature was that high.

MR. BECKJORD: These are from Bob Witt's calculations here, and he did quite a lot of these, and so, I have to start somewhere, and looking at his calculations, this is temperature, and this is radial position, and I made this number dimensionless for reasons that I'll explain in a minute, but for the TMI hot spot, this point here, this is the inside vessel temperature, this is one-third of the way through, two-thirds of the way through, and this is the outside, bottom, and this point here for the TMI hot spot was at a radius of just under half-a-meter.

Now, these were Bob Witt's calculations, and they seem to agree. I mean you've got between 200 and 300 degrees centigrade across the vessel wall, and those were heat transfer calculation-based. He did it for -- well, as I say, he did global cases, and then he did cases where the hemisphere is at this temperature, except when you get to the hot spot, and then you have something like this.

MR. KINTNER: You could check it against the samples.

MR. BECKJORD: His calculation for the hot spot agrees. I mean there's about 100-degree centigrade drop. So, I said, okay, that's what I'm going to use for what I'm

going to do, and then, in thinking about this, I said to myself what does the hot spot look like, and I said to myself, well, I think it looks like a plug.

These are the stresses, the principle stresses in the vessel in the two dimensions, and now here's the hot spot, and I say, well, the hot spot was about of this size, and if I think of it for a moment as a plug and I just cut it out with a cutter, cut a big plug out, now I want to keep the plug in place, and for equilibrium, the pressure on the outside has to be -- if the pressure on the outside is the same as it is on the inside, that will keep it in place, and a simpler way of describing this, since it isn't external pressure that's keeping it in place in the vessel, there are shear stresses acting around the plug which are retaining it in place, because there's a push of war going on.

The pressure in the vessel wants to push it out, and this is keeping it in place, and that's the pressure from the reactor vessel pressure, and this is, in effect, the shear forces acting at the outer circumference, and so, you get this relationship here, where this is the radius of the hot spot, two times the thickness of the hot spot, and that's the effective shear stress.

So, then I said to myself, well, then I've got to get the shear stress. What was the shear stress? So, I took this information here, the measured tensile stress, and

I look up in my old mechanics book and it gives me the ratio -- or it gives me a value of shear stress relative to yield stress, and it's about 84 percent, 83 percent. It's at low temperature. So, there's some question of whether that applies at high temperature, and not having high temperature data, I assume that it does.

The next part, taking this temperature gradient and the yield stress values, 83 percent of the yield to get a shear stress, I calculate across the section moving out from the center an average shear stress, maximum shear stress through-wall, and what I get is this.

This is very hot at this point here. The shear stress is down to about 10 mega-pascals, and when you get out to this point, there is a knee of the curve here, and when you get out cooler than less than 1,000 centigrade, you pick up a yield stress strength and shear stress quite rapidly, and so, by using these values and calculating through-wall, I get a shear stress here or my assumed shear stress as a function of the distance.

This is the hot spot radius again here. So, at the center, very little capability, and right out here and in the TMI case, this happens to be 1,028 degrees, and so, there is a knee of the curve here, and when you move out a little further, you pick up strength very rapidly.

So, now the question is, well, okay, given that,

how big can the spot be, how large can this hot spot be and still retain -- have it retain in place? Well, it goes back to this -- it's the force equation here -- to this equation.

Now, I can explain this first by saying that, well, at a given pressure, I want to look at the force on thin plug, and the force on that plug grows linearly with the radius, and so, at a given pressure -- let's say at a very low pressure, the force on this plug is a straight line increasing with radius. It's simply the radius times the pressure, okay? And if I increase the pressure, then the slope of that line increases, and if I increase the pressure enough, I'll get an intersection. This straight line starting at the origin will hit this curve right here, and that would be the point where the forces of expulsion just balance the force of retention at that point. That is the shear stress acting around the circumference.

Now, the problem isn't quite that simple, because you have to account for the vector, the force vectors, and so it's not a straight line. In fact, if it's a cylindrical plug, the curve comes like this and it's convexed downward.

[Whereupon, at 6:00 p.m., the meeting continued in evening session.]

EVENING SESSION

[6:00 p.m.]

MR. BECKJORD: If it is a radial plug -- that is, a conical plug, with the cone starting at the center of the hemisphere, at the bottom of the head, and projecting down like this and intersecting the hot spot in a -- so that you have, in effect, a radial -- you have a conical -- a section of a cone, that that's the -- that is, the cone is going through the vessel wall, and it's thicker than the perpendicular thickness through the wall. In that case, this curve is convexed up, and these curves are displaced a little bit from each other.

This is the pressure, the internal vessel pressure, and this is the major radius, in meters, of the hot spot, from the center of the hot spot out to the point where the temperature is, the 1,028 degrees. That happens to be right where the knee of that curve was, and this upper curve here is for a cylindrical plug -- that is, a plug just straight through the wall of the vessel -- and the lower one is a conical plug, and this is the pressure radius limit for failure.

I just wanted to say, at some point out here, when the hot spot gets big enough, it's no longer a hot spot, it's like the hemisphere itself, and I don't know where that is, but I think it's -- you know, it's certainly out here.

The vessel is -- the radius of the vessel is 2.2 meters. So, my guess is it's somewhere in this region that the hot spot will be so big that it -- and this is where it was. This it the lower curve, the conical plug.

If that hot spot were a perfect circle -- it was, as I say, just .47 meters in radius. Actually, it wasn't a perfect circle. It's kind of a cut-off circle. So, relative to a circle, the actual hot spot, as it was identified, has more perimeter relative to surface area than a circle would have.

So, since that's -- it's the forces around the perimeter that are important. The fact that it is non-circular moves this point over a little bit.

The pressure in the vessel while this was going on was 9 mega-pascals, and what this says, if it's right, is that if the pressure had been -- gone up a little bit over 15 mega-pascals, it would have blown it out.

MR. KINTNER: Which was the operating pressure.

MR. BECKJORD: The pressure, in fact, did go to 15 mega-pascals after -- but after the hot spot had cooled down. In other words, the hot spot was formed not too long after the molten material fell from the crucible, and it was hot for 30 minutes, and about two hours after the crucible formed, the pressure went back up to 15 mega-pascals, but by that time, the hot spot, from the metallurgical work, was no

longer hot.

MR. ISBIN: In the thermal calculation, what was the heat sink outside of the vessel that caused the temperature gradient through the wall?

MR. BECKJORD: Mostly, I think it was the movement of heat away from the hot spot through the wall itself.

MR. ISBIN: Do we know of any case in which there's a hot spot that blows out?

MR BECKJORD: I talked with Dan Powers, when I was describing to him over the phone, and he said, you know, years ago, we did experiments like this, we had pressure vessels and heated them up with a blow torch, and he said what you're describing is what happened in those experiments, and he told me this -- this was back in -- right before Christmas.

The other point that I want to mention -- there's another way of thinking about the hot spot. The thermal expansion from even a 200-degree centigrade temperature difference is -- I mean the stresses will be enormous. So, I think that probably that vessel did deform, but it doesn't have to deform very much.

I mean the deformation of 1 plus the strain would be about 1.003, and the deformation from a spherical form doesn't have to be very much to relieve that, but the main point is that that hot spot was not in -- under tensile

force. It was heating that spot up. You've got a cold vessel on the outside, and you've heated the hot spot up, and it's under very strong compressive forces, and there's no tensile force operating in the hot spot.

MR. MOLZ: That's interesting. I hadn't thought about that.

MR. BECKJORD: And evidently -- but it would be subject to shear failure. I mean it has a shear weakness, and as the hot spot gets bigger, at some point the force balance favors blowing it out.

MR. ISBIN: Well, with the statements that we were told, if this hot spot had persisted another -- I forget how many minutes -- the vessel would have failed.

MR. BECKJORD: Well, in my mind, that relates to -- I don't have the pressure -- I'll bring the pressure trace tomorrow.

MR. ISBIN: I thought it was independent of the pressure. I mean it was a question of the time that this hot spot existed or is it really tied to what the time-pressure history was?

MR. BECKJORD: Witt's calculations -- he looked at a hot spot of this size against a cold background temperature, and he didn't get failure going way, way out in time. If you had the vessel at -- if the hot spot was imposed on a vessel at 710 centigrade, it failed in a little

over two hours. If he imposed a hot spot on it over the TMI size, it failed in about an hour-and-a-half. So, in that case, the hot spot accelerated the failure by 30 minutes, but if he had a hot spot on a cold vessel, it didn't fail.

MR. MORRISON: Eric, may I interrupt and thank you for your presentation? Since we've passed our normal time of adjournment, let's adjourn, and if there is any other discussion, it can be taken care of in the hallway.

I'll just remind you that 7:45 is the time to start tomorrow, so that we have a chance of finishing early in the day.

We're adjourned.

[Whereupon, at 6:10 p.m., the meeting was recessed, to reconvene Friday, January 14, 1994, at 7:45 a.m.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission
in the matter of:

NAME OF PROCEEDING: NSRRC

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Jon Hundley

Official Reporter
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OFFICIAL TRANSCRIPT OF PROCEEDINGS

Agency: Nuclear Regulatory Commission

Title: Nuclear Safety Research Review Committee

Docket No.

LOCATION: Bethesda, Maryland

DATE: Friday, January 14, 1994 **PAGES:** 253 - 486

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

***

NUCLEAR SAFETY RESEARCH REVIEW COMMITTEE

***

Holiday Inn

Versailles 4 Room

8120 Wisconsin Avenue

Bethesda, Maryland

Friday, January 14, 1994

The above-entitled committee conv ned, pursuant to notice, at 7:46 a.m., D. Morrison, Committee Chairman, presiding.

PARTICIPANTS:

DAVID L. MORRISON, Chairman

ERIC S. BECKJORD

GEORGE SEGE

THOMAS E. BOULETTE

SOL BURSTEIN

ROBERT D. HATCHER

HERBERT S. ISBIN

PARTICIPANTS [continued]:

EDWIN E. KINTNER

FRED J. MOLZ

NEIL E. TODREAS

THEMIS P. SPEIS

ROBERT E. UHRIG

RICHARD C. VOGEL

LAWRENCE C. SHAD

JOHN W. CRAIG

BRIAN SHERON

FRANK COFFMAN

GEORGE BIRCHARD

NICK COSTANZI

PROCEEDINGS

[7:46 a.m.]

MR. MORRISON: I would like to call the meeting to order. It appears that most of the Committee is here now. Since we announced that we were going to start at 7:45 and we have passed the appointed hour, let us begin.

Today what we want to do is to gather some additional background information and have some discussions on the questions that the Commission posed to us back several months ago, and will be the basis of our meeting with them sometime in the next four to six months. We would like to start with a discussion of code maintenance. I believe Brian Sheron is going to lead a presentation in that area.

MR. SHERON: I think that everybody has the viewgraphs that I passed out. I am going to talk about our plan for maintaining code expertise. Let me give you quickly, just some background.

Starting in the latter part of the 1980's we were first faced with this question of maintaining code expertise. This is in the thermal hydraulic area. LOFT and Semiscale shut down around 1986. NRR had indicated to Research that there were no remaining thermal hydraulic issues to justify constructing a large experimental facility. One of the questions, obviously, when you shut

down two large facilities was, we lost this capability. Shouldn't we have an experimental capability.

Research came to NRR. I was in NRR at the time, so I was the one that answered the question. They said, can you give us any issues that would justify a large facility. We said we would love to have one, but we can't tell you that it's absolutely necessary.

Also, most of the thermal hydraulic work that was carried on post-1973 was in response to the ECCS rule that was promulgated in 1973. The research was affectionately called the mortgage, where the Commission said that we would go out and do research to confirm the margins that they were putting in the ECCS rule.

In 1988 if you recall, we issued the revised ECCS rule, which allowed relaxation of many of the conservatisms that were originally opposed. Basically, it signaled to a lot of people that we had completed our mandate from the Commission in the area of thermal hydraulics. Also, right about that time, we were just finishing up the National Academy of Science -- they had just finished up a review of the Office of Research.

One of their recommendations was that we weren't doing any human factors research and it was high priority, and we should start a program. Other programs were gaining some importance. As you know, aging, license renewal and so

forth, were all competing. Severe accident research and trying to wrestle down some of the key issues, the high priority issues there, were all competing with the thermal hydraulic research for decreasing research dollars.

Thermal hydraulic research budget back in the early 1980's at its heyday, when we were running LOFT and Semiscale and developing the codes, was something on the order of $60 million a year. It was about $40 million for LOFT --

MR. KINTNER: Some of that money was construction.

MR. SHERON: It was $40 million a year to run LOFT. There was a lot of other stuff in there. If you will recall when OEC took it over and they really stripped out all the ancillary programs, there was instrument development and some code development that was done specifically for LOFT, when they stripped all of that out LOFT was around $25 million a year to run for the OECD consortium.

We had Semiscale running at -- Semiscale was about $7 million a year. We had two code development programs. It was around $60 million. This dropped down substantially, to around in 1988 it was around $14 or $15 million, somewhere in that range. On top of that, the research budget was coming down. As I think you know it hit a low at one point around that time of $90 million, total.

We started re-prioritizing the research dollars,

to start a human factors program. There had to be started, the work on the aging and license renewal and so forth. There was strong incentives from various corridors in the agency that said you guys solved thermal hydraulics. Let's get on and do something else. The attempt was to try and find out that's fine, let's reduce it to this animal that we originally called the maintenance level.

We went out and we discussed with the laboratory managers -- I did, personally. I talked with Idaho and Los Alamos and the like and I said, what is it going to take to keep a competent cadre of people available at the labs to keep these codes available to us so that if we call you up and say that we need a calculation or something like that, you can do it. They told us how many people it would take. I think it was usually a group of about five or six people, would make up a team.

What we concluded was that around $4 million a year would be necessary to maintain the codes. This was not really any kind of an active development program or anything. It was basically correcting errors that were being identified by users of the code and so forth, and having the people there that could do the calculations.

MR. MORRISON: Brian, how did that number compare with the portion out of the $14 to $15 or the $60 million number that you quoted before?

MR. SHERON: This was all on codes.

MR. MORRISON: I understand that. But you didn't tell us how much was in codes before that.

MR. SHERON: Of the $60 million, as I said, $40 million was in LOFT.

MR. MORRISON: How much in codes.

MR. SHERON: 7 million was in Semiscale. About $13 million was codes.

MR. MORRISON: When you got down to the very basics it was $13 million against the $4 million.

MR. SHERON: Yes. There was no big development program anymore. TRAC was basically declared complete.

MR. ISBIN: About this time though too, Brian, you had the Japanese/German/U.S. cooperative program which ran for some 15 years which was just completed, at a total cost of $500 million.

MR. SHERON: Yes.

MR. ISBIN: That was a very active program code.

MR. SHERON: The U.S. contribution to the 2-D/3-D was codes. I guess our total contribution came out to about $100 million.

MR. ISBIN: Is that included in here someplace?

MR. SHERON: That's included. That's finished up. We were just basically --

MR. ISBIN: No, I meant in your table.

MR. SHERON: Of things not shut down?

MR. ISBIN: No, the background.

MR. SHERON: That's included in that $60 million. Remember, that was $100 million spread out over 10, 15 or 20 years, something like that.

MR. BURSTEIN: In 1986, Brian, there was no experimental --

MR. SHERON: The only experimental activity that was still going on was the MIST facility, which was started following TMI.

MR. BURSTEIN: Do your figures include any input from those experiments into any code revisions potentially?

MR. SHERON: I think there was some money in there for that. Again, it was to try and say what is the minimum needed to be done to maintain our capability.

MR. BURSTEIN: We talked yesterday about how does the agency maintain its expertise. One of the things we discussed was the need to do actual work in order to keep people's alertness and sharpness --

MR. SHERON: You must have read ahead here on my slides.

MR. BURSTEIN: I didn't, but I will wait.

MR. SHERON: That's all right. I think you have put your finger on it. I will get to that. We had dropped down to around $4 million for actual thermal hydraulic

research if you want to call it that. We also had about another $2 million which was earmarked for accident management work which basically involved doing code calculations, looking at various accident management strategies which would also exercise the codes and keep the expertise available.

Remember, this was all in a timeframe starting about 1987 through 1989. What did we learn from all of this. What we learned first off was, when the laboratories and in particular INEL kind of saw handwriting on the wall, that thermal hydraulic research program was coming down from its heyday. At the time the strategic defense initiative, STAR WARS, was a high priority, highly funded program at these laboratories.

Many of the experts, the good people, just moved right on over to those other programs. They said that's where the action is and that's where I am going. Others moved on. For example, Professor Ransom, the Chairman at the Department of Nuclear Engineering at Purdue, he was one of the chief architect's of the RELAP code. I think he just reached a point where it was time to move on and enhance his career. He left the lab.

Basically what we learned was that experts do not want to stay on a program unless there's challenging and interesting work to do that has regulatory application.

MR. MORRISON: Brian, let me question those last few words. Is it essential that there has to be a regulatory application to do interesting work?

MR. SHERON: There has to be some -- they want to see their results ultimately used somewhere. I mean, I used to always say when I was in NRR, everybody wants to regulate. I know that everybody, even our contractors, always wanted to see their work being used somehow translated into a regulation or requirement on the industry or something, so they could say look at the impact we had on the regulated industry.

MR. BURSTEIN: I told you so. Never mind whether it's needed or not.

MR. SHERON: I am just saying what people wanted. I am not saying --

MR. BURSTEIN: This is an important observation. I don't mean to diminish its significance at all. I think it is a philosophy that we have to live with.

MR. SHERON: One of the things we have to do when we justify our programs is, everybody wants to know what is the regulatory product. If it doesn't bear on regulation why are you doing it?

MR. MORRISON: That's in terms of the outside funding, but that doesn't necessarily follow that the capability and maintaining interesting work program has to

have an application. Most scientists and engineers don't really care about the application from a peer sense. They are quite willing to work on it.

MR. MOLZ: You want to think that it's useful.

MR. SHERON: That's right, exactly.

MR. BURSTEIN: That's the point. There are other purposes like improved safety, increased margins, changes that might reduce regulatory burdens, not necessarily add to them.

MR. SHERON: Right.

MR. BURSTEIN: These are certainly purposes and values that people have about the importance of their work.

MR. SHERON: Right. They don't distinguish between adding requirements versus saying I helped remove a requirement. That's an equally challenging objective for a laboratory.

MR. BURSTEIN: Unfortunately, there's a different time constant involved in each of these.

MR. ISBIN: Could I just come back again, because we are talking about a time period in which the cold interfacing between the Japanese and the German tests were ongoing. I would have thought that these would have been very stimulating challenges. Perhaps some of this work was being done by contractors other than the labs. I don't know.

MR. SHERON: We were pretty much finished up. I think what we were doing during that period was writing up the reports.

MR. ISBIN: The reports just didn't finish until 1994, just now.

MR. SHERON: Lou, do you want to talk about what was going on in that period on 2-D/3-D.

MR. SHOTKIN: When the ECCS rule came out we had the uncertainty evaluation, the CSAU that was being developed during this time period. There was a lot of effort going on from 1987 through 1989, possibly into 1990. They were using as part of that effort, many of the results of the 2-D/3-D program. The 2-D/3-D program was essentially finished by then, and we were just finishing up the final reports.

The final reports didn't come out in published form until 1994, but that relates more to getting people who don't speak English to agree on exactly what happened. There were major arguments between the Japanese and Germans as to what was the interpretation of the results. That did go on for a period of about two or three years.

MR. SHERON: As I said, reducing the funding, obviously one of the things we learned is that it's perceived as a decrease in importance of the program in the eyes of the NRC. As I said, since everybody wants to feel

that they are working on something important and everything, this was not a real good sign for them. I think that's what triggered a lot of people to move on to other programs.

In 1990, we first started to find out what the AP-600 design was going to look like. Up to this point we really had no information from Westinghouse. At this point, once we started to know what AP-600 looked like and we knew they now had a pretty definite schedule for when they were going to submit the application for certification, we started work on looking at RELAP and its applicability to the AP-600 and the SBWR.

This triggered an increase in our funding, because as we looked at the code and we saw that we had improved models that Westinghouse announced that they were going to have these certain tests, in December of 1990 NRR sent over a letter asking us to build our own confirmatory large scale, high pressure integral facility. You can see right then and there, we were going to have to apply a lot more research dollars in the thermal hydraulic area to meet the regulatory needs for the codes for AP-600.

This, of course, started new and challenging work at INEL. There was some rebuilding capability that was necessary. Again, they would come down -- some people had left the program and were working elsewhere, so they had to be brought back on. This was to some extent, it could be

characterized as a painful process. Again, people left and now we are bringing them back.

We have not significantly increased thermal hydraulic funding at Los Alamos as we have at INEL. If you look at the levels that LANL was spending on the development of TRAC back in the early 1980's compared to what they have right now, we are only spending a couple hundred K a year I think, on keeping the TRAC code there. My guess is, I would assume there's been a significant loss of capability in terms of corporate memory over the past several years.

MR. BURSTEIN: Did you have a choice between Los Alamos and Idaho, or were there other factors that suggested where you put your rebuilding dollars?

MR. SHERON: Well, the reason was is that there are two codes. There's RELAP and TRAC. If I could just quickly digress to the history of how we got to where we are with two codes. We originally started with the RELAP code back in the 1970's. It was RELAP4. The NRC decided that it needed the two fluid modeling, and it started the TRAC code. I think there was also the THOR code at BNL, and then there was RELAP.

If I recall, around 1977, 1978, Research decided we really can't support three codes. So, they had what we referred to as the code beauty contest. They set up a panel of experts, including Norm Laubin from NRR. Their job was

to evaluate all three codes and make a recommendation, which one the agency ought to support. The answer came out as TRAC.

The Office of Research went out and said we are going to support the research for TRAC code. They dropped funding for THOR and dropped funding for RELAP.

MR. BURSTEIN: TRAC was then the province of Los Alamos?

MR. SHERON: Los Alamos, correct. THOR was Brookhaven and RELAP was INEL. INEL, through various other means like LOFT in which they took funding -- part of the LOFT funding was used and they continued to develop and improve the RELAP code, even though it was not being directly funded. THOR fell by the wayside at BNL and it wasn't funded anymore.

Around the mid-1980's people started to realize that TRAC was chewing up gobs and gobs of computer time. Remember, there weren't PC's and workstations then. It was just almost too expensive to run. RELAP, on the other hand which was a 1-D code, was becoming the code of choice. Foreigners, everybody was requesting the RELAP code. The NRC said maybe we better start funding this again if everybody wants it. We started funding RELAP again and TRAC.

Basically what we had was, we had a work horse

code called RELAP which was a 1-D code and ran fairly quick. Then we had what I call a cadillac which we kept in the garage and didn't bring it out except on Sunday's to go to church. Whenever you had a big 3-D calculation you wanted those 3-D effects and all this, then you went in and ran the TRAC code. We maintained these two codes. Each one had its own mission. That's where we were up until 1988 or so, and then we started reducing the funding on both of them.

As we started increasing funding and we took a look at AP-600 and SBWR, the original assessment was that we don't need 3-D capability. We can handle these reactors with a 1-D code like RELAP. That's why we went back to INEL.

MR. BURSTEIN: That is very helpful to me. Thank you.

MR. ISBIN: At the same time, Brian, I appreciate that you are sort of confining most of the discussion to RELAP and TRAC. At the same time, you have SCDAP and other significant code development programs in progress.

MR. SHERON: I have a whole severe accident program I haven't even talked about yet.

MR. ISBIN: Isn't there some overlap.

MR. SHERON: No. The people that develop SCDAP do not interact very closely with the people that develop RELAP.

MR. ISBIN: You will refer to them separately later?

MR. SHERON: Yes.

MR. TODREAS: That is an important point. On code maintenance this is in the thermal hydraulics area. There's containment and there's melt codes.

MR. SHERON: That's right. There's containment and severe accident codes.

MR. TODREAS: Which you have to weave in at some point, relative to the principles.

MR. SHERON: Yes. I said, where are we going. Also, when we were scaling back this area one of the things we did was, we sat down with our users, NRR, and said, what codes do you think you are going to need us to maintain for you. What we concluded was, they wanted RELAP5, TRAC-P which is the PWR version, TRAC-B which is the BWR version and the RAMONA code which is at Brookhaven. The RAMONA code basically has 3-D kinetics in it and can handle BWR stability type of questions.

Our current assumption is that the fiscal year 1993 funding that we have earmarked -- this has come up, obviously, from about 1988 -- the fiscal year 1993 funding that we have for the thermal hydraulic research right now is about $12.4 million. I think that last year it was $13 million. 6 of it went to Japan to build the ROSA facility,

but that's paid for now. The $6 million that went over last year will remain in this country from now on. There's no more overseas dollars for ROSA.

We are assuming that the current level of funding of around $12.4 million is going to remain constant in the out years.

INEL has started to enhance their capability since the start of the AP-600 and the SBWR work. They brought back some of their experts on the program. We have gotten a letter recently from Jim Lake, manager of nuclear engineering out there, and he has told us that he plans further enhancements. He wants to hire a few more experts to help the laboratory. In the interim they brought on Vic Ransom back to the lab as a senior fellow. He's still at the University but he's sort of a consultant to them.

BNL funding right now --

MR. TODREAS: How much of the $12.4 million how much goes to Idaho for funding.

MR. SHERON: Of the $12.4, how much goes to Idaho versus --

MR. SHOTKIN: I would say about two-thirds.

MR. SHERON: Two-thirds, okay.

MR. BURSTEIN: To understand this, you said last year for example, there was a large investment in ROSA.

MR. SHERON: Yes.

MR. BURSTEIN: $6 million, or something of that magnitude, which will not be repeated.

MR. SHERON: Right.

MR. BURSTEIN: At least we don't plan another experimental facility of that type. That means that there is a large increase in domestic spending. What justifies spending $6 million in the U.S. for stuff that ROSA liberates, as it were.

MR. SHERON: What justifies spending it in the United States, as opposed to where?

MR. BURSTEIN: As opposed to not spending it at all, if you will forgive me. Just because we spent it on some capital experiments, one shot doesn't mean that we have to continue to use that money this year or next, does it?

MR. SHERON: One could make that argument. I think we would counter --

MR. BURSTEIN: I am trying to.

MR. SHERON: We would counter by saying that what we have learned is, from all of this and from our Commission as well -- the Commission has basically told us that they want us to maintain a world class thermal hydraulic program.

MR. BURSTEIN: Understand.

MR. SHERON: To do that -- and I was mentioning to Tom before, the bottom line is that you get what you pay for. We need to invest more money in the thermal hydraulic

area if we want to have the world class expertise that people seem to think we should have.

MR. BURSTEIN: You are going to double the investment in one year.

MR. SHERON: Yes.

MR. KING: Not quite. 2 million this year is going to Purdue, so there is $2 million capital expenditure in fiscal year 1994. It's not like we have $6 million to put on personnel this year that we didn't have last year. Plus, a lot of experimental results are coming in from the Westinghouse loops and ROSA, and it's just going to take more money to start analyzing all that stuff.

MR. SHERON: Westinghouse has two integral facilities and several separate effects facilities, and people are expecting that we need to analyze each of those with our codes to validate. As Tom said, that just takes a lot of money.

As I said, INEL is pretty much on the road now to enhancing their capabilities. BNL, last year we moved some of the SBWR work from Idaho to BNL. I think I may have told you this. The reason was is several fold. One is that BNL does have substantial BWR ex-expertise there. We felt that it would be very useful to bring that to bear on our programs. Number two, we felt that Idaho did not have enough staff to adequately put enough emphasis on both AP-

600 and SBWR.

We kind of got an impression that SBWR work was sort of taking a back seat to AP-600 work at Idaho. We felt that one way we could get the work done and free up Idaho if they didn't really have the resources, was to put it at another place that could do the work.

BNL is right now funded at about a rough number of a million a year. They have the RELAP5 code. Their job is to assess the PUMA facility which is the Purdue loop which is being built, as well as the SBWR. RELAP, however, maintains the responsibility for code development, any code development aspects of the SBWR.

MR. BURSTEIN: Is the work required for the SBWR more or less or about the same as that required for the analysis of the AP-600?

MR. SHERON: They are probably going to be the same in terms of the questions. It's going to be different problems. SBWR looks very much like a conventional -- it's a natural circulation. People are asking a lot of questions about stability. We are going to have to dig into the stability issue pretty hard on this.

The other thing is the passive containment part of it. We are going to have to do more work than a conventional plant analyzing the passive containment and its performance.

TRAC-B, the BWR version of TRAC, this is a program where we took one of our codes and went out on a competitive contract to have a certain organization maintain the TRAC-B code for us. Penn State was awarded that contract, and that's going on right now at Penn State. Professor Mahaffey and Professor Baretta are involved in that at Penn State. They basically are keeping the code. They can do calculations with it, they are running the interface program with our foreign users like the CAMP program and so forth, making corrections to the code that are found.

MR. BURSTEIN: That effectively replaces Los Alamos in this respect?

MR. SHERON: Yes. For the BWR version of TRAC. The BWR version of TRAC originally, way back, was moved from Los Alamos to Idaho. When we put the contract with Penn State that moved the TRAC-B work from Idaho to Penn State. Now, the lineup is that LANL, Los Alamos, has TRAC-P, Idaho has RELAP, Penn State has TRAC-B and Brookhaven has the RAMONA code, in terms of responsibility.

MR. TODREAS: What are the dollars associated with Penn State and the last one? I am trying to add them up and see how they come out.

MR. SHERON: Penn State is $150K a year.

MR. BOULETTE: Brian, did you say that AP-600 and SBWR have essentially the same amount of effort going on?

MR. SHERON: I don't think right now they do. The SBWR is slightly behind on schedule with AP-600.

MR. BOULETTE: I am trying to get the different from $8 million for INEL and $1 million for BNL.

MR. SHERON: I think that right now the AP-600 work in INEL is taking most of the dollars. I apologize, I don't have a breakdown with me. The SBWR work, which is about $1 million, is going on at BNL. We also have $2 million this year -- it's a $3 million total contract at Purdue to construct and operate an SBWR small loop. That would add up to $4 million right there on the SBWR.

Then, there is a code development effort at INEL on SBWR. I don't think too much is going on right now, because we don't have any of the data coming in from our loop. Are they doing anything from the GE facilities?

MR. SHOTKIN: Most of these model improvements apply to both AP-600 and SBWR.

MR. BOULETTE: Does that mean then, as the SBWR starts to crank up there will be more expenditures expected in that area?

MR. SHERON: Maybe. I don't think so, because as Lou said, a lot of the work we are doing on AP-600 is equally applicable to the SBWR. The only place I might see it is if we ran into some sticky questions as a result of the Purdue loop.

MR. BOULETTE: Thank you.

MR. MORRISON: Brian, I would like to ask you to break the $12 million down into three categories, if you could. Out of that $12.4 million, how much of this goes into capital investment, whether you are building a loop or making some components. The second would be just the operating and maintenance costs for any of these experiments or loops that were running. Third, in the code development analysis, code maintenance area.

MR. SHERON: I will try and do it. I didn't bring a breakdown, but I think I can give you a rough idea. In fiscal year 1993, about one-half of that went to Japan.

MR. SHOTKIN: About $4 million in 1993 and about $2 million was put aside for 1992.

MR. SHERON: It was 1992 money. In other words, the total modifications for ROSA were $6.93 million. There was about $2 million of that was fiscal year 1992 money. In fiscal year 1993 about $4 or $5 million was sent over to Japan for the modifications. If you subtract the $5 million off of that you are left with about $7 million.

The only other loop that we were maintaining was North Carolina and Maryland, and that was about $100K each. About $200K to maintain the two small loops, one at Maryland and one at North Carolina State. As I said, Brookhaven was getting around $800K total last year. Los Alamos was

getting about $300K, and the rest of it went to Idaho. About $500K went to Purdue, of 1993 money.

In 1994, again, the maintenance of the two small loops would be about the same. 2 million is going to Purdue for construction of the PUMA facility, about $1 million to Brookhaven for the SBWR work. We may be increasing some of the money to LANL this year. I will get into that in a minute. We may have to do some more calculations with the TRAC code. That number could go up to about say a million to LANL in fiscal year 1994. The rest of it would be going to Idaho.

As I was just saying about Los Alamos, there are certain transients in AP-600 that we have established require a three-dimensional capability. Keep in mind, RELAP is a one-dimensional code, and it does not solve the cross flow terms in the momentum equation. There is an approximation made. In essence, any time you get high radial flows around a downcomer or something where a momentum can be important we usually go to the TRAC code which has the proper derivation of the momentum equation in it for those type of flows.

We have decided, number one, the large break LOCA analysis for AP-600 should look very similar to a conventional plant. The passive safety features are primarily designed to replace the high pressure injection

system which is designed to protect against a small break, not against a large break. Large breaks are protected by accumulators and the low pressure injection system.

Los Alamos, we had planned to run the large break LOCA analysis there. We had also discovered that there might be some intermediate size breaks that have substantial cross flows, and we felt that we may have to run some intermediate breaks for AP-600 at Los Alamos. Now, there may be some asymmetric effects that would warrant running a few more calculations of different transients at Los Alamos.

All this work we are doing on AP-600 and SBWR, we expect to begin decreasing in the fiscal year 1995, 1996 timeframe. At that point we think we will be finishing up with the ROSA testing, by the end of 1995, if we go into a second phase. Hopefully, Westinghouse, although they just announced a delay of six months in the OSU tests, the plan was that the OSU facility would be finishing up. The PUMA facility at Purdue, we would have gotten the data from that. By about 1997, we would start winding down with this work.

Am I going to get myself in the same situation I was in 1988? What am I going to give to the contractors as good challenging work. The only new work that is projected right now is the CANDU3 certification. Current schedule, as I understand it, they plan to submit that officially towards the end of fiscal year 1994, which would be this summer.

We owe a paper to our Commission which we are preparing right now, which will tell them which research we think is needed to support certification of CANDU. As I said, the application is expected in the latter part of 1994. Current review schedule is looking like somewhere between 48 and 60 months. I take that with a grain of salt right now, but that's the official numbers.

Our plan was to start the code work. If we are going to develop an independent capability to analyze CANDU -- this is a strange beast. It has a horizontal pressure tube core with headers and so forth. It's a figure-eight type of loop in terms of the number of passes through the core. It's heavy water moderated, as you know, positive moderator coefficient. It's just a different beast. The plan was to start code work, if we were going to have an independent capability at LANL, which would include incorporating 3-D kinetics into TRAC-P and converting t' horizontal pressure tube type of core.

Our understanding is that some of this type of work may have already been started when these people were working for the N-reactor at Hanford. It's not like we are coming into this totally cold. However, right now, we had to take a cut in fiscal year 1995 funding, and this CANDU work was eliminated in our budget. Although I understand that the way it works is that if the Commission decides that

this is work that needs to be done, then they can restore the funding.

MR. BURSTEIN: As a practical matter, does the funding for this kind of work come from the licensee's fees?

MR. SHERON: Yes, it does. In other words, it's Atomic Energy of Canada Technologies, AECL Technologies, which is the U.S. company applying for the certification. They only pay for the NRR review. They do not pay for the research. The only time that they would be required to pay for the research is if somebody decided that the research was necessary for the certification.

MR. BURSTEIN: I thought that's why you were in business.

MR. SHERON: It's not necessary. In other words, anything that is necessary for certification is the responsibility of an applicant to submit, if it's necessary. A lot of people have difficulty with this concept. You can argue that there's no need for the Office of Research to exist in the ultimate.

MR. BOULETTE: Somebody to pay for all of your activities, that's all, besides us.

MR. BECKJORD: There are two sources of payment for those funds. One is the applicant. What Brian is saying is, if the Commission decided that the particular element of research that we are talking about is necessary,

then the applicant would be billed for that research. Or, as an alternative, the applicant might be able to do it on his own and provide the results.

The other case, if it is not required, then it is billed to all of the license holders, divided. Most of the -- I don't have a rundown. We are now segregating these things and keeping an account of which is which. The research on reactor safety is for the most part divided among the license holders as fees are apportioned.

MR. TODREAS: I have a question. What about the concept of your reviewing in detail the Canadian tools, the best Canadian tool to do this job. Is there a presumption that there's a big gap in this tool?

MR. SHERON: No.

MR. TODREAS: Your concept is that you have to develop another tool --

MR. SHERON: No, it's not.

MR. TODREAS: Your conclusion is, you keep talking about a new code effort. Therefore, I concluded that you had reached that decision. I am going back on that.

MR. SHERON: What I am saying is, if I go back and look the agency -- I will say the agency being in this case the customer, NRR -- decided that for AP-600 and SBWR they wanted their own independent audit tool. They could have taken the Westinghouse or GE codes and said we are going to

use these.

MR. TODREAS: I will say, these are completely new reactors without any experience. The CANDU is somewhat different.

MR. SHERON: We have no experience.

MR. TODREAS: You are saying they said they needed the independent audit to --

MR. SHERON: No, they haven't said it for CANDU.

MR. TODREAS: They haven't.

MR. SHERON: They have not said that yet. We are saying that there are several options. The paper we are presenting to the Commission is going to present what the options are. One is that we can go off and fund the development of our own, independent audit tool. The other option is that if we don't think that we can produce a validated tool on the timeframe needed by this agency to make a decision on certification for this reactor, the other option is that we go and take the Canadian tools and do a thorough review of them, and if we are satisfied and happy with them, then we use the Canadian tools to do our calculations or whatever we want to do. That's another option.

MR. TODREAS: That's good. I don't see this at all parallel to the passive plants. The passive plants, you have no basis now to say the Westinghouse and GE tools are

going to be good or not good because of the data and nothing is available.

On the CANDU plant they ought to have the tool and the validation for it on the shelf, and then you can examine it to see if it's good enough.

MR. SHERON: I know.

MR. BURSTEIN: That philosophy has not stood us in good stead on light water reactors in the past. That's why we have a lot of independent and expensive code development. That's an argument that we have had around this table since I have been a member of this Committee. What's different about this.

I heard the word "time constraint" as being the only criterion -- not philosophy, not independent expertise -- time constraint. Hell, that didn't stop us in the past from developing.

MR. SHERON: What I am looking at is, I think it's easier to some extent for us to modify the RELAP code to simulate a plant like AP-600 or SBWR than it is for us to take one of our codes and convert it to make it look like a CANDU plant.

MR. BURSTEIN: I am sure it is.

MR. SHERON: I look back and say we started work on AP-600 in 1990. This is 1994, and we are still not done with our code. Four years have gone by. Somebody says, if

I have to t··rn around and start on a CANDU code this summer and have it ready so that the agency can do audit calculations within four years I am saying that realistically that's going to be pretty tough to meet, considering that I have no contractors that even have any experience with these kind of reactors.

I have to go out and find where the expertise is. I have to figure out how to do it. We are going to be on the learning curve. There's a lot of questions that go along with how we are going to analyze this design. It's got the positive moderator coefficient.

If you get a LOCA without scram, this thing turns into a pretty nasty accident. The question is, do we have to analyze it. Is that going to be something that has to be analyzed. Severe accidents --

MR. BURSTEIN: The question is, are we going to u·e the same criteria for our treatment of a CANDU as we ·ave used for domestic designs of various kinds.

MR. SHERON: I don't know, quite honestly. All I am trying to point out right now is that the next challenging work that would come along, if we are talking about keeping the contractors enmeshed with challenging work, would be CANDU3.

MR. BURSTEIN: As an aside, can you tell us how realistic this CANDU application appears to be?

MR. SHERON: I understand it's --

MR. BURSTEIN: Is it for real, or is it somebody's idea of what --

MR. BECKJORD: CANDU first requested a review of their design as a preliminary matter. They wanted to establish whether or not or to what extent the reactor, the CANDU3, did not meet U.S. requirements. It's their expectation that it will meet U.S. requirements. Because of the press of work, something which is done on a preliminary basis, was not getting high priority in NRR. The schedule on that slipped.

When CANDU became aware of that, they decided that if they were going to get the review done that they would have to submit an application for certification, which is what they have decided to do. They want to go ahead with certification. It's on a somewhat later schedule than their original request for the preliminary review, but as far as we know it will go ahead.

MR. SHERON: It's unclear right now also -- there's a lot of questions here. If our originally budgeted funding, even if it's restored, was sufficient, basically due to unfamiliarity of everybody with this design, NRR has not really put together what their user needs are yet for the CANDU. I don't even think they have even had a chance to focus on it.

We have gone to White Shell up outside of Winnipeg, and we have looked at their integral loop, RD-14. I think our preliminary conclusion was that it's a pretty good loop, sufficient size. They probably need to do a little bit more on scaling justification. In general, we would not recommend going out and building an independent loop, ala ROSA.

MR. BURSTEIN: Horrors. How will you use vendor's facilities.

MR. SHERON: I am sorry, I thought I made a touchdown. You put your arms up.

MR. BURSTEIN: I thought you did too. Did you get a whole bunch of letters?

MR. SHERON: We have talked about this in the past.

MR. BURSTEIN: Why was ROSA? We said we had a conflict of interest.

MR. SHERON: No.

MR. BURSTEIN: I beg your pardon. I was misinformed.

MR. SHERON: We just wanted an independent capability.

MR. TODREAS: We didn't have another alterative. SPES wasn't the same.

MR. SHERON: I guarantee, if I said I was going to

go contract with SPES to use SPES to simulate AP-600, that thing probably wouldn't have been built because of the scaling concerns everybody would have had. I could not have justified that scaling. That's why I didn't go to SPES. That's why I didn't say I will use the Westinghouse loop, it's good enough.

MR. BECKJORD: SPES is a --

MR. SHERON: It's tall and skinny --

MR. BECKJORD: Whereas, the ROSA -- the one that Westinghouse is using at SPES.

MR. TODREAS: Are you going to contract with OSU to use their loop for any of your tests?

MR. SHERON: We have started negotiations with them to find out how we can do that. There are some questions about, for example, who owns the OSU loop. Is it Westinghouse, is it OSU. If that's the case, is Westinghouse going to let us go in and use their facility and so forth. Lou, where does that stand?

MR. TODREAS: Without going into the details, that is a case that would make Sol -- convince h ... chat the Canadian experience you just indicated is not unique; that you are thinking --

MR. BURSTEIN: Marvelous, and I think you did make the touchdown. I am just amazed that you learned in such a short period of time.

MR. BECKJORD: There is also the containment experiment at Westinghouse.

MR. SHERON: We may, for example, contract with Westinghouse to run a couple of other containment experiments beyond what's needed to support certification with their one-eight scale facility, rather than go build our own.

As I said, the Canadian loop is a fairly large scale loop. It has five parallel channels in it. As far as I am concerned, I think it looks pretty good. If I was going to build it -- if somebody told me to go out and build a CANDU loop it probably wouldn't look very much different from what the Canadians have. I would rather go up there and contract separately with them to run any additional tests that we think are necessary.

MR. VOGEL: That sounds like there's been a change in attitude.

MR. SHERON: No, it's not.

MR. VOGEL: I think you ought to go ahead, while you are still ahead.

MR. BECKJORD: Brian, mention the thermal hydraulic and kinetic code from CANDU that they --

MR. SHERON: Their code.

MR. BECKJORD: Yes, their code.

MR. SHERON: I said, that's one option. We

already have their code. We have already done some calculations.

MR. BECKJORD: I couldn't remember whether you mentioned that.

MR. BURSTEIN: Professor Todreas made a comment about the nature of the CANDU analysis capability and the passive light water reactors that I think needs -- I would like to hear more about that, either from him or you, Brian. It seems to me that that difference is not particularly understood by some of us, and I think it may be very important.

MR. TODREAS: My point was that currently, the vendor and the NRC are developing capabilities to understand the passive reactors. If you are the NRC you cannot go to the vendor and get a package of their code and the verification package, bring it back to your office, look at it and say, everything is really pinned down and I don't have to go out and do anything.

In the Canadian case, it's not a new reactor. Therefore, I know there's a lot of questions about the Canadian design. In a practical sense this is not a new reactor, and you ought to go through that exercise because that may positively limit the amount of independent work that you think you have to do.

MR. BURSTEIN: I think that's an important point

of which I did not really appreciate. You are absolutely right. One is, the development of AP-600 and SBWR are new. The vendors don't have all the marbles yet. We have 20-odd commercial CANDU plants around the world that have been designed and are operating and have a lot of maturity that that design possesses. That's a substantial difference.

MR. SHERON: The only difference right now is that we do not have the expertise in these reactors. I would repeat what Tom Murley said when we were doing the calculations with RELAP of ROSA and AP-600, to do comparisons to see how well ROSA was going to simulate the AP-600 performance. He said we learned more -- he said, my staff and the contractors learned more about the behavior and the operation of this reactor through that study than we ever would have got just reading what the applicant put in front of us.

I do have to look at it from the standpoint that if we were to develop an independent code, we are going to gain a lot more fundamental understanding than if we just saw down and read a whole pile of stuff that the Canadians put in front of us. I am not using that as a justification, and say I am going to go off and develop a code. This decision hasn't been made yet.

MR. BURSTEIN: Is there anybody still around who remembers CNPA.

MR. TODREAS: Do you want to help the rest of us?

[Laughter.]

MR. BECKJORD: Pressure tube reactor --

MR. TODREAS: Westinghouse.

MR. SHERON: I would just say in conclusion on this CANDU thing that, I think the biggest question is going to come up in the severe accident area. They don't have any severe accident codes at all. They can't come up with any way at least in their minds, that they can melt this thing down. If we have to get into that business of looking at source terms, which we will, we have to figure out how to get there and the fact that they don't have any severe accident codes, and they don't have any severe accident data.

MR. ELTAWILA: There is no database. There is a version of the MAPP code that the Canadian uses.

MR. KINTNER: Who pays for the CANDU work?

MR. SHERON: The research work?

MR. KINTNER: No, anything you do for CANDU, codes or whatever.

MR. SHERON: The actual certification review that is done by NRR will be paid for by the CANDU applicant.

MR. KINTNER: Any work you do on --

MR. SHERON: Any research work that is done on our codes, on experiments, is basically paid for by licensee

fees that pay the NRC through fee recovery, the 100 percent fee recovery.

MR. KINTNER: U.S.

MR. BECKJORD: Brian, the amount of work that we have done on CANDU to date is not large. We have spent a couple hundred thousand dollars on CANDU to date. The question is really before the Commission at this point. The Commission is going to decide on the extent of research that would be required. I think it's also likely that they will take up the question of how that will be paid for.

In terms of large expenditures, the issue has not been decided.

MR. TODREAS: I just want to make one other comment, because Brian left it on the table. It is true, that if you really want to learn intensely you put what somebody has generated on the side after you read it, and go through everything and regurgitate it yourself and regenerate it yourself. You know, in the case of the CANDU reactor, with the language barrier down, with the country so close, with a whole group of experts who have worked on that plant for a long time, it seems to me that the NRC, but particularly your contractors, there ought to be some really creative hiring and counsel reaching out to get individuals to push your learning curve up real fast by in fact getting the guys who have done the development and written the

codes, done the activities in the first instance, to work with our lab teams or whatever.

We really don't have to claw this up from the beginning in a very expensive, long term track.

MR. SHERON: We are not proposing anything yet. Right now, we are just looking at options.

MR. TODREAS: You have mouthed some of the words like hey, we learn a lot by starting over again and reinventing all the knowledge base.

MR. KINTNER: What is the policy that now exists? With no particular forward looking of building of U.S. plants in the United States -- you are doing the AP-600 but nobody really thinks anybody is going to build one for a while, and it's even less likely that somebody is going to build a CANDU, at least in this country -- what interest does the Commission have as a whole in working on this at all? Are we really going to pay for it with a profit and so forth?

Here, the U.S. utilities are paying you guys hundred or $150.00 an hour for every time you pick up a piece of paper. Why are we doing CANDU at all?

MR. BECKJORD: The answer to that is very simple. The Free Trade Act that was signed with the Canadians a couple of years ago includes the stipulation -- specific stipulation -- on nuclear power plants.

MR. KINTNER: We will license or certify --

MR. BECKJORD: No. The agreement doesn't say anything about whether the U.S. will or will not license. What it says is that the Canadians wanted nuclear power plants to be specifically included in the scope of the Free Trade Agreement; that Canadian designed reactors, it should be possible for them to be exported.

MR. KINTNER: That's one thing. But for the NRC to become involved in a significant way the only question is, if you want to do it and they are going to pay you for it fully, that's one thing. Is that the way the thing is arranged?

MR. BECKJORD: That's the way, as Brian said, the NRR's review on the CANDU3 now, the costs that are accumulated for that purpose are paid by the --

MR. KINTNER: The costs for doing any code work whatsoever for CANDU will be repaid by Canadians.

MR. BECKJORD: Code work that is done, code evaluations that are done in connection with NRR's review of their application, will be paid by the AECL. The research at this point, which as I say is, the total expenditures on it, are rather small. That research is paid for the same way as the rest of our work.

I think the question is going to be coming before the Commission and they will decide is, how much research

they would like to see done, the extent of it, perhaps where it will be done, and how it would be paid for.

MR. SHERON: The other thing that I was going to say here is that right now our plan was to start at LANL. Idaho, we do not think have the resources to start a major code development effort right now on CANDU3 or even to get into a major CANDU review effort because of priorities on AP-600 and SBWR. The only place we thought we could conceivably start work is at LANL. Also, we think that TRAC-P appears to be more applicable to handle expected CANDU transients, if we were to go and develop an independent capability.

I think what's missing in here -- I don't know where it went -- quite honestly, I don't have any staff right now in the branch to manage any additional work on the CANDU reactor. We are up to our ears in the AP-600 work now and the SBWR. I really don't have any staff to manage any new contracts on AP-600 probably until I start shedding some of the AP-600 and SBWR work as it finishes up. There's a problem there, as well.

If I do go with CANDU work at LANL, regardless, if I finish up AP-600 and SBWR in 1997, again, I am going to be faced with the question of first off putting challenging work in front of Idaho, to keep the codes and expertise there. I am also going to have my funding fairly well

split, because I think the CANDU work is going to probably pick up and require more funding than what we are currently doing. This money would have to come out of Idaho funding.

MR. KINTNER: Let me ask another question. AP-600, they reduce thermal requirements by 40 percent. I know that there are questions about small flows and small heads in the systems and so forth. But the basic question of can you take heat out of the fuel elements, I guess that's the basic question -- I hope it's the basic question -- it ought to be much easier, since the amount of heat generated in the fuel elements is so much lower.

It's going to take you three years to get the AP-600 codes in order. That's what it said in the previous viewgraph. We can produce a validated code for CANDU in three or four years. I thought there was a similar statement about AP-600, three years.

MR. SHERON: I said that it took us -- so far, we have been working four years, and we still do not have what people would consider to be a validated code.

MR. BECKJORD: But relative to Ed's question, I think he was asking about normal operation at power. The questions that you are focusing on have to do with the operation of the emergency safety systems.

MR. SHERON: What we are focusing on is any event that actuates and requires the operation of the new passive

safety systems, and to understand their performance.

MR. BECKJORD: The questions don't really relate to normal operation at power.

MR. KINTNER: I just don't understand how you make codes. I guess that's the answer, in fact, it will take three years in a pressurized water reactor in which the characteristics are reduced from the real issues of safety. I recognize this question about the flows coming in from core makeup tanks and so forth. Three years, I mean, three years to think about that and put it into mathematics.

MR. SHERON: Also, to get the data from experimental facilities that are being built.

MR. KINTNER: Then, you have to match it up.

MR. BECKJORD: If you take the case of the AP-600 tests at ROSA, when is the starting point for your three years?

MR. SHERON: For AP-600?

MR. BECKJORD: Yes. Let's say take the case of -- you are well into that now.

MR. SHERON: We gave a contract to Idaho to start to systematically examine RELAP, to see what models needed to be improved to simulate AP-600, or to find out if AP-600 was going to have any new or exciting phenomena that RELAP just couldn't handle.

MR. BECKJORD: The question is, when was that?

MR. SHERON: That was in 1990, beginning of 1990.

MR. BECKJORD: The experimental results should be coming forth this year. Then, when they are in hand you will evaluate them.

MR. SHERON: Right.

MR. BECKJORD: That's the cycle.

MR. KINTNER: You get $10 million a year, is that right? What is the code costs alone, the budget for code work alone this year.

MR. SHERON: For code work alone, on AP-600?

MR. KINTNER: Total code work, alone.

MR. SHERON: Total code work, excluding experimentation.

MR. KINTNER: Yes.

MR. SHERON: It's probably about $8 or $9 million.

MR. KINTNER: That must represent 50 people, 50 professionals, working fulltime?

MR. SHERON: Yes, probably.

MR. KINTNER: I don't understand, I guess.

MR. SHERON: This is not all on one reactor, though.

MR. KINTNER: I understand that. You have several codes.

MR. SHERON: Several codes, maintaining them for their --

MR. KINTNER: As far as any creative, intellectual work, anything going beyond what you have done for years in licensed plants and present operating plants. You have two reactors, plus whatever you are going to do with CANDU. I am trying to get some kind of a benchmark on that.

MR. SHERON: Lou, do you want to say something.

MR. SHOTKIN: This year, most of that money is going to analyze the data that is coming in from ROSA and from the Westinghouse and GE facilities. There is a commitment we have with NRR, that we are supposed to evaluate the data that is coming out of the vendor test programs. I would say that most of that money is going to analyzing, performing calculations for most of the tests that are coming out from the vendor and our test facilities. Brian is including that as code work, but it's really application of the code to the test data.

MR. MORRISON: I think you are questioning, do you need 50 people to do so.

MR. KINTNER: I just don't understand. I know a little about those systems and I know a little about those questions that are being asked. What I don't know about is codes, and why the code is so difficult to interpret the physical facts. You have experiments, a number of experiments. You look at the data, you look directly, eyeball to eyeball, and they tell you whether the flows are

calculated.

There's no real question about natural circulation. We have used natural circulation in these ways for many, many years. The specific issues, what was called yesterday the key issues, don't seem to be sufficient to require that kind of effort to understand and interpret.

What you have to recognize is, not only are you guys trying to interpret the contractors are interpreting it as well. Apparently, what you would think you were doing was reconfirming whether the contractors were thinking about it correctly. Put the whole thing together, and I have a very hard time appreciating that much effort is required. Either it is going to work or it isn't going to work. It's just that simple.

In terms of once more the fundamentals, that is to say the questions of, can you get water into the reactor vessel, can you remove heat by natural circulation, these are straightforward, black and white questions. If they aren't black and white from the tests, somebody is going to have to do something about the design of the system which makes them black and white. It isn't going to be some minor variation plus or minus 10 percent in the code predictions, it's going to be the difference whether these things are certified or not or whether anybody is going to buy one.

They are either going to work, they are going to

put water in there to cover the vessel, the circulation is going to be sufficient to remove the heat, period, or you don't build the damn things. It's in that kind of a context that I have a hard time seeing this much effort required, going beyond what is already existing for pressurized water reactors developed by $5 million over the years.

MR. BECKJORD: Has Brian or Lou explained the work that was done on the AP-600 ADS, automatic depressurization system?

MR. KINTNER: I have heard about it from previous ones, and also from Westinghouse.

MR. BECKJORD: There is certainly one question there, and it appears that this came up a couple of years ago. The work that your people did showed that the valve sizing was inadequate for the low pressure, the lowest pressure valve.

MR. KINTNER: That's been responded to.

MR. BECKJORD: That's right. It was this kind of work that brought that up.

MR. KINTNER: The reason I am making this point so strongly is, you are headed into a period in which you are going to be crying for money for other kinds of important research. The priorities are going to have to be recognized. The question is, is this priority being properly measured. I don't know the answer. From what I do

hear, it does seem to me that it's a reasonable question to ask.

Why pay so many people to maintain codes?

MR. BECKJORD: Neil has looked at this question.

MR. TODREAS: I will speak up but I won't shoot Ed down in a sense. What I think is going on is, there's a need now to move in and create a number of models that hadn't been effectively done relative to the coding before. There's condensation, maybe level as well, things to do with non-condensibles and things like that. There was recognition of all of this stuff. Idaho dealt with them, but nobody drove a steak through and created good and robust models to put into the codes. That was one thing.

The second thing is, there's a need to go back and play catch up and really document the code well. I say, these two things are maybe real focuses for this year that are requiring what I would say is a bit of extra effort.

Coming back to the central point. Without a lot of detailed checking on it, I still hav the feeling that in the main contractor's shop the leadership isn't there to create a small, effective, hard hitting team, to do the job in an efficient way that conserves resources that you are talking about. I still would suspect the job is being conceived and being done in a bit more grandiose way with a bit more resources than probably is necessary, if you really

got at it and had the right technical leadership from the top in the contractor's place.

MR. KINTNER: This comes back to our discussion yesterday.

MR. TODREAS: That's my gut feeling.

MR. KINTNER: The organization and management of the code.

MR. TODREAS: I would say that Brian, Lou and Tom King, we haven't really asked them this. They haven't had a chance to really present anything along this point, these kind of intuitive feelings, that they could shoot down with the evidence or corroborate. I [illegible]'s an open question. I think your skepticism is healthy.

MR. COSTANZI: Neil, I think you have raised a very important point, and maybe the staff ought to try to address it. It seems to me that it's a problem that almost any industry that is dealing a lot with codes -- and the Defense Department has it in spades -- is, how much of this is reusable. Have you reused things from past codes, or every time you think you have to develop a new code it's a clean sheet of paper and you have forgotten everything that you had before, and don't try to incorporate the things that were good and worked well.

I think that gets at the efficiency question that you are raising, Neil. Ed, maybe there are some new models

as you suggested. You have to look at some new phenomena that hadn't been examined before. Has there been a real attempt to reuse what is already available and has been proved to be satisfactory.

MR. TODREAS: I am also talking about finding better people to work on the job, and charging up those good people who are in the organization to even greater heights by a more energetic driven contractor group. I think you can really make time that way and perhaps some money, over the next two or three years.

MR. BURSTEIN: Professor Hatcher said, are we getting into a discussion about "sacred cows" and I think we are darn near close to it, if we are not there. It's something to be kept in mind. I think it's a very good observation.

MR. SHERON: If I could, let me quickly go through the task group. I told you yesterday what the punch lines were of the task group, and let me carry it a little bit further. As I said yesterday, a common recommendation was to make utilization of university expertise. I had a talk with Jim Lake, the manager of nuclear engineering at Idaho, about this whole problem that Neil pointed out, this business of expertise and program development and so forth.

He pointed out, he said, they sort of complained. He said gee, most of our thermal hydraulic work is what he

called the fire drill type of nature. I say fire drill. In other words, it's all geared toward specific problems, like AP-600. Gee, put in a condensation model because we have to have it for AP-600. Gee, put in a level tracking model because we really need it in order to answer the ACRS problems on AP-600 or SBWR.

He said, we really would like to have a longer term, what they call base R&D effort on the code, where we have this small solid team of experts that is working constantly to improve these models but not trying to meet some fire drill deadline or anything. Actually, going along systematically looking at the code and making the improvements that are needed in there, so all this stuff isn't done on a hurry up, eleventh hour basis.

We tend to agree with them, that if we are going to maintain this expertise in thermal hydraulics in the long term, a couple of things are needed. One is that the contractor needs some assurance from the agency that the agency is going to support them on a long term basis. In other words, it's not going to be haphazard funding, it's up one year and down the next because there's no work or anything.

If they are going to go out and hire these experts and everything, they need some assurance from our part that we are going to continue to fund them so that they can pay

their salaries, so that they don't have to be looking for jobs for these people in the next year or two.

I have asked INEL to develop a plan for this base R&D effort. What would they propose to do, what kind of people would they put on it, and so forth, what kind of funding level. The other thing is that they don't want to go out and hire ten or 15 new experts because regardless of what assurances we can give them, budget cuts are real, Congress doesn't sit here and say we should fund thermal hydraulics. If a budget cut comes, we have to deal with it.

One of the ways INEL wants to increase their expertise is to utilize university expertise much more, through the use of subcontracts. We would provide them with some additional funding, specifically for subcontracting. The thought right now is that a contract with a university would probably be to a specific professor or to a group. They would be basically assigned to do research on a specific issue related to the code. I use as an example, interfacial heat transfer. It could be something like condensation, it could be something like level swell or whatever the specific issue is that we feel that we need to do more work on.

Under this contract that they have with the laboratory the university -- this would include a literature search and review to find out what's been done previously in

this area so we are not reinventing any wheels, possible model development, looking at existing models, improving them or developing new models. Maybe they need to run some small scale separate effect experiments, bent scale things, to get some basic data to help them in validating their models.

They would prepare some of the documentation for the model, at least from the standpoint of this derivation and so forth. They would work very closely with the INEL, this base R&D team. It would be a very close collaboration. Obviously, when you develop a model it has to be compatible with the architecture of the code in which it's going to be put into.

Again, the R&D team would have to work with these people to make sure that the model they were developing, that the model was mathematically compatible with the architecture of the code and so forth. The INEL R&D team would be responsible for incorporating these models into the code and making sure they run in the integral sense of the overall analysis.

However, we would rely principally on this university professor to be the expert on the subject. Obviously, we are not saying that the laboratory would renounce all responsibility. They would certainly be knowledgeable in this area and so forth. But, if it came

time to defend the model we would probably want to call in that professor to get up and say here is what I did, here is how I derived the model, and here is why I think it's okay.

MR. MOLZ: By the university professor being the expert, do you mean in a sense of explaining how the model works or if there was some kind of emergency that came out, sort of taking responsibility for doing the running and analysis.

MR. SHERON: No, towards the explaining. In other words, one of the things -- we go before the ACRS Subcommittee. Quite honestly, they are holding us to a level of proof that is pretty heavy. They don't like engineering judgment. If we go up there and say we put this model in because our engineering judgment says that it's good enough, that doesn't satisfy them. They want to see the whole nine yards.

I would expect that for a certain model that was being put up to say this is what we put in the code and here is why it's good enough, that professor would be the one that would say here's the work that I did, here's the literature search I did, here's the experiments I did to validate my model, et cetera.

MR. MOLZ: That would be workable.

MR. SHERON: And, document all of that in a report so that even if that professor somehow left the program or

whatever, that all of that basis would still be documented somewhere in a retrievable form, so that the next person coming along at least could go back and read that and understand what was done.

MR. MOLZ: You could probably do a fair amount at universities along those lines at relatively low cost. The students would find it interesting.

MR. SHERON: Of course, there would be a deadline because students want to finish it out.

MR. MOLZ: That's right.

MR. SHERON: So, at least we would get stuff on a pretty good schedule.

MR. VOGEL: I would think that your code maintenance problem would be directly related to the quality of the documentation; is that true? And if it is true, are you working on upgrading the quality of documentation?

MR. SHERON: We are upgrading the documentation. We have agreed to produce a complete documentation of the RELAS by September, and it will reflect all of the models in the code as of June. Part of the problem is that the code right now is in this transitory period. The people that are working on the development are trying to actually develop these models that have to go in for AP-600. Documentation is the last thing in their mind.

One of the unfortunate things is that with at

least the ACRS Subcommittee, they want to see everything that is going into the code yesterday. It's just not written down and documented yet because of the transient nature of this whole beast.

One of the big problems we have had is that the information they have is not what is physically in the code today. The question is, do I stop everything and tell the people that are supposed to be developing these new models to calculate AP-600 to stop, and go back and document and thereby delay that part of the program. It's sort of a dilemma that we are in.

MR. VOGEL: The model developers must be a natural law or something, because it seems to lack talent in documentation.

MR. SHERON: I will admit, it's the last thing that code developers want to do. It's not a fun part of the job.

MR. MORRISON: Sol, you had a point?

MR. BURSTEIN: At the risk of talking with many of my colleagues who are from the university background I think this is a great idea, but I wonder if you are using the wrong reasons and trying to do things because somebody said let's use university people. According to the report that was submitted to the director by the group, the cost benefit improvement -- you pay university professors and students

much less money than you do consultants evidently -- the schedule you referred to, people want to get their thesis done, accepted and out, are two very strong reasons for going to the university.

But you also talk about a longer term base R&D effort. It's no longer a maintenance of codes, but now you are talking about an R&D effort. I don't know if there's been a demonstration that you need it, or that's the vehicle for attracting university interest.

You also commented on the fact that one of the problems with contractors is, they don't have long term assurance. Is there a different yardstick that says you are compelled to fund a university on a longer term basis?

MR. SHERON: I am not proposing to fund a university on the long term basis.

MR. BURSTEIN: You used the term "long term assurance" to --

MR. SHERON: To the laboratory. I said the laboratories are hesitant to go out and --

MR. BURSTEIN: Have you compelled them to have a long term relationship with the university under your guise?

MR. SHERON: No.

MR. BURSTEIN: Because that is no different than their requirements for a contractor.

MR. SHERON: I can see a relationship with a

university where a professor finishes up, does all the work that is needed for a certain model and documents everything, either they are done or perhaps if the professor does good work they give him a new task.

MR. BURSTEIN: The other thing is, you are asking the universities to make up for the deficiency and lack of documentation.

MR. SHERON: No.

MR. BURSTEIN: I thought that's what I heard, that the guys were too busy that developed the codes to document it, and we need somebody to do that.

MR. SHERON: No. What I am saying, as Neil said, there may be a lack of talent -- if you want to use that term. Let's say that we need some additional talent at the national laboratories in this area. The laboratories are very hesitant to go run out -- this is a declining industry. There aren't that many experts around that want to go and work in Idaho Falls, Idaho.

How can Idaho get these experts. They do it -- where are the experts anyway. The people that really know their stuff are in the universities. Therefore, --

MR. BURSTEIN: What prevents Idaho from going to the universities now or last year, or two years ago.

MR. SHERON: Nothing. It's policy, perhaps.

MR. BURSTEIN: Probably some direction from NRC.

MR. SHERON: No.

MR. BURSTEIN: Let me ask another question. The recommendations from the task group which you are a member, suggested that maybe some of these aging university people with all these histories and knowledge might come aboard as consultants to NRC for a few years, and help mentor. Has any of that been implemented further?

MR. SHERON: No. The genesis of the recommendation was -- if you remember, the recommendation said first, that it was recommended that several more of these experts be brought on board in the Office of Research, like a Joe Kelly, to help bring up the expertise in the staff. One of the questions we discovered was that even with Joe Kelly, Joe was wavering, because of the nature of the work. A lot of people don't want to come here and say gee, I am going to be a project manager. I want to do technical work.

We had to convince Joe that he was going to do technical work and he wasn't going to turn into a bureaucratic paper pusher. A lot of people just don't want to come to Washington, high cost of living, high cost of housing, and prospect of --

MR. BURSTEIN: I am sure that going to the universities doesn't mean they have to come here.

MR. SHERON: The question is, how can we attract

people to come to the government to work. The thought was gee, maybe there are professors out there that retired when they were 60 or whatever, but they still want to go back and work. We have one, Bob Brill and John Gallagher, from Westinghouse. He retired from Westinghouse, he still wanted to work, and when he came to work at NRC he's in the NRR group now. I think he said right off, I plan to come here and work for maybe about five years and then retire.

The recommendation was, maybe that's where we can find this kind of expertise, people that have the wherewithal and means to move to Washington and willing to come and work for the government, and to help mentor these programs for a short period before these people just want to retire completely.

MR. BURSTEIN: I think that's a great idea, but I hope that it will be looked at in a broad context.

MR. MORRISON: Neil, you had a question?

MR. TODREAS: My comment was that I think the idea of creating a team in which you spice the team on certain model building activities and all with people outside is good. The thing I think you really ought to keep you eye on is, it requires very good managers at Idaho running this to coral, direct and make effective university participation. You have to keep the university participation on the ranch directed toward a model that will fit in at all the edges

in this code.

You have to have people at Idaho who are intellectually confident enough to do battle with maybe prima donna's who you go out to hire to do specific types of jobs. That's really the challenge I think this program gives you.

MR. SHERON: The other challenge, just to carry that on, we need good project managers in NRC. I will be quite honest, the laboratories in many respects have their own agenda.

MR. TODREAS: I stopped beating that one. Now, I am moving on to the lab. That's what you have to watch and help them to do.

MR. SHERON: Right.

MR. MORRISON: I would say in both cases what is missing in this plan before it seems to be to be adopted by research or NRC, the division or the branch, whoever is responsible for this, should write an evaluation plan that they have in here. What are you going to do annually to assess whether this work is of the quality that you have expected, and is it yielding the value that you wanted to get out of it. I don't think it should wait five years for that to happen. It ought to be up front so that everybody knows what the expectations are of the plan.

Fred, do you have a comment or question?

MR. MOLZ: Yes. A couple of things that Sol said, I want to get straight in my mind. We are talking about code maintenance, the code and maintenance problem now, right? That, automatically, is a long term problem. It goes on forever, right? We do have to have long term relationships. There is no way out of that, unless you decide you don't have to maintain the codes. You have to keep turning over these projects.

MR. BURSTEIN: In the past we have had a history of switching contractors in that area. One of the concerns is that if you substitute university for contractors or national lab, there is no different mechanism that says you are tied to a university for a longer term than you might be to a contractor or to a lab.

My concern was, if we are expecting that, we have to have some other mechanism that has been in place in the past. I think it's important that we retain those relationships, unless there is good and sufficient reason to change them.

MR. MOLZ: You mean, the national lab relationship.

MR. BURSTEIN: Or, whatever, whoever is in charge of maintenance. I have no problem with having a university specialist in some area do that or a lab, or a contractor. In order to be effective as you point out, it has to be on a

continuing basis. There is nothing in the appropriations routine, I believe, that says once we make a contract with anybody that we are compelled to continue with in the following years.

The university, whether it's on a grant or the lab that is on a contract, could very well be superceded by available funds. That's a risk that I think we have to face.

MR. MORRISON: Obviously, this subject is of high interest. We are running well over the time we had alloted. Brian, why don't you try and finish up in about 15 minutes. Then, we will take a break and move on to the next one.

MR. SHERON: I think I can do it in about five minutes.

MR. ISBIN: I don't intend to prolong the conversation. I would point out that in Neil's advanced reactor subcommittee meeting and in the report that you will be getting Eric, some of these same questions came up. I think that the full Committee is looking forward to your response. It also calls for clear mission statements for all of these research projects that you have identified and will be identifying in the future.

With that brief comment, we will look forward to your response.

MR. MORRISON: Brian, back to you.

MR. SHERON: Just quickly, on the severe accident codes. I think we have a little different situation right here. First off, just recognize that we are not dealing with just water in its two different phases, liquid or steam, which we are in the thermal hydraulic codes. In this, we have many more disciplines. As you can see, I have tried to list them here.

Not only thermal hydraulics but understanding core melt, slump behavior, fission product transport, source terms, structural failure of the vessel, special ones like direct containment heating or the liner melt through, core-concrete interactions. This is corium interacting with concrete. Debris coolability, molten material with no relying pool of water, hydrogen behavior, challenges to the containment, containment performance, steam explosions. These are just examples of the various disciplines.

As I said, while we are resolving many of these issues --

MR. KINTNER: Is the implication that you are going to write codes on those subjects?

MR. SHERON: We have codes on all of those subjects. Some codes span several subjects, but we have analysis capability for all of those subjects. Don't cringe.

MR. TODREAS: Two of them, MELCOR and SCDAP/RELAP.

MR. SHERON: We are resolving, as you know, some of these major issues such as liner melt through, DCH and the like. However, we are not going to terminate -- I shouldn't say all of our research -- all of our capability to analyze these. I don't want to stop for example on direct containment heating and say okay, that's solved. Therefore, three years from now if somebody raises the question, I don't have any way to analyze it or any people that are expert enough to talk about it. So, we will be maintaining the expertise in these areas.

We also will continue to develop and improve the codes, and we want to maintain and participate in international research. Again, this business of international leadership, a lot of it is hinged on these international programs we have. For the thermal hydraulic codes we have the CAMP program. For the severe accident program we have the CSARP, the Cooperative Severe Accident Research Program.

This is really what I think keeps our codes in the forefront internationally. If we didn't have these, if we didn't make these codes available, I think the Europeans would just go and develop their own or use somebody else's codes and wouldn't care about ours. Right now, RELAP and our severe accident codes, I think, are the most widely used codes for safety analysis in the world.

Current funding levels for severe accident are about $16 million a year. We also get about $2 million a year coming in from foreign funds through the CSARP program.

MR. KINTNER: That $16 million includes research, actual physical research?

MR. SHERON: Yes. It's experiments and codes. We believe that the residual uncertainties in severe accident phenomena are really much greater than what we have right now in the thermal hydraulic area. We think this is sufficient to provide an adequate challenge to our researchers. We have seen no indication yet of people wanting to go off and do other things on the programs. All of the researchers at Idaho and Oak Ridge and Sandia seem to be pretty well challenged.

We are concerned that if funding levels drop significantly, one of the first things we always hear from the foreign participants is that they are not going to get the leverage that they wanted and they are going to drop out of the program. They drop out of the program and it does two things. One is, we lose the foreign funds and the foreign participation. We also are going to lose international leadership, because they are going to go and either develop their own codes and the like. Then, we are going to get into this competition business, which we really don't want to get into.

MR. MOLZ: The competition business, what is that? Elaborate on that just a little bit.

MR. SHERON: I will give you an example, that right now the French are spending gobs of money on the CATHARE code which is a rival to TRAC or RELAP. I have heard from various sources gee, the French CATHARE code is much better than the NRC code. What are you going to do about that Sheron.

It's like I don't even have the CATHARE code. They won't give it to us. They have a requirement that, in order to get the CATHARE code you have to send a person from your organization to work at CEA for a year before they will give you the code.

MR. TODREAS: Do it.

MR. MOLZ: What if we gave them a little money and let them develop it. Instead of competing, why do we always to compete. Maybe we should cooperate.

MR. SHERON: We are not competing. What I am saying is that we are going on a merry way. We are doing our own thing with our codes. There are people, when somebody says gee, the CATHARE code is better than the NRC code, that's like a challenge. It puts up a red flag.

MR. MOLZ: It's like that, yes.

MR. SHERON: I apologize, but one of those people was a Commissioner. Last time I checked, I stood up and

take notice. That's one of the things, we don't want to get into the competition. I know that over in ISPRA they have some grandiose plan. What's the name of that code, ESTER, which is going to be a rival for MELCOR. We don't think it's going to work. The point is that if these guys all drop out of MELCOR, then they are going to go off and dump gobs of money into this ESTER code. The next thing you know is, people are going to be saying gee, the ESTER code calculates something different than MELCOR. What are you going to do about that.

MR. MOLZ: The cooperation, maybe it needs to be a little more balanced. Maybe there ought to be, instead of us maintaining this dominance which requires us to spend a lot of money, maybe we should drop down in certain things and let them --

MR. SHERON: That's the whole idea of this cooperative program. For example, CSARP is basically, we want them to give us all of their data and experience on severe accidents.

MR. MOLZ: It sounds like we want to run every show though.

MR. SHERON: It's not so much that we want to run every show.

MR. MOLZ: There's somebody in our government or one of the Commissioner's that thinks that we want to

cooperate but be the leader in everything. That's what I heard.

MR. SHERON: What it is, I think it's different. What it is, we were the leader for so long and people don't want to give up that leadership.

MR. TODREAS: He has a very good point.

MR. MOLZ: Maybe the whole thing would be more stable if we kind of mixed it a little bit, especially with the nuclear industry in this country somewhat suppressed right now. Maybe that's a strategy.

MR. SHERON: What I am saying though, we in the staff, we don't look upon CATHARE as competition. I am not sitting here setting my budgets for thermal hydraulics from the standpoint of I am going to be better than CATHARE if it takes every penny the taxpayers have. That's not it.

What I am saying is, the French are dumping in -- they have 25 people working on this code. They have a different situation over there. They don't have the adversarial relationship, if you want to call it that or the arms length, with their industry. They are all one big happy family. Their development team, they are getting the benefits of CEA, FRAMATONE, EDF, all of that expertise.

It's like, if we were working with EPRI, Westinghouse and GE, all trying to develop a code. They have a different situation over there.

MR. MOLZ: They ought to develop a superior code with a lot less money.

MR. BURSTEIN: I think that you just put the suggestion that maybe you ought to look -- it might be profitable.

MR. MORRISON: I think this is a philosophical issue we aren't going to resolve at this time. We ought to reserve it for a later time.

MR. SHERON: I will finish up right now.

MR. ISBIN: All I would say is, I have attended at least one CSARP meeting and have seen the documentation for the second one, I would say that the NRC program is extremely well balanced.

MR. SHERON: Thank you.

MR. VOGEL: Better quit at this point.

[Laughter.]

MR. BECKJORD: I would just like to add one point on this. I think that in order to reach a conclusion on this question of foreign cooperation there's another aspect of the problem that has not been discussed. There are international rivalries, and then extend into the commercial area. Many of the countries that we have cooperative agreements with on research also have very active nuclear R&D programs, and it is their full intent in due course to market their wares in the United States.

That's a very important aspect of this which has to be considered in arriving at any final conclusion.

MR. SHERON: Our plan right now for severe accidents is to maintain funding in the foreseeable future, up to the $13 to $16 million range.

MR. KINTNER: Is that severe accidents only?

MR. SHERON: Severe accidents only, yes.

MR. TODREAS: Excuse me. If you are finished with severe accidents, I would like to put a proposal or proposition on the table for you to think about. We have talked about code business in thermal hydraulics, we have talked about it in severe accidents.

Basically what you are saying in severe accidents is, we are at a level today high enough where we can maintain our national lab capability, our researchers are happy, and we have stability. My proposition is, now is your chance in the severe accident area to think ahead to the future and maybe move to a model like you are moving in the thermal hydraulics area, where you have a national lab dominated directed program but you make a team approach with others, maybe universities and maybe other individual consultants, who you hire on a problem-specific, model-specific basis.

You don't have a long term commitment to them, you have flexibility in cost. You can get their expertise. You

try to think of a structure to move into in the severe accidents that mimics what you are doing in the thermal hydraulic area, and you start to think about it and do it now, while you have the chance to make a smooth transition. In two or three years you may not be as happy. Your program may not be as stable, and you have the opportunity now.

MR. SHERON: That's a good point. I think we will follow up on it and see what makes sense.

MR. TODREAS: The way you went through everything here, I don't think you are thinking about that at all. You were not talking at all about making severe accident structure look at all like the thermal hydraulic structure in terms of management.

MR. SHERON: Right now, no.

MR. ELTAWILA: We are doing some effort in severe accident code, and we are going to look at them and try to determine what is the minimum capability that NRC needs to maintain in the future. It's along the same line that you suggested but it's not going --

MR. TODREAS: I don't actually think it is. My suspicion is that each of the national lab groups that have the key programs are jealously guiding the perimeters and not letting anybody else into the model building, model assessment of their codes. Now is the chance to break that perimeter and project ahead.

MR. ELTAWILA: I don't want to prolong the discussion. We have broken that mode of operation in the labs. Model development and assessment is happening at all the labs, by foreign partners, by private organizations. The code developer, itself, does not get into major code assessment.

We have people in different organizations that can run the code and can assess the code. If needs exist to develop model, we have that capability right now.

MR. MORRISON: Ed.

MR. KINTNER: Suppose that a virus infected all of the computers in the United States that can run these codes including desk calculators, mechanical desk calculators, and all we had left was slide rules, would we shut down the industry.

MR. SHERON: That's a question Eric might answer.

MR. KINTNER: It's just a general question. I ask it seriously, because --

MR. BECKJORD: You said, would you close the industry down. It would rock back. You would have a lot of problems. For one thing, you look at the student today, a Ph.D. student, most of them don't know what a slide rule is and never saw one.

MR. BURSTEIN: The answer is probably yes, but nuclear power wouldn't be the only thing affected. You

wouldn't be able to get from here to there or tell anybody about it anyway.

MR. KINTNER: It's the only one I was worried about, in this particular context.

MR. MORRISON: I realize that when I made my comment earlier that we were going to take a break now, that we probably should finish the codes and have Andy Murphy wrap up the code discussion on the structural aspects. Andy, do you want to hold forth for a few minutes.

MR. MURPHY: We were going to rearrange the schedule a little bit on that. As it turns out, Brian talked to you about the codes that his group maintains. Mine will be on code maintenance. Our code work involves interaction and validation more of commercially available codes. We don't maintain a RELAP or particular structural code. Most of those codes are commercial codes. Larry had some comments versus the other kinds of codes.

MR. SHAO: The major objective of our Research office is to support the user's office. Not only in the structural area but also in the mechanical, electrical and material area, the regulatory staff does not review computer codes. They don't review computer codes. It was a conscious decision about 20 years ago.

It just too many computer codes. There's no way you can validate all the electrical, mechanical, structural

and material computer codes. We only validate when something we find out there is a problem or some critical issues. What does staff do. The staff review the design criteria, the construction techniques, the industry standards, maintenance, surveillance, testing and inspection. They skip the computer code part because that part takes a lot of human resources, and takes a lot of time and money to do it. NRC do business in engineering area.

In the standard area I would like to give you a viewgraph here.

One of our major functions in the Division of Engineering is to participate and to coordinate for the agency, the National Code Standard Activities. Not only does the division engineering staff actively participate in certain committees, important code committees, but many other NRC staff members also participate in various committee.

There's a list here, American Society of Mechanical Engineers, especially in the Section III for design and construction of nuclear power plants, Section XI on in-service inspection. Also, we participate and coordinate in IEEE, Institute of Electrical and Electronic Engineers, ACI, American Concrete Institute, ASCE, American Society of Civil Engineers, and American Society of Testing Materials.

We use this so-called consensus standards as much as possible, through our regulation like 50.55(a), standard review plans and reg guides. Using these standards, saving a lot of NRC manpower in them. We agree with these standards. That's a short description of how we do business.

MR. MORRISON: Larry, I guess as a question of historical perspective, this approach is obviously accepted from the regulatory process as one that is valid and credible. Do you know what drove that particular decision.

MR. SHAO: Purely manpower.

MR. MORRISON: Purely manpower.

MR. SHAO: As a matter of fact, 20 years ago I thought the thermal hydraulic side reviewing all these computer codes, I talked to my boss and said should I sta looking at these codes also. We did estimate. In order to review all these computer codes you need another few hundred NRC staff and a lot of money, a lot of research. It's just too big a task.

We see some of the stress reports. For one component the report is that long. They are using all kinds of different codes, ANSI, all kinds of computer codes. We can do this but it would take an army to do this.

MR. MORRISON: I guess what I am leading up to is, there must be something fundamentally different between our

willingness to accept these standards as codes and a Westinghouse code for an AP-600 related to thermal hydraulics.

MR. UHRIG: These are not vendor codes. These are professional society codes that have been developed with --

MR. SHAO: Mr. Morrison is talking about computer codes.

MR. MORRISON: The computer codes that are behind these particular standards.

MR. SHAO: There is no difference between thermal hydraulic codes and structural codes. We use ANSI --

MR. UHRIG: You don't take Westinghouse codes.

MR. SHAO: They develop their own computer code.

MR. UHRIG: Do you use Westinghouse codes?

MR. SHAO: Sometimes. In this area most of the codes -- Westinghouse uses so-called industry available computer codes, like ANSI. They use them for structure analysis.

MR. BURSTEIN: Larry, I think the Chairman's question might be perhaps put in an example of the EPRI seismic versus the NRC's contractor seismic conclusions. There was no contractor proprietary information involved that --

MR. SHAO: For instance, EPRI signed the curve and Livermore signed the curve, they are not really computer

codes. They are so-called design criteria, different. We look at the design criteria in detail. Every major design criteria, we do review. When you say does the piping run for this, what are the thermal stresses in that piping code, or what is nozzle -- we do check in details.

I takes about $5 million to build a nuclear power plant. A lot of engineering codes do bring the --

MR. BURSTEIN: We have histories, Mr. Chairman as you will recall, of RTD codes and standards. I can remember in some of the earlier lives of people at this table, that trying to develop our own codes and standards -- I recall somebody wanting to write a standard for a nuclear plant turbine generator as an example.

We have had a long history with military standards that were thought at one point applicable to our civilian nuclear programs and to some of our other activities. The use of industry standards has served everybody well. It is a very pertinent question, as to why we don't do more of it.

MR. VAGINS Actually, there's nothing very unique about piping, concrete structures. There's nothing nuclear unique about it as there is in thermal hydraulics. Thermal hydraulics gives us the loads. Once we have the loads and the load configurations, what's the difference whether it's a fossil plant, petrochemical plant, railroad, bridge. It doesn't make any difference. I did this all my life.

Therefore, the codes have been in development for the last 40 years, starting with the railroad industries and started with the aircraft industry on redundant frames, structures and piping, et cetera. We have just authenticated industry codes that exist. This is the most efficient and effective way to do it. As Sol said, why would we reinvent the wheel.

There are certain cases where uniqueness comes in. For instance, in the work I am doing on I&C. We are not developing any codes but we are appraising everything out there, all the standards out there in their application to nuclear environments. If we find indeed that there are problems, particularly a nuclear environment that creates a problem that existing standards and codes -- particularly IEEE standards -- don't fit, we will have to do something about it.

First, we have always gone to the industry. The only time we have not gone to the industry is when we have a unique and individual case, such as thermal hydraulics and MELCOR. Where do we get melted corium except in a nuclear reactor.

MR. BURSTEIN: We haven't had any there yet. One case where -- I will let the other gentleman tell you about it sometime.

MR. UHRIG: One observation. About 20 years ago

Herb Goldstein at Columbia sent a benchmark problem out for an ANS meeting on shielding, standardized power level. I think there were about 20 participants in this. The range of answers were between -- with one exception -- the range of one thousand to one. The exception was ten to the sixth.

This was companies like Westinghouse, GE, Babcock and Wilcox, the various laboratories. There was a one thousand to one difference in the two extremes. They ran the whole gamut. I hope that kind of problem doesn't exist anymore.

MR. BOULETTE: That isn't necessarily a problem. It depends on the significance of the issue. When issues are not too significant we don't care how accurate they are.

MR. UHRIG: With 25 years of shielding I can give you all kinds of problems now that we can give to GE, Westinghouse, Los Alamos, that have a big spread of difference on the answers. That's because the ultimate answer is down in the mud.

MR. BOULETTE: It doesn't make any difference.

MR. UHRIG: You don't devote your energies in that area.

MR. SHAO: The only time that NRC was involved in the so-called computer code in the engineering area -- if you remember -- in 1979 there was five plants shutdown because of computer code error. It was a seismic computer

code instead of combination problem in that computer code.

MR. BURSTEIN: That was before the China Syndrome movie hit the streets.

MR. SHAO: Those five plants were shut down because of computer code error.

MR. BECKJORD: Larry, one question. The fracture mechanics codes for example, one of them used on this Yankee Rowe --

MR. SHAO: Yankee Rowe, yes. I say generally they don't. In some specific case like Yankee Rowe, we do review the computer code.

MR. BECKJORD: That's an exception.

MR. SHAO: That's exception to the rule, yes.

MR. MORRISON: Any parting questions or comments by the Committee on codes and code maintenance?

[No response.]

MR. MORRISON: If not, let's take a break. We will reconvene at 10:15.

[Brief recess.]

MR. MORRISON: I would like to reconvene the meeting, please. According to the agenda we would like to spend the rest of the morning addressing four questions that were posed to us by the Commission.

The question is, is the research program doing the right things. Are there enough resources to do what is

being done. Are the skills of the staff and the contractor base keeping up with the changes and the Commission's needs. Is the program staying ahead of the problems or is it trying to catch up to the problems.

I think we will have a very interesting time discussing these questions. We will ask the staff to give us some background, to proceed with our discussions. Eric Beckjord would like to lead off the presentations.

MR. BECKJORD: Thank you, Dave. I would like to introduce Lloyd Donnelly - you. I don't think you have had a chance to meet with him yet. Lloyd is Director of our budget affairs, administration and contracting and procurement for both the laboratory contracts and for the commercial contracts. He has been very helpful in getting us out from under some of the problems we had with the auditors in the past. We hope to remain out of there, out of harm's way.

I thought I would discuss the resource issues briefly, to tell you where we are as of the month of December, end of the calendar year last year.

The first thing I need to tell you is that the agency turned money back to the Treasury for fiscal year 1994 and 1995. This decision was made in about the end of November. I think the agency total on each of these years was $15 million returned for each fiscal year. As you can

see, research held a position of -- we were clearly the biggest contributor to that.

There were reasons for it, that in the case of research -- although I think there were some of the reasons were similar in other parts of the agency -- the financial facts behind this $8 million reduction in both years is that at the end of fiscal year 1993, the unexpended obligations for research were $62 million. That was an increase of $12 million from the year before.

There were also unexpended obligations from prior years of $17 million. This added up to a total of 80 percent of the fiscal year 1994 budget. That's too high, and it reflects on our financial management. It was for that reason that the decision was taken to undergo the rescission.

The reasons for that are on the next slide. The principal reason is that the money that was available that we were contracting out toward the end of fiscal year 1993, we were still awarding those contracts late in the year. If we had gotten the money obligated early in the year we probably would not have been in this situation.

Money that is obligated late in the year is carried over. In effect, it adds to whoever holds the obligation -- let's say a laboratory -- it increases their forward funding. So that, if you take a particular contract

that was funded at a million dollars annually if, at the end of the fiscal year the obligation in that contract is 1 million, the laboratory who is holding that contract is forward funded in effect a year for a year's work.

This matter of the late obligation of the funds is the main explanation of the situation that developed. It was not the only explanation. There were also matters of late de-obligation of funds on completed projects. In other words, we had projects which were completed and there was no further work underway, there were no charges, and there was money remaining in those obligations to laboratories. We undertook about a year ago to catch up and de-obligate all of the money that was not being used.

We are very close to that. I think that activity will be completed by mid-year this year, we will have worked through that backlog. A part of this unexpended obligation was due to the fact that we had not de-obligated funds that were not being used.

The last category is simply the delay in billing time, the delay between the time the work is actually performed and people turn in their time. The laboratories pay for work that they have subcontracted, and there's a time lag between the accrual or fact of those charges and the time when we are actually billed for them. This is generally about two months. We receive bills for work that

is accomplished in most cases by two months afterwards, at which time those bills are paid. There are cases where it extends longer than that.

To the extent that you have a delay in billing that also increases the apparent unexpended obligation. In other words, you have money out there and it has really been spent, but it doesn't show up on your books as spent due to the billing delay. Two months is a considerable amount. That's one-sixth of a year. If you are spending on the average as we are, about $90 million a year, one-sixth of that is tied up in billing delays. As I say, there are a few cases where it's more than that.

The next slide shows what we are undertaking to do about this. First of all, we are using excess of fiscal year 1993 carryover funds before we are using new, 1994 fiscal year funds. We have established a goal of awarding the contracts and obligating the money earlier in the year. The goal this year is to obligate 65 percent of the money by mid-year.

MR. UHRIG: This fiscal year?

MR. BECKJORD: Yes.

MR. UHRIG: March 31st?

MR. BECKJORD: Yes. I should mention that this is easily said. It is less easily done, for the following reason. We have a small fiscal section, a few people, who

carry the load of obligating this money. It is because of the few people that we have to do this work, it can be done more efficiently by obligating money for a whole year's expenditures rather than obligating money in small pieces during the year. In effect, it takes the same administrative effort to obligate a small amount of money as it does to obligate large amount of money.

Because of this fact we have been obligating money on a rolling basis going forward. That is to say in the case of one contractor, the laboratory, we would obligate that money early in the fiscal year. Then, the people would go to work on the next, and they would be obligating money throughout the year for a year's work ahead. This was the reason that we were getting into difficulty.

We are attempting now to get that done earlier in the year. In effect what it means is, we have to do better planning and have to get all of the paper ready early in the game, early in the fiscal year, to carry this process out.

MR. MORRISON: Eric, does this also mean that there will be fewer new starts in fiscal year 1994?

MR. BECKJORD: Well, the new starts are part of the -- we are obligating money for new starts as part of it. I should ask Lloyd.

MR. MORRISON: Perhaps I don't understand the first bullet then, using fiscal year 1993 carryover funds.

I am assumir hat those are obligated in lieu of 1994 funds which you don't have, and you are going to have fewer 1994 funds which says there are probably fewer starts. That's my logic.

MR. DONNELLY: What we are trying to say there is, if we found selected projects that were heavily funded in prior years and those funds hadn't been expended, we were able to reduce the budget in 1994 and just let those 1993 funds carry through and fund the work, rather than adding 1994 funds on top of a large amount of 1993 funds. That's where we were getting excess forward funding in the past.

MR. UHRIG: This will avoid de-obligating funds in the future then.

MR. DONNELLY: On active projects. We will still have to de-obligate those that are left over after the project is completed.

MR. DONNELLY: That would be less.

MR. DONNELLY: Yes, much less.

MR. BECKJORD: There was a fair amount of money, the de-obligations, it seems to me that it was $6 million.

MR. DONNELLY: The amount that we will de-obligate by April would be in the order of about $5.1 million. That's for completed projects and some are for active projects, mostly completed.

MR. BECKJORD: That is money that is turned back

to the controller.

The next slide shows what the effect of this is going to be. There are two main effects here. One, is a reduced capability to take on unanticipated work. I will give you an example of that. One piece of unanticipated work that is going to cost some hundreds of thousands of dollars will be this study at the National Research Council on the digital instrumentation and control work. We hadn't expected to do that, so there was no budgetary provision for it.

Most of the expense will be incurred in this fiscal year of 1994, probably to-thirds of it will be incurred in this fiscal year. The balance, maybe a quarter to one-third, will be incurred next year. The fact is that there are funds available. Part of that availability comes from the money that we will be de-obligating and turn back to the controller.

What we will have to do in cases such as this is go back to the controller and justify getting the funding from him for these unanticipated projects. I guess a better way to say it is, it reduces the ability I have to undertake unanticipated work from funds directly available to me including -- we have always kept a reserve in the past. We are not able to sustain that reserve under the situation that has occurred. Because the controller has money, I

expect to go back to him and request that he make that money available on a case by case basis.

The other impact is that we had anticipated CANDU research, and we have cut that out. That funding was eliminated from our budget. Any funds that the Commission decides that they will spend on CANDU research, we will have to go back and get from the controller. Those are the two main impacts.

If you ask, is this going to impact any high priority work, I think the answer to that is no. I expect to go back in the case of each budget and ensure that we are expending the available funds only on the high priority items. So, there will probably be some work of lower priority that will be dropped out as a result of this action.

As part of these budget reductions we were holding about $800,000.00 for other offices in support of principally the work in Russia and other countries of the former Soviet Union. We were holding that for other offices. Turning that money back does not have an impact on research.

We have a list of projects which have been delayed as a result of this, and it is our view that it doesn't impact the safety work. That's a quick summary.

MR. ISBIN: Does that mean you will not be

involved with the Russian program?

MR. BECKJORD: No. We did not turn back the money that we are spending. We were originally given the money and other offices were charging to it. To the extent that they charge money on these projects, they will do it from their funds and not from these funds.

Do you have any questions on this turning back the money?

MR. VOGEL: When was the change made? It used to be that you couldn't carry over unexpended money from one year to the next. That's different now.

MR. BECKJORD: You have to obligate it. Our funds, if we obligate money before the close of the fiscal year, it can be carried over.

MR. VOGEL: That didn't used to be the case.

MR. BECKJORD: It has always been the case for the NRC, we have it until it's expended.

MR. DONNELLY: DOD couldn't.

MR. BECKJORD: That's right. Other agencies have one year. Most other agencies can't do that. Are you sure about DOE?

MR. DONNELLY: No. I said DOD. I don't know about DOE.

MR. KINTNER: What can you say about projections for future years, the next three, four and five years,

recognizing that these have to go through Congress and so forth and you --

MR. BECKJORD: The concern that I have is that any time an agency makes a rescission, it's pretty clear that when the Congress begins to look at the next year's budget they are going to be looking at the number before the rescission and the number after the rescission.

I am told that the Chairman has taken a very active interest in this, and he has met with the Appropriations Committee on this subject. The expectation is that the NRC budget will not be affected in the future by this. In other words, the projected budget minus the rescission will not become the new baseline.

MR. KINTNER: Your hope is that you will stay at $90 million or thereabouts?

MR. BECKJORD: The total research budget including the high level waste, is about $100 million. This number has been going down slowly every year and probably those pressures will increase, because the budget deficit goes out into the future. I don't sense the same level of concern that there was three years ago. Up until about two years ago when we entered every fiscal year there was not an appropriation at the end of the year. We went forward on the basis of the Congressional resolution. That's a very limiting situation.

Congressional joint resolution does not in effect authorize the whole funding for the year. Whenever you go forward on that basis, until the appropriation is agreed upon, you are very limited in the funds that you can spend. For that reason, as long as we had that situation, we were not able to get our rull alloted money. That hasn't happened now, I think this is the second year that we have had an appropriation.

MR. UHRIG: That basically means you couldn't obligate new contracts.

MR. BECKJORD: You are very limited in your ability to do that, that's right.

MR. UHRIG: That would force things into the latter part of the year, which then resulted in the situation that --

MR. BECKJORD: I don't sense a return of that problem. I do say that the budget is going to be under close scrutiny every year, and in particular the point that we discussed briefly yesterday. With a declining base for payment of fees the agency does have a problem, because if you have fewer units that are paying fees then the per unit fee is going to go up. We will always be under that kind of pressure.

MR. UHRIG: Are you obligated to take all the funds for major facilities out of this year's budget or do

you project those into next year's budget?

MR. BECKJORD: It has been some time since we have had a large capital budget in research. We are funding small capital requirements out of the annual. It was not really -- I don't think that was a considered a capital expenditure. We are providing funds for the purchase of up to date computer hardware. In a sense you can call that a capital expenditure because it's good for the useful life of the equipment. We are funding that on an annual basis.

Lloyd, is there anything that you would like to add to that?

MR. DONNELLY: No, I don't think so.

MR. MORRISON: Do you have a separate presentation?

MR. DONNELLY: No, I don't. We initially scheduled it that way and decided to combine it.

MR. UHRIG: One of the issues that came up yesterday was the inordinate time it took to get contracts implemented. Is there anything that you are implementing that would expedite this situation, or is this really just sort of recouping --

MR. BECKJORD: Reducing the lead time to award a contract.

MR. UHRIG: Yes.

MR. BECKJORD: That's a continuing struggle. I

was talking with Dave yesterday during the break about sole source contracting. What I learned is that the NRC is not the only agency that is having difficulty with sole source contracts. Sole source contracts with us are very rare now. It's such a difficult way of proceeding. The few exceptions are things like the work that we expect to do, we expect the National Research Council to do for us. That is a sole source contract. We have a few others.

I guess what I should say is, we do not do, as a rule -- they are very exceptional, sole source contracts with commercial organizations.

MR. UHRIG: What I was really getting at is the technique that is being used by other agencies, of broad agency announcements with sort of multiple dates for proposals. They get those in, the work is done, and then when the money comes in it just sort of -- the preliminary work is done. I don't know whether that's a technique that is useful here or not.

MR. BECKJORD: We undertook four years ago, when we undertook a number of broad agency announcements. Can you, Brian or Larry, I think they occurred in your areas. Do you have any comment as to what was our experience with the broad agency announcement? Were we able to accomplish what we wanted to, and what about the administrative lead time on awarding.

MR. SHERON: They sounded nice but the problem was is, you can't be very specific in a broad agency announcement. It has to be a more general description of the type of work you want. It took a fair amount of time to put something like that in place.

The thing we tried now is the basic ordering agreement, where you go out and award a contract of up to $2 million over a three year period, in which you basically have someone on retainer that has the right technical expertise in the area that you are interested in. Now the difficulty we are having with that because we thought that would help us is, the difficulty with that is that every time you want to put a task at that organization that won the contract you have to write it up, it has to go to contracts. Contracts has to go out and negotiate it with these people. That's been taking upwards of two months to just put a task in place.

So, I guess our experience is, we haven't been really thrilled with anything that's been available to us. Everything takes time. Even the National Academy thing, I think, we were sitting there hassling with contracts.

MR. KING: I am still hassling with them over sole source justification, even though the Commission told us to go and do it. It's pretty time consuming.

MR. MORRISON: You mean, they haven't agreed to

what we gave them?

MR. KING: Nope.

MR. MORRISON: What's wrong with it?

MR. KING: They say it's not an urgent and compelling reason. Even though the Commission told us they want to tie it to some immediate safety issue, it's the only way they will accept it. I am still haggling with them over the words. They gave us a new format for it, which they could have told us a week ago. Now, they have decided they want a new format for it. It's that kind of thing.

MR. MORRISON: Have you tried --

MR. KING: The Academy is ready to go. They are waiting for the request for proposal.

MR. KINTNER: Does the Commission personally understand what's going on?

MR. BECKJORD: Ed, I have to tell you, I don't think so. We have a lot of problems of this nature, with the procurement organization.

MR. MORRISON: Ed, it's my impression, and these guys know it better than I do, this is perhaps even out of the Commission's hands with two things that Congress has done. One, the chief financial officer act that they had a couple of years ago that gives a lot of clout to these people in the financial and procurement side of the organization. The other is the fact that there are so many

Congressional investigations with GAO or the IG's that look at these things with regard to awarding something that's out of the ordinary anywhere, most procurement officials that I have talked to are just very afraid of doing anything that is trying to bend the letter of the law.

In fact, I think most of these guys pride themselves -- with the competition within the organization pride -- when they get up to 99.9 percent and all of the work is competed, they want to find out where can I get that other one-tenth of a percent because I want 100 percent. I don't want 99.9 percent.

When you back that off and talk about some of the set asides then for small business and minority contractors and disadvantaged contractors, it gets very tough business to get anything sole source and anything done quickly, other than on competitive. I think as we heard, it's two years to get a competitive procurement in place.

MR. SHERON: The competitive procurement, the minimum time is six months. Our experience has probably been more like nine months. You send over the statement of work that has to go out and two weeks later the contract officer sends it back with a bunch of comments, and then you have to noodle it up. If the person who needs to noodle it up is out on travel you lose a week there.

When you go back and forth a couple of times, once

it goes out and it's announced in Commerce Business Daily, then there's a 45 day period depending upon the contract. A lot of people write in and say can I please have another 30 days. The agency usually bends over backwards and gives people more time. Then, we have to put in place a source selection panel. That's a very formal process. These people have to meet with the contract officer there. They have to fill out forms, have to rate and grade every proposal.

Then, they come up with what they call the best and final list. The best and final list, then they go out with more questions to the best and final saying, in order to make our decision we need more information. Then, these people have to prepare responses to that. Then, the panel has to meet a last time. It goes on. Nine months to a year is about our experience for a commercial contract.

As you heard -- I think someone put on a slide yesterday -- I think about three-tenths of a staff year may not be unreasonable for the time for the staff effort required to put such a contract in place. We just don't like to put too many of those in place because of the high resource requirements.

MR. HATCHER: Does University contracting go the same way?

MR. SHERON: Same way.

MR. KINTNER: Has anybody talked to Gore?

MR. DONNELLY: Gore and his group are looking into all of the rules pertaining to procurements, and particularly procurements of ADP resources. In our agency by the way, it has an initiative to look into the processes that are used for commercial contracting within the agency, in hopes to streamline that somewhat. I wouldn't be too optimistic that we are going to do much better.

MR. BECKJORD: Well, the case that is really difficult to understand is the National Research Council. There is no competitor organization. There is an urgent and compelling need. I just don't have too much patience when I hear what Tom just said. I may leave this meeting early this afternoon.

MR. BOULETTE: I am surprised you are still sitting here.

MR. KINTNER: Is this the right time to discuss this, Mr. Chairman?

MR. MORRISON: The floor is open for discussion.

MR. BURSTEIN: It would seem that based on what we heard, in the second question under item one of the Commission's or list of the Commissioner's memorandum it says, are there enough resources to do what is being done. I gather that the answer is obviously yes, despite the decisions and --

MR. BECKJORD: There are enough financial resources.

MR. BURSTEIN: To do what is being done.

MR. BECKJORD: To do what is being done.

MR. BURSTEIN: I think that is the important point, the financial resources. Are we going to talk about other types of resources, Mr. Chairman?

MR. MORRISON: I would assume that that's under this resources downsizing staffing level skills. We will get into the internal resources and reduction in number of FTE's. I would hope that it would be addressed, the functions that are restricted to government employees versus those that contractors can do. That, again, affects the balance of how the work is done.

MR. KINTNER: What I was going to do is ask the staff, in the best of all worlds, recognizing that there are good business practices and you have to be sure you don't have conflicts, have to be careful that you don't give lots of good things to your friends, et cetera, with all the experience that you have had in doing business over the years, what in the best of all worlds should change so that these things can be done more effectively, more efficiently, more precisely and get on with the work.

What do you think could be done. Are we now, like we said yesterday, do you think it's home?

MR. MOLZ: You have to decentralize the process so that not so many people --

MR. KINTNER: I am asking the staff. These are the guys that have to work with it.

MR. MOLZ: And, they can't do that.

MR. KINTNER: Why?

MR. MOLZ: Because, how do you go up above and tell the guy he doesn't need to sign it.

MR. BURSTEIN: Maybe we should hire a procurement consultant and have him do all the contracting. I am sure that's been discussed.

MR. DONNELLY: I would say that I don't think the problems in the NRC are unique. I really don't. I don't see any procedures that our procurement shop or processes that they are asking us to go through --

MR. BURSTEIN: They are not unique to government, is what you are saying.

MR. DONNELLY: That's correct. We are following the government procurement regulations and rules.

MR. BURSTEIN: That's part of the problem.

MR. DONNELLY: It is, indeed.

MR. UHRIG: There has been situations -- I know the Department of Defense has given substantial contracts to certain organizations to manage programs. For instance, a $5 million a year program where they in turn contract with

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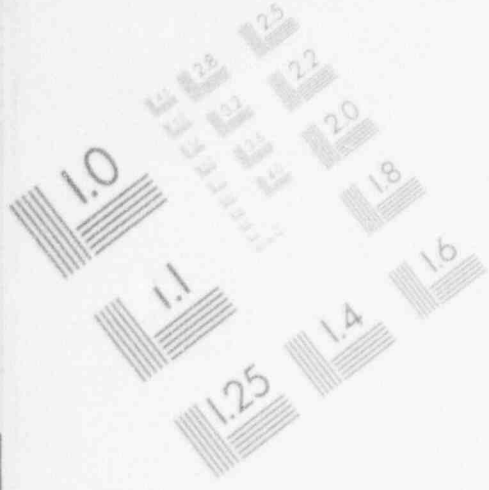

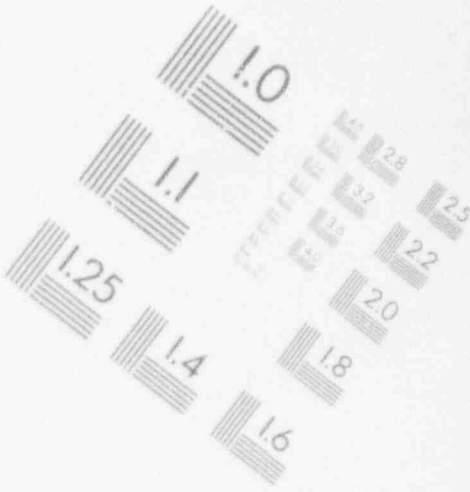

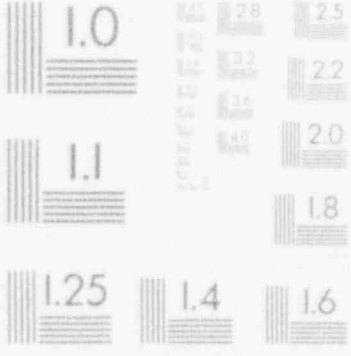

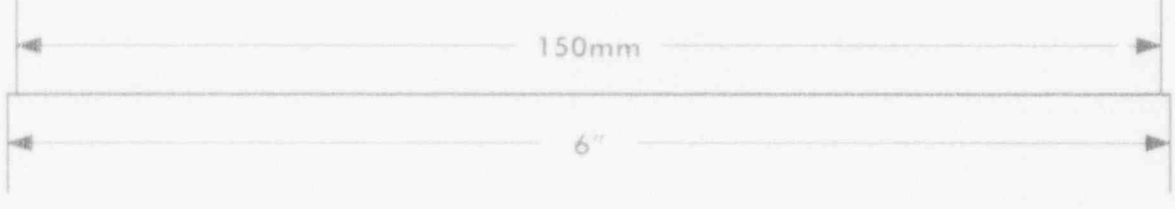

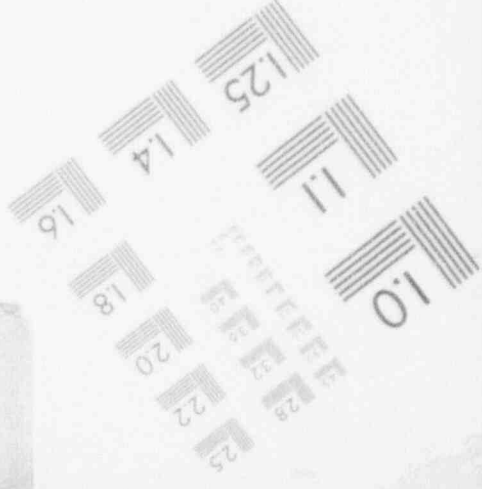

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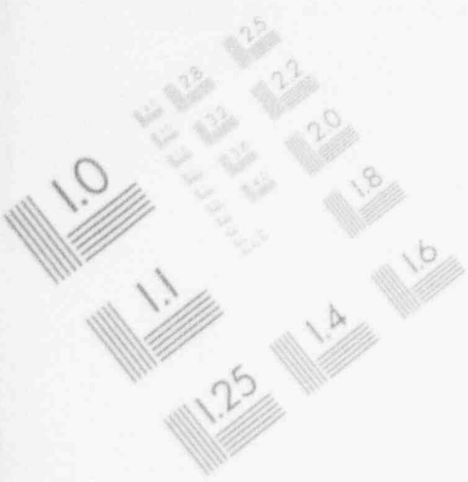

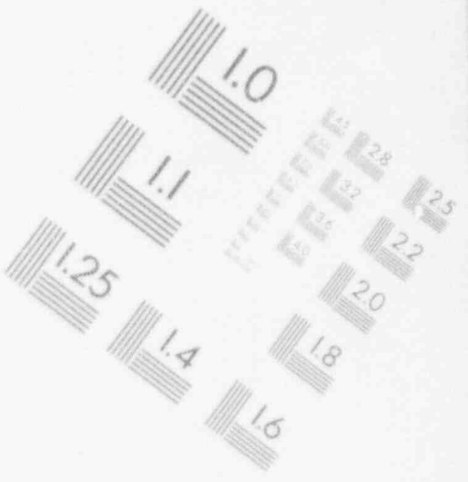

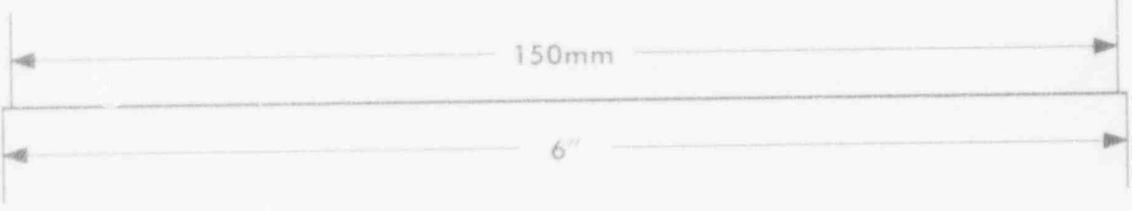

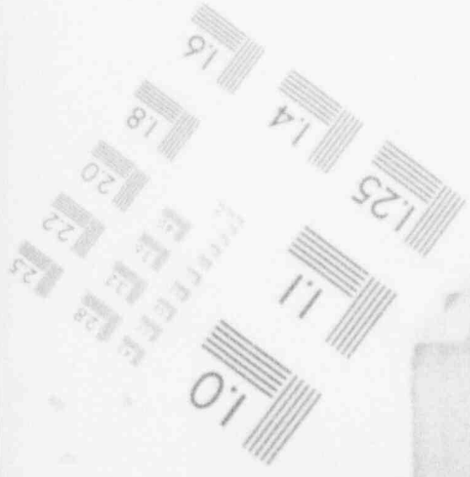

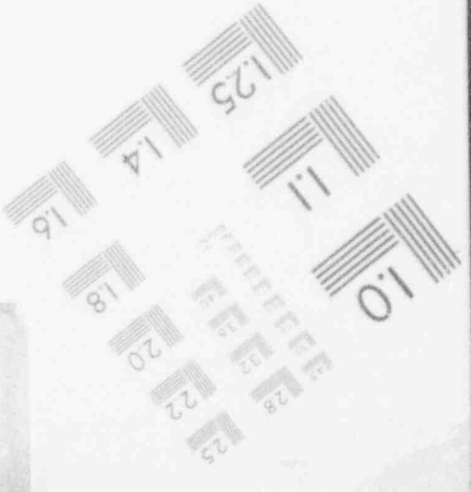

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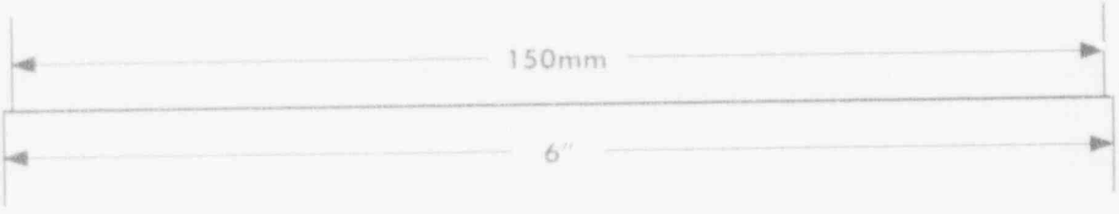

different organizations. I think set contract is the right word, but I am not sure.

MR. KINTNER: That's a little bit what Brian was talking about, having task orders.

MR. UHRIG: It may be. Basically, management -- that whole program resides with the specific organization, but it is subject to supervision by the people in the government agency. Specifically the one I am thinking of is, the Army Research Office has issued a number of those and there are organizations around the country that run programs for them.

MR. BURSTEIN: There are cases where government agencies have entered into procurement service arrangements with subcontractors to provide procurement services and management services of contracts from a strictly non-technical point of view, the administrative end of the business, just as they do janitorial services or mail services. I don't know if there is any prohibition against an agency or arm of an agency doing that?

MR. DONNELLY: I don't know.

MR. MORRISON: Bob, if I understand what you are talking about, those kind of contracts are the exceptions. It seems to me that if you are a prime contractor you are still stuck with the same rules basically that the agency is, and that every subcontract you either have to justify a

sole source for the subcontract or go competitive for the subcontract. You have to live by the same rules. It just moves it over, it doesn't eliminate the rules.

MR. UHRIG: It's my understanding that it did, in the particular case. That was the basis for doing it. Otherwise, they wouldn't have done it.

MR. MORRISON: I think the ARO one, if I am recalling those kinds of contracts is quite an exception, and most of goes to universities, as I recall.

MR. UHRIG: That's true, in this particular case.

MR. SHERON: If I could add, in trying to answer your question, when I look at the things that we are doing right now in terms of the contracting, the administrative side, it's all admirable and I think it's good. I don't think we are putting in stuff that is superfluous and the like.

The problem as I see it is, these documenting and reporting requirements have in fact increased on the staff a little bit over the past several years which is fine. Like I said, what they are trying to accomplish is admirable, I think. The problem is, number one, when you add administrative burden on the staff it takes away from their technical time. Then, the fact that we have had to reduce or FTE. My division had to go from 60 people down to 50. Yet, we are given the same amount of money and are asked to

do a little more administrative work.

What I am seeing -- and I think this may be reflected in what you have heard from Neil about thermal hydraulic capability for example -- is just a decline in technical capabilities at the staff. They are spending more time doing the project management work and spending less time overseeing the technical work. To some extent -- it's nothing that's going to stand up all of a sudden as this big, major problem. It's just a slow decline that one sees over the years.

That's really where I see where we are trying to find this balance. One of the things we are looking at right now in the thermal hydraulic branch is perhaps assigning a couple of people who do good project management work, basically give them fulltime project management responsibilities, which would hopefully free up some other people to become more fulltime technical people, rather than having these people trying to split their time and do neither job well, as a way to cope with this.

One of the reasons we could absorb these impacts was because in the human factors branch we were able to turn in $1 million because we weren't going to spend it anyway, because we didn't have enough people to manage it. That's one of the reasons there was very little impact with this budget cut.

We are becoming people limited. That's really what it boils down to.

MR. KINTNER: One of things we said in our Subcommittee report was -- and this comes from long experience -- these administrative organizations tend to look on themselves as filters, as a reason for being as and of itself rather than a mechanism to assist in getting productive work accomplished. Over a period of time they are more and more that way.

The only thing that seems to work -- it doesn't work all the time -- is personal persuasion, somebody taking this thing instead of sending it over and waiting two weeks for it to come back, hand carrying the damn thing or putting it down saying, I need this tonight. That takes more time too.

My sense is, from what you guys tell me -- it would be instinctive anyway -- that this kind of attitude that you have to satisfy us, we represent morality and what the Congress said, the higher order of things, you have to satisfy us, and we have no particular responsibility to help you get your job done. Is that a fair assessment of what's going on, slowly but surely, as you said, a slow decline and slow increase in this kind of filtration.

MR. SHERON: I can give you a personal opinion. I think that's pretty -- there's a lot of truth there, maybe

not 100 percent with everybody. For example, management directive 11.7 is a classic example, where the Office of Administration decided they were going to "help us" and put together this management directive.

When we first looked at the first cut of it we figured it was going to probably add three to four months onto even a laboratory contract to put it in place because of the formality of our interactions that it imposed on us with the labs, as opposed to things we had already done but on an informal basis. They wanted a formal negotiation of costs with the contractor.

MR. BECKJORD: I think they were largely successful.

MR. SHERON: Yes. I am saying that's an example of --

MR. BECKJORD: There's no question, that was their starting position. I think those problems are resolved now.

MR. SHAO: Everybody in the government lives by the rules, otherwise you get investigated. You have to follow the rules. Within the government you cannot blame anybody because everybody wants to live by the rules. There are certain rules, right or wrong, you have to live by.

MR. MOLZ: Are you familiar with the management contractors that the EPA uses at their various laboratories around the country?

MR. MORRISON: I have some familiarity with them.

MR. MOLZ: I don't know if that would have any relevance to these kinds of problems. Essentially, they use these people to be able to respond quickly and to be able to get out from under red tape. They go through all the red tape and the competition to give the contract, and then when it comes to doing various things they can call up on the phone and do it. They are not bound by all of the rules.

MR. MORRISON: I am not sure that's exactly the right statement. It's my interpretation of what I have learned so far -- and I have been dealing with EPA considerably over the last two months -- that if it's the contractors that I am thinking of, they are basically not much different than the Goco organizations that the national labs represent. They happen to be there on site, co-located with the government. Research Triangle Park has several of these things and most of the other labs have them as well.

In some cases there is still a very formal barrier between the government staff as there has to be and these contractors. Likewise, these contractors are supposed to be operating under some sort of a direction of the government staff there. It doesn't quite eliminate all of the problems. Although I would sense it's the same role as the national labs play.

The pressures that are coming up in Washington and

have been quite apparent over the last couple of years is, for more competition. It basically started with the professional services organization here, targeting the Department of Defense FFRDCs. I don't think that the DOE FFRDCs are going to remain unscathed for many more years in this. They will be in the same lump. Congress has sort of picked it up as well, what about this whole thing that we are calling Federally funded research and development centers which are most of the contractors that NRC uses. I suspect that 90 percent of your budget must go to national labs, or some number.

MR. DONNELLY: About 70 percent.

MR. MORRISON: If the screws get tightened on them, I think that will double the problem that you have. I wouldn't be surprised over the next couple of years if we start to see that. The same thing is going to happen in EPA. I think EPA is already starting to experience it.

Sitting down and talking to a Brian Sheron equivalent with an EPA it's the same sort of question, the same sort of thing. EPA thinks it has a nice workforce analysis, that they have asked all of these people in these research labs, how much time do you spend do you doing science, how much time do you spend doing contract administration, how much time do you spend doing technical assistance. I am sorry, I don't have it with me. The

amount of time doing science is not terribly large.

MR. BECKJORD: I don't know how much time you want to spend on this. My own experience with our procurement people is that if we have something which has to be done urgently we are generally able to get it done on an expedited basis by putting a lot of attention on it, management attention and our staff attention. The problem is that you can't do that for everything. I mean, you don't have enough time and people to make everything a special case.

They are under the same kinds of people problems that we have. They have had high turnover rates. They have relatively few people who are very experienced. If you can get them on a particular job you can get it done faster. The jobs that move are the most important ones on the peak, they are not the average.

MR. MORRISON: Why don't we move to the subject of the resources. I assume that there are some other presentations on behalf of the staff, given the agenda that's laid out.

MR. BECKJORD: The related subject that we are taking up this afternoon is on the retention of skills in technical disciplines. What I would like is that the part on downsizing, staffing and skills, the division directors are here. I think what would be useful would be for each

one of them to give you a very brief summary of what the status of their division is.

We are, as we have said, the authorized staff levels are decreasing. You have heard a number of times now that we are people-limited. I guess what I would like to do is ask each division to --

MR. KINTNER: Are you going to the afternoon session, this SRM Item 4?

MR. MORRISON: No, we are still under Item 1.

MR. KINTNER: Still talking about downsizing staffing levels.

MR. BOULETTE: Discussing both items, is that what you are suggesting?

MR. BECKJORD: Yes.

MR. KINTNER: Before we leave this funding thing, let me ask one more question. If I try to restate everything that I have heard so far in funding it is that with minor variations here and there, in totality, your present circumstance is that you are able to fund what you need to fund, and your expectation is that you are going to stay fairly well and be able to continue to do that, barring some new administration that cuts you in half or whatever.

The answer to the Commission is that the general level of funding in research is appropriate. That's what I hear from all of this.

MR. BECKJORD: I think that's correct. If you as'. about -- if there is some large new program that comes forth, then the answer would be different. I don't know what the conclusion is going to be on this CANDU question. I think that's probably the biggest single uncertainty on the horizon. If the Commission decides that a major research program is needed on CANDU, we have neither the people nor the monetary resources to undertake it as things now stand.

MR. KINTNER: Barring that, you are reasonably happy and are not going to be constricted severely by budget cuts.

MR. MORRISON: Ed, perhaps to elaborate a little on this, the Commission's question to us is, are there enough resources to do what is being done. I have chosen to interpret resources broader than financial. The human resource base is an essential part of that.

MR. KINTNER: Sure.

MR. MORRISON: As ultimately, there would be facilities and equipment aspects associated with it. One of the concerns that I see -- and obviously Eric has expressed it -- downsizing itself is an issue. There isn't enough people to do it. Even if you have the money there isn't enough people to do it.

MR. KINTNER: As the dollars alone, that section

of it, everybody is reasonably happy and comfortable.

MR. MORRISON: I think what we want to do the rest of the morning is address the numbers of people issue from each of the divisions that are involved.

MR. SHAO: Do you want me to say something about my division?

MR. MORRISON: Larry, go ahead.

MR. BURSTEIN: Before that, if I may, Mr. Chairman, you have a total RES office number of people and allocation. Could you tell us what that total is.

MR. BECKJORD: The total is at the end of this fiscal year, 1994, it's 224. That's authorized. We now stand in the high --

MR. DONNELLY: Eric, let me correct you. By the end of 1994 we have to be down to 232. In the end of 1995 we have to be down to 224. In terms of numbers of people that we have right now, if my memory is correct, it's around 237.

MR. BECKJORD: So, we are pretty close. With the expected attrition we should be very close by the end of the year. What these numbers do not include I should point out, is the President's directive on reinventing government calls for a reduction of about 12 percent. It's further broken down. It has an important component in it, which is to reduce the ratio of managers to total number of employees.

The agency in that matter, kind of stands out. We have a high manager to staff ratio. I think I expect that we will have some goals to meet over the next probably couple of years that will change that ratio by a factor of two. Research right now is of the order of one to three and one-half or something like that. I expect the agency is going to be going to something like one to eight or one to nine over the next couple of years. Along with the downsizing there will be a substantial effect on the structure of the organization.

MR. UHRIG: Is there no recognition of the nature of the work that is involved in this? If you have a lot of people in house doing work -- for instance, if the work were done within the organization -- you would not have that high a ratio.

MR. BECKJORD: I think there is a recognition of it. If I recall correctly, I think the figures that are mentioned in the report, government-wide, are something like one to 15. I think there are reasons related to the nature of the work at NRC, where it will be higher component of managers. Still, I think the agency is going to be going to something like one to eight or one to nine over a period of time.

The other point is, part of the President's directive is going to be reducing the proportion of the

higher ratings and the professional level of 15's. It poses some very challenging problems in terms of the things that you are thinking about, which is the retention of skills and bringing on and training new people to take over the future. It's a very challenging situation.

MR. UHRIG: Is there a prescription on how this is to be accomplished? Is it simply to eliminate the higher positions, or is it not to promote --

MR. BECKJORD: I think every agency is going to wind up coming up with -- there may emerge from this kind of a generic approach. I don't know. I haven't heard of anything like that at this point. I think it's up to the agency, to figure out how it's going to do it.

MR. UHRIG: You have all the other rules superimposed on this with reference to set asides and minorities and that type of thing?

MR. BECKJORD: When you talk about funding now, the set aside --

MR. UHRIG: There are effectively quotas, are there not?

MR. BECKJORD: Goals, may be the right word.

MR. UHRIG: Goals, okay, minority goals, that are to be maintained?

MR. BECKJORD: I don't know how that's going to play in all of this. I think that certainly the agency has

had goals about minorities, employment of minorities, developing management talent among minorities and women. I think those will continue. The number of positions -- the agency is going to be downsizing, and the management group is going to be downsizing.

As I see it, there's going to be a transition period in some years, two or three or four years that it will take to get through a downsizing and get back to some kind of equilibrium situation.

MR. DONNELLY: I think the Presidential orders go out through 1999 to achieve all of this. Exactly how it will play out in each agency and at what pace and so forth, I don't know. I think the solution to the problem is about every conceivable idea, from attrition to reorganization, to different approaches to doing the work, cutting out the work, to whatever we can do to still get the most important part of the mission done with those constraints.

MR. BURSTEIN: If I understand from what you both said, the fiscal year 1995 goal of 224 could be or would be further reduced by the President's directive another 12 percent.

MR. DONNELLY: No. The 12 percent, as I understand it -- you probably heard the number of 252,000 for the whole government.

MR. BURSTEIN: I just heard Mr. Beckjord and you

-- I am not looking at anybody else at the moment -- I put that very clearly and want to have this affirmed, that you now had 237. You had to get down to 232 by October of this year. You had to get down to 224 by October of next year. In addition, if the President's directive on reinventing government were to apply to this agency, which it seems to be, there would be an additional 12 percent reduction expected over what you now defined as the next five years.

MR. DONNELLY: That is not correct.

MR. BURSTEIN: Well, why don't you guys put your heads together and tell us what it is.

MR. DONNELLY: I will tell you what it is. If we were to go to the 12 percent, we would have to go from the 224 to 215. The 12 percent is an aggregate number and not an additional number.

MR. MORRISON: What is the base year that the 12 percent is applied to?

MR. DONNELLY: The 12 percent is applied to, as I understand it, I think it was the 1993 was the base year, fiscal year 1993. Therefore, the first two increments, cutting down to 232 and then down to 224, count against that 12 percent.

MR. BURSTEIN: The goal would be 215?

MR. DONNELLY: If research has to take the 12

percent, the number would be 215; that's correct. I believe that is through 1999.

MR. BURSTEIN: That helps me immeasurably.

MR. BECKJORD: I stand corrected. I thought the 12 percent was from the 224.

MR. DONNELLY: No, it's not.

MR. BURSTEIN: Very good. Maybe now, we could get into whether we got the right mix of people or not in the division chiefs.

MR. KINTNER: One other question. Are you going to be especially hit by the high three accidents?

MR. DONNELLY: I really am not qualified to answer that question. I think we need somebody here from personnel. You mean, within the office of research?

MR. BOULETTE: Could we clarify the question, so that I understand it? What is the question, Ed?

MR. KINTNER: Larry, could you qualify it? I could do it, but you can probably do it better.

MR. SHAO: Is it the high three?

MR. KINTNER: Yes.

MR. SHAO: Because we --

MR. KINTNER: Your annuity is based on the three years of your highest salary. There was a pay raise about three years ago, which means that many people will come to a point very shortly now in which they will have earned the

highest in three years, therefore, it's a good time to go out and take an annuity. I know that in a number of other agencies there's a good deal of fea of that because some of these people are right at the peak of their performance. They are badly needed and in senior positions and so forth, but why should they stay around?

MR. SHAO: To answer your question, we got another raise this year. Luckily, SES got a raise this year also.

MR. BOULETTE: That's not a management problem.

MR. SHAO: The thing is that also, I think in the research only really one SES retired, Warren Minners retired.

MR. KINTNER: This problem isn't going to affect you.

MR. SHAO: It's really not going to affect us that much.

MR. MOLZ: Just one observation. When downsizing goes on in the private sector, we always end up with invigorated organizations. It may be that the process itself is kind of rough. Decisions are made, cutting is not done uniformly. There are pieces removed. There are additional things given to -- the resources are moved so that in the downsizing some people actually come up 20 percent ahead of where they were to begin with and things like that.

If that could be done -- there's no reason why it couldn't work that way in government -- I gather that basically can't be done.

MR. DONNELLY: I think the approach the agency is using is that our top management wants to see how research and how other organizations would propose to get to those lower levels, and then look at it from an agency standpoint.

MR. MOLZ: Won't everybody propose for everybody else, to take the cuts?

MR. DONNELLY: No. What they did was allocate the cut evenly on a percentage basis, and then ask each organization to come in and say what would the impact be if you had -- how would you do it and what would the impact be -- if you had to go to these levels. Then, there will be some agency decision made as to the best way to accommodate the cut.

I think in that process it might not be exactly as you described. But there will be some of this, we don't want to take it here, we can take more here and even increase some activities in the process.

MR. BURSTEIN: Excuse me. Again, I would like to get to the office director or chief input. This is complicated terribly by this manager to staff ratio change, that what you are being compelled to do is not just to reduce the staff but to reduce the most competent, higher

paid, long lived, built in experience that the agency or that RES particularly has. How do you avoid -- you are not going to be able to do this just vertically and get lower level and upper level and others. You have to take it out of the best parts of the staff, it seems to me, because that's where you get at the improved -- if you call it that -- ratio. I don't see any other way of doing it, do you?

MR. BECKJORD: We haven't established exactly how we are going to do this over the whole program.

MR. BURSTEIN: We are trying to tell you.

MR. BECKJORD: I hear that.

MR. MORRISON: Sol, you just missed the concept that underlies all of this, which is called empowerment. Your lower level person is supposed to do the job without a manager.

MR. BURSTEIN: Without the salaries, without the titles, and all the other things.

MR. MORRISON: Of course.

MR. BOULETTE: But his point is, how the change will be -- I just drew up some numbers. You will be going from 50 managers to 20 managers. That's a big change, not just 12 percent. It's a factor of two and one-half.

MR. UHRIG: Is there also an issue of bumping in this agency or not? I know that the Army's labs have gone through this a time or two, and there was a cutback of 100

people and 1,000 job changes because of the bumping. Do you have something in NRC like that, or is that not applicable.

MR. SHAO: To bump you let people go.

MR. BOULETTE: Attrition, right?

MR. SHAO: Right.

MR. BECKJORD: The expectation is to handle the reduction in total numbers by attrition.

MR. UHRIG: Which will usually catch the higher people, in most cases.

MR. BECKJORD: It also happens that research, if you look at the age of the research staff, it's older than other offices in the agency. The last time that I saw that number it was well above 55, was the --

MR. BOULETTE: The management is not disproportionately older than the staff, are they?

MR. BECKJORD: This was total. This was the total personnel. I have seen those numbers but I don't recall the age profile.

MR. KINTNER: Is there any policy of deliberately moving people from one part of the agency to another for training and for development?

MR. BECKJORD: Yes.

MR. KINTNER: Could that policy be applied in a case like this?

MR. BECKJORD: Yes, I think it will be.

MR. KINTNER: To really strengthen the --

RR. BECKJORD: Rotational considerations.

MR. KINTNER: That Fred is talking about?

MR. BECKJORD: There's a lot of that going on. That's been going on for the last several years.

MR. MORRISON: Why don't we ask Larry to give us some of his observations from his division?

MR. SHAO: Let me describe my division here. The Division of Engineering has an annual budget of about $30 million a year. There's electrical engineering, mechanical engineering, seismic engineering, structural engineering, materials engineering and metallurgy, and structure examination. We do work on operating reactor safety, license renewal and advanced reactors.

As far as funding is concerned, that $30 million is sufficient to work on most of the important subjects. We do have FTE problem, tremendous FTE problem. We really have only 22 technical staff, not counting the branch chiefs and division directors, just 22 technical staff to carry the $30 million. In addition to research, we do a lot of reg guides, regulations such as PTS rule, Appendix G and Appendix H for reactor vessel, 50.49 for EQ and a lot of other regulations.

These are many carried by the 22 technical staff. In the last few years, let me describe --

MR. TODREAS: Of the 22, how many do you exclude as managers?

MR. SHAO: Just excluding branch chief and up.

MR. TODREAS: How many are there?

MR. SHAO: We have three branch chief, one division director, one deputy director.

MR. TODREAS: You have five, over 22.

MR. SHAO: Five, over 22, plus secretaries. Let me describe the seismic and structural engineering branch. The function of this branch is to evaluate seismic and structural integrity, containment integrity, and seismic engineering.

Right now, we have seven technical staff, mainly because we lost two senior structural engineers in the last three months. They took early retirement. These two structural engineers will not be replaced, because we have no FTE. Another problem is, everybody is around the average age of 55. They may retire within the next three to five years. We have no young engineers coming up.

The same way with electrical and mechanical engineering. So far we have only eight technical staff. In the last year we have three senior engineers retire. One is electrical engineer, one is mechanical engineer, and one is nuclear engineering. These three engineers will not be replaced.

MR. BURSTEIN: This is eight, for both electrical and mechanical?

MR. SHAO: Eight, both electrical and mechanical, and advanced I&C. We have only eight technical engineers in this branch. In the material engineering branch we have seven technical staff. They handle the reactor vessel integrity, piping integrity, steam generator integrity, and NDE examination.

Recently the branch chief was transferred to another branch, so we have acting branch chief. Also, one senior material engineer was lost to NRR because he got a promotion. So, we are looking for a new branch chief. The senior material engineer will not be replaced.

All together, as I say, we have $30 million program money, a lot of regulation and reg guide work, but we have only just 22 technical staff.

MR. TODREAS: Could you sum back before you had the 22, it sounds like you lost 8 or 9.

MR. SHAO: This includes the loss.

MR. TODREAS: You are down to 22.

MR. SHAO: Down to 22.

MR. TODREAS: What did you start with above 22?

MR. SHAO: Recently we lost --

MR. TODREAS: About 8?

MR. SHAO: 8, yes.

MR. TODREAS: It sounds to me like you have a disproportionately large loss from the 237, 232 numbers that we were talking about before. Is that about right?

MR. SHAO: It's all voluntary.

MR. TODREAS: I know. I guess I am looking at Eric, too. If whatever our starting point was by peoples' voluntary retirement, you have taken disproportionate loss.

MR. SHAO: It sounds like it.

MR. TODREAS: The management decision has also been not to replace anybody there. Therefore, it's not disproportionate. There is some thinking associated with that, that I think you ought to comment on.

MR. DONNELLY: Let's get some other numbers out on the table that might help here. Our authorized budget number started out to be 244. That was our baseline, that we came down to 232 and then down to 224. When we had a budget of 244, we had an on board strength of about 250. We were over our budget. We have worked that 250 down to about 237, if that's correct. Of course, our budget has come down disproportionately.

What you have to be careful of is, on one hand talking about budget changes, and on the other hand talking about people. I am not sure some of the people that Larry talks about leaving may have been against that base of 250 and not against the lower base, I don't know. I don't know

over what time.

MR. SHAO: The people are loss over the last year.

MR. DONNELLY: Within the last year.

MR. TODREAS: What I am observing now, I will just update my numbers. From 250 down to 237 or 232 is like 18 people. Larry might have started about 35 to 40, and of those 18 people it sounds like he has lost half. He has accounted for about one-half. There's a real high concentration of loss in his area, which is to be sustained with no replacements. That's my observation.

MR. MOLZ: If that's a decision that was made, that's fine. If it's not a decision that was made, it's not fine. It's an example of the management not working. It's sort of taking it as easy as it can be taken.

MR. DONNELLY: That isn't the way it was done. When we had to draw down to these lower levels the top management in the office of research looked at where these cuts could take place and discussed them with each division, and arrived at where the cuts would be taken. It wasn't just happening because of attrition.

MR. TODREAS: That's not what you said before, though. You said that there was no plan, it was just voluntary and that sort of thing. We are getting contradictory statements.

MR. SHAO: When they retire it's not forced

retirement, is what I am trying to say. It's a voluntary retirement.

MR. TODREAS: Then, some positions should have been removed from somewhere else, and you should be hiring new people.

MR. SHAO: The trouble is that we had to get a lot of expertise outside the agency. I think the agency said you cannot get anybody from outside. Sometimes you can be stuck, because we need some experts.

MR. TODREAS: The reason I am going through all of this is, I think it comes back to what I said before, you really can't make the decisions. You can't move the money around to emphasize what you see needs emphasizing. I don't know how we help in that dilemma. That, I think, is the root of the trouble of a downsizing in a government organization.

MR. BECKJORD: I could give you a quick answer but it will be a very quick answer, not at a lot of detail. We are going to be downsizing, and the office is going to be going from four divisions to three. That paper will go to the Commission before very long. As we work through that, I think a lot of the number parts of it will become clear.

What Larry was saying was that you don't plan. The reduction in staff was not planned, because there was an early out opportunity and some people took use of that

opportunity. You can't really plan that beforehand. There's an agency policy on that and people applied for it, and a number took that route. We are responding to that. In effect, the management action is going to be in reaction to that, because there was really no way to anticipate that.

We are going to be downsizing. One of the first steps is, as I say, going to three divisions. The schedule for this will go into effect when we move into the new office across the street in June of this year.

MR. BOULETTE: Eric, if I understand correctly, as these people are attrition out of the organization there was a senior management decision not to fill those positions.

MR. BECKJORD: I can't fill those positions, because we are over authorization. I can't hire people when I am over authorized level.

MR. KINTNER: You have authority to move from one to another of your branches.

MR. BECKJORD: Yes.

MR. KINTNER: But you don't have people with the qualification --

MR. BECKJORD: You can do that. As I say, we have submitted a plan which will be going to the Commission. The plan incorporates many of these things. I can't set that before you today.

MR. BURSTEIN: May I ask Larry two questions. One

is, it appeared to me that when you had 30 staff you had five managers, two at the director level.

MR. SHAO: SES, yes.

MR. BURSTEIN: That gave me a ratio of one to six.

MR. SHAO: Yes.

MR. BURSTEIN: Now that you are down to four managers, although you are advertising for a replacement, that will be five. That comes out to be a little over four. You are going in the wrong direction, according to the office.

MR. SHAO: It's being fixed. You have to hear it, maybe a few minutes from now.

MR. BURSTEIN: May I ask the important question to me at this moment. Of the 22 people that are on the premises now in the technical staff, is that the right mix. Do you have the capability and the diverse disciplines necessary to do the tasks that you outlined.

MR. SHAO: We need reinforcement in certain area. We need reinforcement in certain area, like material. I would like to have one more electrical engineer.

MR. BURSTEIN: The electrical and material sciences are --

MR. SHAO: I need a separate material engineer and maybe one -- I think each branch needs one or two more engineers.

MR. BURSTEIN: Each branch, means three more people.

MR. SHAO: That means about five to six people, in order to go back to the original strength.

MR. BURSTEIN: I am not talking about going back to the original strength. I am asking you, do you have the right disciplines to do the kind of --

MR. SHAO: If a guy is on vacation -- for instance, I have one material expert -- if he's on vacation, I am in trouble. One seismic, if he's on three week vacation, for that three weeks it's not ethically covered.

MR. BURSTEIN: The answer is, I have them as long as they are there. But if they get sick or go home, I am in trouble.

MR. SHAO: Each discipline, I need two people who know what's going on. One guy maybe take a vacation or sick leave or something, that one guy gone and you stop functioning. You don't run the branch right.

MR. BURSTEIN: I am not sure that I understand that answer, because I don't know how many disciplines there are. I counted seven. That would mean 14 people. Maybe I don't know all the --

MR. SHAO: Some of this 14 is not every --

MR. BURSTEIN: Structural, seismic, mechanical, electrical, I&C and materials.

MR. SHAO: And, NDE examination.

MR. BURSTEIN: 16. Why do you need 22? I am trying to get at the question of whether you have -- irrespective of numbers -- whether you have the technical resources to handle the work that you are obligated to discharge.

MR. SHAO: Right now I am telling you, I don't have enough FTE people working to handle all the research program and write the regulations, change reg guides, and support NRR. I have one structural engineer, and I can't do all the three things.

MR. BURSTEIN: The right disciplines and the ability to do all the work, are two different things.

MR. SHAO: Two different things.

MR. BOULETTE: Do you envision staffing up in your organization?

MR. SHAO: Essentially, I may pick up some people from one of the divisions that is eliminated.

MR. BOULETTE: I am saying that I understood that there was the capability of swapping from one organization to another.

MR. SHAO: We have train some of the people who are coming in.

MR. BURSTEIN: Say it again?

MR. SHAO: We have to train some of the people who

are coming in.

MR. BURSTEIN: Are there enough resources, it sounds like no.

MR. SHAO: No.

MR. BECKJORD: There are not enough resources within the current structure. We are going to have to restructure, and there probably will still be a shortage of resources.

MR. BURSTEIN: This goes to the heart of one of the Commission's questions, that's why we are pursuing it.

MR. BECKJORD: What will have to happen out of all of this is a review and reordering of priorities. Also, we will have to find some way to bring some new people into the organization because of the expected retirements.

MR. SHAO: In another ten years most people sitting here will be gone, too.

MR. BECKJORD: I will tell you, there are no easy answers here.

MR. BURSTEIN: That's clear. Thank you, Larry, for being the first guinea pig. We didn't mean to land on you but it helps to flesh out these responses we need to make.

MR. SHAO: Okay.

MR. BOULETTE: As an aside, I think you all know that the industry has gone through the very same turmoil.

Everybody is reorganizing, downsizing, right sizing, whatever you want to call it. It is difficult.

MR. MORRISON: John is going to make some comments?

MR. HATCHER: Excuse me, Mr. Chairman. Could I make a comment about this business of downsizing? Having seen the experience that I am very familiar with in the petroleum industry over the last ten years, I would somewhat dispute Fred's contention that when you downsize -- and I am sure that you do in some respects -- many times --

MR. MOLZ: It's not that I said as 100 percent. There are companies that downsize and go bankrupt. Overall, you do have an invigoration.

MR. HATCHER: I would agree with that. One of the things that is happening with the petroleum industry is, they found that the easiest thing to do was to offer early retirements to many of their senior people who had the experience to make judgments about things for whom the present day managers do not have the background. They promoted young people into management positions who are not qualified many times.

This is my argument that, yes, downsizing may be a very good thing to invigorate an organization but it should not be done solely based on economics and at a level at which people are being paid or potentially what they have to

be paid in retirement.

MR. BURSTEIN: Often, the most valuable people you have and the ones that you want to retain are smart enough to get out early.

MR. HATCHER: That's part of what is happening, too.

MR. MOLZ: That happens everywhere. That's a problem of downsizing. The only way you can counteract that is be able to hire while you are downsizing. If ten people leave and you hire five people, you have downsized by five.

MR. HATCHER: But, if you only hire at the junior level and you have lost several senior people, you still have a net loss there in experience.

MR. MOLZ: That's true.

MR. BOULETTE: We can talk about this for quite some time. One of the things that my company is looking at is an incentive program that would target the junior people, but you have to be careful on how you do that, obviously, on the lower performing people. Good luck.

MR. MORRISON: Joe, why don't you step up to the table and give us a few comments.

MR. BECKJORD: Joe Murphy, as you all know, is acting division director for safety issue resolution. He's acting in place of Warren Minners, who retired earlier this month.

MR. MURPHY: Basically where we are is, we have 47 professionals below the branch chief level, spread out into three branches, engineering issues branch that basically does generic issue resolutions, severe accident and issues branch which does some generic issue resolution and has a primary responsibility for IPE reviews, and then a probabilistic risk analysis branch that does PRA research.

In terms of the generic issues process, I think we have about the right staffing. Some of our staff are narrow in their scope. We have efforts underway to send them to our training center to broaden them, so that they can handle more tasks than they can at the moment. That seems to be working very well.

In the other two areas, the IPE review and PRA research, we are about at the ragged edge. In the IPE review we have just enough people to get it done, I hope, on schedule. We are at a situation where one person leaving, one person shifting, one person getting sick, and I know my schedule is going to go to hell. We are very limited in skills in that area.

In the PRA research area, we have a number of people with PRA skills. What we need, I think, is someone who has expertise, someone who is recognized as an expert in the field. We are in the process now as an agency, of looking at risk based regulation in a very serious format.

We are working closely with NUMARC in this regard, as NUMARC comes up with suggestions in this area.

What it appears likely is that although we don't have a user request from NRR at present, that we are going to be very soon hit with requests to develop guidance documents for NRR reviewers to be able to use to look at various aspects of things like how to optimize technical specification using risk analysis techniques. There, besides the staff we have, I see a real need for someone who has reputation.

The problem we have with staffing is also true of the industry, of the national labs. Basically what's happened is, there was good news and bad news, and it's the same news. The good news is that at one time all the talent was in PRA as it developed and was centered in the NRC and the national labs. Through the IPE program that talent has dispersed to the utilities, and the utilities are now using risk analysis much more than they ever have in their decision making process.

The bad news is that in that process the labs lost significant amount of their competence. The labs, at one time were very deep in PRA talent, are now almost uniformly shallow in that talent because that talent has, quite frankly, flowed where the money was. At the time of the IPE's you could get more money working for a utility than

you could for a national lab if you were a PRA person.

I anticipate that as the IPE's wind down to a close, there may be a migration backwards. More and more, the utilities intend to maintain their IPE's and use them as management tools almost. We are going to have a problem in terms of getting the intellectual guidance, intellectual superiority that we need in terms of guiding our programs. We have people who can handle the routine tasks, but I am a little worried about the intellectual leadership.

MR. TODREAS: Can I follow up just a little bit on that. In a sense, why care whether the intellectual base on PRA flows back to the laboratories or not? If you have leadership at the NRC and you need to do contract work, go to the organizations that have the technical competence to do it. It may not be the laboratories.

MR. MURPHY: I agree with you wholeheartedly. The problem is that the technical organization that is developing it more than anywhere else right now are in the electric utilities. The electric utilities have conflict of interest -- we have problems with our lawyers, and they are driving us crazy.

MR. TODREAS: I am not saying to go the utilities. There's a lot of independent company type activity there. You may have to go to those people in the research activity and not the lab.

MR. MURPHY: I think that's true. We are already heading that way, but we have the same problems with PRA.

MR. TODREAS: Well, universities have -- we have our own problem in this whole thing. Certain universities may be developing new people, and I don't know where they are going.

MR. MURPHY: There is a problem, as you well know in that, the universities who had active programs in PRA five to ten years ago was a significantly larger number than it is now. I am not sure why that is so. I think the problem is that it's hard to say that PRA is a discipline. Reliability engineering sometimes fits into the statistics departments and sometimes it's been in nuclear engineering departments. It sort of has been scattered, and never seemed to have a home that encouraged its growth in a lot of the engineering departments.

There are still universities that are producing good students in the area. The number of active programs has dwindled.

MR. ISBIN: Could you give us a breakdown of the different divisions that you have. For example, you mentioned generic engineering issues and IPE's and PRA's. Could we have the numbers?

MR. MURPHY: I don't have the precise numbers with me. Basically, they are about evenly spread. There's about

15 in each branch.

MR. ISBIN: Is generic issues eventually going to be finished?

MR. MURPHY: Let's hope. We are winding down in that area. Right before I came to this division there were two generic issues -- there was an extra generic issues branch. That has been folded in, and we are using the people who are doing generic issues, we are trying to use them in IPE reviews. That requires a training activity to get them ready to do IPE reviews, since most of them had limited experience in PRA.

Another activity that I probably should mention -- not through the office of research -- as a result of the activities of our PRA working group, our PRA training program has been transferred from our office of personnel to our technical training center in Chattanooga. We are in the process now of working with those people to develop a better training program that first starts off by analyzing what the needs of the agency are, and then tries to develop specific courses to meet those needs.

The program we have had in place for years has more an introductory course, a couple of two week courses from PRA that would allow general staff members to come in and become familiar with the terms and basic knowledge. It was not a detailed program.

We have a long term training program, and I think after a few years that's going to kick in. Then, where I am really going to need talent, I will need some intellectual leadership on the staff, perhaps more than I have right now. That, I am not sure I can train. That, I think I may have to import from outside.

MR. TODREAS: One other question. I have a feeling that people who staff the division you are talking about, with the exception of the PRA section or branch, are more of the generalist type. If you were looking to move that type of person back into the other technical focused branches in research, that flow is more difficult. Is that correct?

MR. MURPHY: It's somewhat correct, I would say. Actually, what I am trying to do is -- we have some people that, from the days when we had lots of generic issues -- let's put it that way -- we had some staff members that were very narrow in their scope, and they were working valves and experts in valves. What we are trying to do now is expand their horizons by providing training to them, so that they are broader in what they can work on.

MR. TODREAS: I see. They were focused on a generic, a typical generic issue.

MR. MURPHY: We have a number of generalists, but we have some people I am actually trying to make more

general. In the PRA area, actually, the best people for PRA tend to be systems engineers, as long as they have experts in statistics and things like that, that are behind them and can help them when they have a problem. A number of our people are generalists in that area as well.

As I said, what I am worried about there is, as we come into coming up with innovative techniques that we can use directly in the regulatory process, right now, the branch is not strong in terms of staff members as opposed to the branch management, in terms of somebody who you can really give something and turn them loose and figure they are going to come up with something new and innovative for you. We have one or two of those, but we don't have a large number.

MR. ISBIN: The decision with reference to risk based regulations is expected in what timescale?

MR. MURPHY: We are working closely with NUMARC and with NRR. I think we are in the process of trying to develop an integrated plan that says where we are going and what can be used. Right now, there are a lot of task forces underway that are exploring various aspects of it. I think it's going to be a continual process that is first starting out, and will continue over a couple of years.

MR. ISBIN: That's an area where this Committee really has not looked at in any depth.

MR. MURPHY: In terms of where the agency is going, it's still somewhat in its infancy. We are in the process right now of trying to develop an agency-wide PRA implementation plan. We have taken a very preliminary first cut as to what that should be. It needs a lot more work before it's ready to see prime time. It's an inter-office effort, and there's a logistical problem just getting the right people together in the room at the same time to make things happen.

We are moving down that path. Industry is moving down that path. I think what we are facing now is the question is, how far do we want to go. Industry is facing that same question. We are coming down to, if you will, the goodness of the data that we operate on, the basic reliability data that is available to us and the goodness of the models that are developed and the sophistication of them, is dependent on how you want to use them.

There's a variety of uses. There's a screening thing you might want to use in something like rated QA that doesn't require much in the way of advancement, it requires documentation of the right way to do it. There's things like the British have done at the Torness plant in Scotland, ESSM system that are almost risk meters. They modify their PRA as each component goes in and out of service and recalculate the risk. If you do that sort of thing, then

the precision that is required in your data and your models is much higher.

There's going to have to be a joint decision, both by us and by the industry, how far we want to go down that path. We are not there yet.

MR. VOGEL: It sounds to me like you are stretched awful thin.

MR. MURPHY: I agree with that.

MR. BECKJORD: I think that Dick's assessment is a correct one.

MR. VOGEL: The interesting thing too is, these are not problems that he's facing in the IPE's, and shifting risk based regulation. Those are --

MR. BURSTEIN: That will keep him busy a week or two.

MR. VOGEL: Yes.

MR. MORRISON: Eric, do you want to pick up the other division?

MR. BECKJORD: Brian, do you want to cover yours quickly? Then, I will ask Nick.

MR. SHERON: I have three branches, the reactor and plant systems branch, human factors, and accident and evaluation branch. Reactor and plant systems is the thermal hydraulic research. Human factors covers the human performance as well as the advanced digital I&C. The

accident evaluation branch is basically severe accidents.

The total staffing is about 51 people right now. I think my staffing levels is supposed to go to 50 at the beginning of fiscal year --

MR. BURSTEIN: What was that number?

MR. SHERON: I have 51 people on board, total, right now. I think my staffing level is supposed to be 50 at the beginning of fiscal year 1995, which would be next October.

MR. BURSTEIN: That's how many branches?

MR. SHERON: I have three branches. I have five SES, including Tom, myself and three branch chiefs. There are seven section leaders. In essence, it's two per branch, two sections per branch, with the exception of reactor and plant systems, and there are three sections there. We sort of inherited a section when we eliminated the advanced reactor branch, about a year and one-half ago.

The numbers are basically, reactor and plant systems has about 17 people, human factors has about 11, and accident evaluation has about 16. This basically translates into about 34 or 35 technical people. I count section leaders. They are supposed to be spending about one-half of their time on management and about one-half of their time on technical. Seven section leaders translates to about two and one-half managers, three and one-half technical people.

With that, you come up with about 34 people, technical people, to manage the contracts. I have a budget of about $34 million a year, and that's divided among about 34 people. On average, each project manager or each person in my division manages about $1 million which translates to about the work of about five people at a laboratory. There is some work as you know, some experimental hardware stuff, so that would reduce a little bit.

MR. TODREAS: Brian, I must add the 17 on the 34, to get back to your 51?

MR. SHERON: Yes.

MR. TODREAS: Then, I can --

MR. SHERON: I am sorry, I have seven in the front office. I have Tom, myself, two secretaries, two management assistants --

MR. TODREAS: Stop for a second. The 51 isn't just technical people. If you started with three secretaries --

MR. SHERON: I started with 51, total.

MR. ISBIN: Including secretaries and all?

MR. SHERON: Including secretaries, managers, technical assistants, management analysts.

MR. BOULETTE: How many secretaries do you have?

MR. SHERON: There's a total of five and one-half.

MR. MORRISON: I think they are trying to get to the number ratio for supervision.

MR. SHERON: The number you want is, I have 12 managers for 51 people. That's about one to four, total.

MR. TODREAS: How many technical managers do you have for technical people -- get the secretaries out of the discussion because it's just screwing us up.

MR. SHERON: As I said, there's 34 technical people and there's 12 managers. I said, it was a little bit lopsided because I did inherit an additional section when the advanced reactor branch was dissolved. We have maintained that as a section, that probably doesn't have enough people to warrant just being a section.

As I said, I have about $34 million. That translates to about $1 million per project manager on the average, although it's not evenly distributed. As I said, reactor and plant systems has about 17 people, total, which is about 14 technical. Their budget is $12.4 million. Human factors has about 11 total, so that would be about eight or nine technical, and they have a budget of $5 million, $5.5 million. Accident evaluation with 16 total or about 12 or 13 technical, and their budget is $16 million.

We have about 160 contracts active in the division at any one time. Just for statistics, that comes out to a little bit over $200K per contract that will manage, so that

will give you an idea of the dollar amount. Those are just the statistics, I guess.

With regard to where our needs are and the like, I think I would say that the severe accident branch is in pretty good shape. I don't have any qualms about that. The people seem to be managing the money they have, they seem to be doing a good technical job, as you all have reviewed the work and everything. We are pretty satisfied that the branch is moving along fairly well. I wouldn't ask for any more money or any more people. As a matter of fact, I will probably be looking towards a slight reduction perhaps, in money towards the future.

As I have said before in the human factors branch, that's where I got a problem. I have only two people that I would call I&C types. Yet, as you know, this is a fairly important area. I really would need, I would guess, two more people in this area and maybe three. It depends. I would almost see, as the human factors program has reached this mature level, I could almost see splitting, to have one section deal solely with human factor issues and the other section dealing almost exclusively with advanced digital I&C, sometime in the future. Right now, I don't have any people to use all this work that is fungible, that I can more from one place to another to pick up the I&C work.

The human factor people are almost psychologists,

in terms of their training. They are not engineers.

The reactor and plant systems branch, the thermal hydraulic, I have 17 people in there right now. I actually have two people that are working on CANDU which, if we were to pick up CANLJ, I could probably apply them there. They are mostly, their specialty is in the physics area. They are not necessarily thermal hydraulicists. Right now, as Eric said, I don't have any resources really to handle what would be necessary for CANDU.

In addition, for whatever reason with the codes and so forth, I think we need to enhance the reactor and plant systems branch with some new fresh technical talent in there. There is one individual in there who is not even an engineer, he's a computer scientist. He's sort of been placed there for a long time. As you can see, I can't really rely on that person to manage detailed technical contracts in the thermal hydraulic area. We try to use that individual as best we can, for more administrative type tasks or low technical challenging tasks.

In the same sense, barring the CANDU problem, even though I say I need new technical talent in there, I do not need more people in there. In other words, I don't need to go to a branch of 20 people. I think there are some people in the branch that, right now, if I were to be able to consolidate project management work in some individuals and

bring in some real strong technical people, these people maybe want to be transferred or rotated elsewhere in the office. That's something that needs to be considered.

That's sort of it, in a nutshell, where I am. Like I said, the hard spot right now is in the advanced digital I&C. I also have -- to close it out -- I also have two graduate fellows. As I understand it, once the graduate fellow goes off to college to get their advanced degree, they don't count against my staffing numbers. Right now, I do have a graduate fellow from Clemson, who just stated. He is supposedly an expert in computer science and were going to use him in advanced digital I&C. He counts against my staffing. He's getting up to speed, but come next August he's going to go off to graduate school for a couple of years.

As Neil knows, Jennifer Uhle, who is also in my division, is off at MIT right now for four years, getting her doctorate. Again, I do have some fresh blood that will be coming back into my division within the next several years.

MR. VOGEL: Brian, you said, I think, that one staff person essentially supervises five workers out in the field?

MR. SHERON: I am just using as an average, $200K per staff year at the laboratory. So, $200K times $1

million per person, that's five people.

MR. VOGEL: Out in the field isn't there a group leader, generally, to take care of the other four guys?

MR. SHERON: Yes.

MR. VOGEL: It seems to me that maybe this is management piled on management.

MR. BECKJORD: He's talking about contract management in that sense, I think.

MR. SHERON: I am just saying that the project manager is overseeing the work. When I say overseeing it -- as I said, the average contract is $212K. That's just about one staff year. It's not necessarily all in the same area. In fact, that person may be managing the work of four different people working in four different areas. When I say managing, they are overseeing it.

MR. MORRISON: It's not like a branch chief.

MR. SHERON: No, they are not a branch chief.

MR. MORRISON: I think that's the confusion.

MR. SHERON: It's contract management. They have to make sure that this person is working on the right stuff, that they are not going off on tangents, that they are not overspending and the like, and they are staying on schedule and problems are being identified.

MR. KINTNER: There is one question that's very hard to answer which is, are there any subjects on the

horizon that would change the whole emphasis within research in any one branch? Let me explain it.

There are several studies going on as to what do you do with all the plutonium in the world. Some of these studies are going to conclude that what you do is, you burn them in light water reactors. Suppose there was a decision made that you are going to burn mixed oxide fuel in light water reactors. Would that change the load significantly on research, and change the mix of people that you need?

This occurred this morning when we were talking about neutronics. It is a different mix, circumstance that's going to develop. There may be different safety issues associated with that. That's just one.

The other increment you have talked about is CANDU. But are there any other potential storm clouds on the horizon that affects this question of staffing --

MR. SHAO: I can give you one example of that. Recently industry and NRC are very interested in QA.

MR. KINTNER: In what?

MR. SHAO: Quality assurance.

MR. KINTNER: Again?

MR. SHAO: We just pick -- industry and industry propose to use so-called QA now, Appendix B right now.

MR. BURSTEIN: Why don't you study something useful, like decommissioning, which we are all going to get

into before we solve the QA problem.

MR. SHAO: NUMARC in their proposal, they want to use --

MR. BECKJORD: That's not research.

MR. BURSTEIN: I think that's an important question. What are the things that will have a significant impact. There are things like new fuel cycles and trend toward some earlier decommissioning than people thought. I don't know to what extent these will impose research burdens. I would hope that somebody might be thinking about that.

MR. SHAO: Decommissioning, also including decontamination too.

MR. BURSTEIN: That goes to another question that the Commission asked, are we anticipating enough or reacting to -- is the program staying ahead of the problems, or is it trying to catch up to the problems. I think there are some issues out there that we are not staying ahead of. I think that is perhaps because of resource constraints, not because we don't know they are out there.

MR. TODREAS: Before we get on complete new issues, what I didn't hear except right at the end was, in the systems area I thought you had a lack of technically qualified managers, thermal hydraulics, to really run the lab programs. Did you say it and I missed it, or do we

disagree?

MR. SHERON: I just didn't say it.

MR. TODREAS: Okay. I thought that was your biggest gap in the systems area. I am bringing this up because if it's true, I want to make sure that the rest of Committee hears it.

MR. SHERON: I think that was a concern. I think if you read the task group report, we indicated that one of the problems we saw was that we felt that our contractors were not getting strong management direction from the agency in this area, from that standpoint.

MR. TODREAS: The other thing I would like to bring up is, I think this graduate fellows -- whatever that program is and however you are able to get it going -- program is a very interesting and useful thrust for the future. Apparently, it's concentrated in this division. It is a way to build a track, to get new blood into the agency.

Was there particular reasons concentrated in this division? Is it a cutoff avenue? Could it be exploited by others? Is it an anomaly? What could we derive from the positive thing that you did to get it started?

MR. BECKJORD: Yes, we can do it. It isn't going to be possible to do it for two dozen positions. The numbers are going to be small.

MR. TODREAS: We are at two, but is like six to

eight conceivable, or is that even too high.

MR. BECKJORD: I think that would be difficult right now, in the mode we are in.

MR. SHERON: To answer Ed's question from before, the one area that is coming up for example is the extended burn of fuel. NRR just gave us a user need letter, asking us to look at our fuel models, to see what we need to do to validate them.

MR. KINTNER: That's a good example.

MR. SHERON: We have identified a program to do that. Unfortunately, that's one that took a delay because of the budget cut.

MR. MORRISON: I would like to come back to those issues after lunch. I think it would be better off to have Nick close out on the staffing issues, and at least we have that set aside. We still have the other division to cover.

MR. COSTANZI: The division of regulatory applications is comprised of three branches, the regulation development branch, radiation protection and health effects branch, and the waste management research branch.

The waste management branch does the research in the division for the most part. There are a few minor research efforts in the radiation protection branch, but those are small and I won't speak much to those. The waste management branch is comprised of ten technical staff.

Basically, it's earth sciences, geologists, hydrologists and the like. There are a couple of people with modeling background who assist in the management of code work at the center in the case of high level waste, and laboratories and universities in the case of low level waste.

The current mix of technical talents in the waste management branch seems to be appropriate for the tasks that we have before us. The high level waste, the primary focus of the effort is, as you well know, is on the site characterization questions. That's DOE's major activity at the moment, in developing a repository.

In the area of low level waste, the primary activity is focused on development of performance assessment tools for use both by the licensing staff and for use by the states, in licensing and monitoring and ultimately closing low level waste disposal facilities.

The budget for the waste management branch is both high and low level, combined, is on the order of $10 million. The dollar contract load per staff is on the average of about $1 million per staff manager. The average project size is about $300K, but there are some great variances. There are some projects that are twice that, and there are some projects which are only in the $100K area or less.

That's about all I have to say about that.

MR. MORRISON: Are there any questions of Nick, on the waste branch?

MR. TODREAS: The whole division -- are you going to go on to the rest?

MR. COSTANZI: If you wish.

MR. TODREAS: How many technical people are in the division.

MR. COSTANZI: The total number of technical people in the division is 50.

MR. ISBIN: How many?

MR. COSTANZI: 50, 5-0.

MR. TODREAS: There's ten in the waste, and how many in the health effects and how many in regulatory development?

MR. COSTANZI: 20 and 17, respectively.

MR. TODREAS: 20, in the --

MR. COSTANZI: 20, in the radiation protection and health effects, 17 in the regulatory development branch, and there are three outstanding vacancies. In the division, there are five SES, three branch chiefs, a division director and myself. Amongst those 50, there are five section leaders. There's an additional eight support staff, which includes secretaries.

MR. ISBIN: The 20 in radiation protection, I gather that you said that there's a minimum amount of

research?

MR. COSTANZI: That's right. There's a little bit of research, which is aimed at keeping abreast of the developments of radiation effects at the molecular and biological level. There is a little bit of research having to do with the hot particle problem. The bulk of the funds expended in that branch are for support of rulemaking, which includes development of reg guides, I should say.

MR. TODREAS: I'm switching back, is that okay?

MR. ISBIN: Sure.

MR. TODREAS: The 17 people in regulation development?

MR. COSTANZI: That's correct.

MR. TODREAS: Is that number a comfortable number to do the job, or too many, too few? I don't know what the level of press is there.

MR. COSTANZI: It's not a comfortable number at all. We have a backlog of regulatio.. There are new initiatives to improve the regulation process as well as improving the regulations themselves, making regulations less prescriptive and more performance based, alleviating burden. We have a backlog of regulatory activities, both in regulations and in reg guides.

There are a number of guides -- a great number of guides -- which have never been reviewed or haven't been

reviewed in many years, that really ought to be reviewed for their continued applicability and utility or trash canned. We don't have the resources to do that effort. We are just about keeping our head above water on the rulemaking with important safety significance, that are demanded by immediate safety issues or directed by Commission or in some cases directed by Congress.

We really haven't been terribly successful in working off as much of a backlog of rulemakings as we would like. We are making a dent in that area but it's precarious. We don't have much margin to do other things.

MR. TODREAS: The people who work in that area, has there ever been much movement into the rest of the office, or is this a special group of people working on regulations.

MR. COSTANZI: The answer is, both. Yes, to both. They are a special group of people. Yes, they have experience in the program offices, NRR and NMSS.

MR. TODREAS: I didn't mean that. To me, they are closer to NRR and NMSS than they are to other people working in research who supervise contract research.

MR. COSTANZI: I think that's a fair statement. There are a few people not in the waste management branch, in the division, who do have research experience and background, and who also have contract management background

in addition to the contracts that they are managing in the division, in those branches. By in large, the people in the regulatory development branch particularly, do not have a research background. That's less true in the radiation and health protection branch.

MR. MORRISON: Are there any other questions?

MR. ISBIN: Are these areas where the Committee should be involved or not? In the past, we have not really looked at any of these activities.

MR. MORRISON: I am not sure that's the exact statement. We have looked at them in the past, but infrequently.

MR. ISBIN: But not in detail. I mean, we have looked at them superficially. Are these areas where we should be actively looking or not?

MR. MORRISON: I think it's best to ask Eric his opinion of it, since our real role in life is advising Eric. Does he want to seek any of our wisdom, for whatever it's worth.

MR. BECKJORD: Well, we have included this for completeness, so that you could get the whole picture. I think that the regulation development part of the office runs according to a clock which is set by the Commission and by the other two key program offices. It seems to me that to the extent that the research program isn't closely

involved in that, it would be appropriate. Otherwise, I don't think it would be the best use of the Committee's time.

What I am talking about, you have reviewed license renewal, research and things like that, and research related to the certification of the advanced reactors. Most of the things that Nick is talking about do not involve research programs. I mean, decommissioning would be somewhat exceptional to that.

MR. BURSTEIN: I think that subject, plus the possibility that you might get involved into risk based regulation, might be of some interest to this Committee and might be of some benefit to you. Those are the kinds of new issues that we are trying to identify in this process, among other things, where it appears we don't have the capability right now to address them should they blossom in the near future.

MR. MORRISON: I would like to suggest that we break for lunch. What we will pick up after lunch is this whole discussion on whether the programs are staying ahead of the problems or trying to catch up, as well as the sacred cows and retention skills and technical disciplines, which was the fourth question.

Why don't we make it no later than 1:30 then, which gives us about 50 minutes.

[Whereupon, at 12:38 p.m., the committee was recessed, to reconvene at 1:30 p.m., this same day.]

AFTERNOON SESSION

[1:35 p.m.]

MR. MORRISON: Since most of are back from the Committee, I would like to reconvene. Ed Kintner has informed me that there will be two limo's to National Airport, leaving at 3:45. We will plan to try to recess about 3:30, roughly two hours, to cover the topics we would like to finish before we leave.

Let's start with the item that is listed on the agenda as retention of skills in technical disciplines, and then we will move back to some questions when the rest of the staff get back that are coming. Eric had planned to cover some items with regard to the technical disciplines.

MR. UHRIG: Are there viewgraphs?

MR. BECKJORD: Yes.

MR. UHRIG: We wouldn't want to miss a single word, Eric.

MR. BECKJORD: If I could have the first slide, please, George.

These are shown in two categories. The first one is the critical disciplines that we see emerging. There are two shown here. The first one is in the digital instrumentation and controls area, including the person-machine interface.

The person-machine interface part of that has

already emerged, I would say. The digital part is emerging rapidly now, both for replacement control systems for operating plants, and it's obvious that any new plant designs now are based on digital instrumentation. We have a very limited capability in that area now. We have several people who have worked in it, who have had experience in it, one of whom has been involved with the program that we have in Norway at the Halden reactor which has been working in this area for some years now. That's an international program, of which we are one of the sponsors.

It's a cost-effective way of funding a rather substantial effort, and it's done under the auspices of the OECD Nuclear Energy Agency in Paris. We have been supporting work there for some years. In terms of the application to U.S. plants and licensing actions, that is the part that is emerging now. I think we will have to strengthen our effort in that area.

MR. MORRISON: Eric, before you leave that, could you make a comment as to whether that capability exists elsewhere within the NRC. Does NRR have some digital capability?

MR. BECKJORD: NRR has about a dozen people in this area. I don't know how many of them have had some experience. There are a few, who have had lengthy experience. John Gallagher's name has been mentioned

already. I know some of those people but I don't know them well. I don't know what the depth of the experience of the rest of that branch is.

MR. SHAO: Advanced I&C branch.

MR. BECKJORD: Yes.

MR. SHAO: Jerry has recently been transferred to a new branch, Jerry Wormeil. His background is in systems, again. Jerry Wormeil's background was in systems.

MR. BECKJORD: That's why I say, I don't know the detailed background of the other people. We have two people who have worked in the digital area and we have one person who works on the engineering aspects, the effects of the environment, Christina.

There has been a discussion at length between ACRS and NRR, on the requirements for new plants which will incorporate digital systems. The ACRS recommended last spring that the Commission go to the National Research Council and get them to put a workshop together, and get a report of advice on the use of these new systems.

I think one of the reasons for that was that -- there were several reasons. One was, I think NRR's initial position in this area was that digital systems would be fine if there was an analog backup. I think this was the main point that was troubling to the ACRS. That position was changed. While this was going on last spring, we had

already planned for and were organizing a workshop on digital systems.

There were two or three main questions that were posed for discussion at that workshop. The first one was, let's discuss all of the opportunities that digital systems make available. That is, not only the controls but expert systems, the neural networks and that type of thing as well. The second area was, what are the problems that could lead to safety concerns about these systems. In particular, how to deal with the problems we know have occurred in nuclear and other systems due to undiscovered programming areas and this type of thing, and what should be done about the problems of environmental disturbance.

We had that meeting in September. It was jointly sponsored by the NRC and the National Institute of Standards. I think it was a reasonable success. It did not satisfy the ACRS. The ACRS attended it -- I would say a good half dozen of the ACRS members were there for the first half day of a two day workshop. Only one of them stayed on beyond the morning session, at least I only saw one who stayed on.

Their conclusion was that the Commission should still go ahead and go to the National Research Council. This letter came forth in November.

The Commission decided fine, we will go to the

National Research Council and we will have a study. I have been working with the Commission on Engineering Systems, Arch Wood, and Dave is well acquainted with that Commission and with Arch. We have met with Arch Wood and with -- the man's name is --

MR. MORRISON: Dev Mani.

MR. BECKJORD: Yes, Dev Mani. We have given them the ACRS letters, we have given them the proceedings from the September workshop that we had, and various other background information. We had a very good session with them, kicking around what the agenda should include. They are preparing a draft prospectus.

What we have asked them for is to organize a workshop on these topics that I have outlined, and these are essentially the same topics that we discussed with them. After the workshop they will have formed a Committee which will arrive at a consensus, and give the Commission advice on essentially best use of digital systems and what matters should be given particular attention in a regulatory framework.

I hope that we will have a contract by the end of the month on that, so that they can get going. They will have about an eight or nine month schedule to hold the workshop, and then after the workshop it will take them another five months to get the consensus report out. That

takes a fair amount of the time, that is, developing the consensus. First, they develop the consensus and then take the final report to the National Academy's review committee.

MR. TODREAS: Eric, do they start on that report business -- does that five month period just go after the meeting, the workshop, or does it start before that.

MR. BECKJORD: As I understand it, they form the committee before.

MR. TODREAS: They get them started.

MR. BECKJORD: They get them started. But after the workshop is over, then the Committee meets and they develop their consensus. That's probably another meeting for them, possibly. Then, they write a consensus report. That takes up just less than one-half of the five months. The other half is getting it through the National Research Council procedure. You were at the NIST meeting weren't you, in September?

MR. BOULETTE: No.

MR. UHRIG: I was there.

MR. BECKJORD: You were there, okay. Do you have any comment on that?

MR. UHRIG: As I commented yesterday, it sort of -- there were two themes here, that were in contrast with each other. One was the fossil group saying we are going ahead. There are no great problems, what are you guys

hanging back for. The other group was the theoretical people, who basically kept expounding on all of the problems associated with verification and validation. The conclusion that one would get by listening to them is, you can't get there from here. The truth is in between.

I think there was a pretty good exploration of what is out there and what's going on. I don't think there was any attempt to draw conclusions. I think there was limited discussion, because the program was packed with people. They only allowed a very short period for discussion. I think that was perhaps the major concern that I had, was the inability to really draw any conclusions from the presentations.

It was a well organized meeting and a good program, and very informative. I am looking forward to the proceedings. There was a lot of good material presented there. I think it was a good first step.

MR. KINTNER: Eric, are you going to try to broaden the topic, the way we discussed in our letter to you yesterday?

MR. BECKJORD: I am sorry, to broaden it?

MR. KINTNER: Yes, the long conversation that we had, to look at total system perspective and not just the software/hardware part of I&C systems, try to find some over arching role and so forth? We have talked about that for a

year now. Just this morning, Brian said he's thinking now he can separate human resources back out from instrumentation and control.

Somehow or another, nobody understands what the hell we are talking about. Maybe we just don't know ourselves what we are talking about. If this is something which is not important and it's foolish to try to achieve it, let's get off it and forget it. But here is this Committee, working fairly hard now for over a year, trying to put down words that press towards this total system approach starting in the human resources all the way through the machine, to get some over arching understanding of the implication to reactor safety and totality of modern equipment.

Somehow it doesn't catch on. In our recommendation in the letter which I signed this morning after we discussed it yesterday, specifically asks that the topic be broadened to include that. You don't intend to, you do, or what?

MR. BECKJORD: I guess --

MR. KINTNER: I don't know what we are doing. I don't know what the Committee, what purpose it serves, if we try to provide this kind of suggestion and guidance and nobody pays any attention to it.

MR. BECKJORD: What should be the direction of

that? Do you believe it should be in prescribing the approach that the license applicant should take on overall systems design?

MR. KINTNER: No. I think it is somehow to get somebody, somewhere, to begin to understand the implication of the modern systems to the totality of reactor safety. It goes beyond what is in aircraft, it goes beyond what's in the fossil plants. You have the human on the one side and the plant on the other, and there's a huge number of questions of how you interrelate these two through these modern systems.

That whole question, that very difficult one to even define but you can pick out individual pieces of it, that's what I think the ACRS was trying to say in different words; that there should be a new approach to looking at this subject.

MR. MOLZ: Didn't somebody say a while ago that there were only two people in instrumentation and controls, two I&C?

MR. KINTNER: Yes, that's right.

MR. BECKJORD: In research.

MR. MOLZ: In research, that's right.

If a program were going to be developed, a research program, you would have to increase that number. Wouldn't you say that you would need more than just two?

MR. KINTNER: Let me be very blunt. The people in that organization don't understand what we are talking about, and they couldn't if they did understand, couldn't put it together, could not put it together. The combination of the human to the machine through the instruments, they couldn't put it together.

MR. MOLZ: You are talking about the two existing people --

MR. BURSTEIN: Who can? In all honesty, this agency -- say, okay, maybe that's an admitted circumstance. How do we recommend to them something --

MR. KINTNER: So, the letter imported two suggestions. One of them was from the ACRS, which was to get some people who might -- maybe -- can find some experts somewhere that understand this question and start looking at it in that way. I think that's what the ACRS has been pressing for. I think that's what we have been pressing for.

MR. BURSTEIN: To integrate those research programs?

MR. KINTNER: The other one is to integrate the research programs. Maybe there are different -- maybe there are better ways. I know what I would do, if I had the job of doing it. It's very clear in my mind what I would do.

MR. BURSTEIN: Carry on, if I may, Mr. Chairman,

to the question that Eric just asked. Would that result in an awareness on the part of RES staff as to what is possible, and be able to hit the ground running if some application comes in or some request comes from NRR. Or, should it end up in some regulatory requirement guide, specification, request --

MR. KINTNER: Both.

MR. BURSTEIN: That, this is what -- if you are going to come in with an I&C system employing digital --

MR. KINTNER: It's both.

MR. BURSTEIN: Phenomena, it ought to include these things.

MR. KINTNER: It's both. They are going to get -- they are already beginning to get things to be certified and approved from a broad perspective of overall control. If there's going to be anymore reactor plants, it's going to be there. Somebody has to think about it in these kinds of terms, from the regulatory point of view.

Let me just make a stupid, simple way. One conclusion I might reach is that I would forbid that you can with one finger start the main feed pumps. That's one example. I would forbid it.

MR. BURSTEIN: Why?

MR. KINTNER: Because it might be unsafe in a modern circumstance. When I say start the main feed pump I

mean get the whole system up and running.

MR. BURSTEIN: That's not what you said.

MR. KINTNER: I didn't. I was exaggerating, for effect. That's what is coming. That is what in fact people are now bragging about being able to do. They are bragging about being able to run a reactor plant -- this is one of the things that Bob pointed out -- the operator is nothing more than an overall supervisor. He sits up there in the office and --

MR. BURSTEIN: They are not going to have him, if he's just going to sit there.

MR. KINTNER: Somewhere in all of that is the right way to run a reactor plant with modern equipment. That subject is not being addressed.

MR. BURSTEIN: I think what we are trying to do, Mr. Chairman, is to get Eric to respond to the letter before you have signed it. That is, the I&C report. Maybe that's a little bit unfair. With that as perhaps an acknowledgement, the question of what this bullet comprises and how we approach it, might have to be redigested, in view of what our Subcommittee report endorsed by this group yesterday and today says to you and how you respond to it.

MR. MORRISON: I agree with you, on the procedure, we may be putting things in the wrong order. I thought it was appropriate in that this National Academy study is still

in its shaping process or may still be in its shaping process.

MR. BURSTEIN: It may be appropriate for this Committee to seek to make a presentation to the NAS or the NRC group, the National Research Council group.

MR. MORRISON: In essence, it goes beyond that, if they are already starting to conceive of a workshop and identify committee member. If you have selected the committee members who are only the digital folks, digital control systems, then you have ignored the human factors aspect of it. That will be hard to recoup at a later stage of that study, especially given an eight month time horizon.

MR. BURSTEIN: That's the other aspect of this item that I think we have not yet discussed, the human factors process, which I think Ed was trying to get us into. I think we have head from Brian earlier as to the work that is going on in this area and the concern that this Subcommittee had, that it wasn't adequate enough.

I guess I don't know what your response to those issues are at this moment.

MR. BECKJORD: I certainly don't want to attempt to respond in detail to the recommendation before I have received it. What I think I can say Ed is, I am agreeing with Sol on that point. I am willing to explore ways of responding to that recommendation. It seems to me that the

line that might make some sense would be to look at something like the general design criteria and say, is there anything that we ought to rethink in the general design criteria for reactors as a result of this new opportunity.

I am a little leery of the words because I saw them before, the arching responsibility, over arching strategy. I have been on both sides. Most of my life I have been in development. What I know, from my own experience on both sides is, innovation does not happen from within an agency like the Nuclear Regulatory Commission. I don't think it should, either. In fact, it's even excluded in the background in the enabling legislation, for the reason that the agency shouldn't be developing and regulating things at the same time.

If there's a way to approach what you are talking about without impeding development, then I would be willing to try to do that, Ed. I am seriously concerned about giving a technical organization here a charter to do something, which might impede technological development. The job here is to review applications. It is not to develop systems.

I think there's a line there that one could cross over, and it would be --

MR. KINTNER: Let me pick this up, because I don't disagree with you at all, as far as that's the history and

that is the purpose. If you look at the circumstance today, the one difference which is in any sense applicable for or against safety in operation of reactors, is that one. It does involve a completely new set of relationships between human beings and the reactor plant, through a complex set of computers and presentations on screens and so forth.

It's a different situation, and it is not going to be looked at in this broad kind of way unless you guys do it. It's going to have, one way or another, safety implications. I know what the vendors are doing. They are building these beautiful mock up's and leading you there and saying I can do this, this and this, and this isn't that great. You only need two people, one guy sitting up here and one guy back there. That's all you need.

That's not the right answer. There has to be a broader view taken at somewhere in the very beginning, at the outset.

MR. BURSTEIN: I have sympathy with Eric though. It's not his job to critique that kind of an application. If it comes in from a vendor and says this is what we are going to do --

MR. KINTNER: Forget it.

MR. BURSTEIN: It's not NRC's job to say that's inadequate.

MR. KINTNER: Forget it. This Committee, on two

occasions -- and I am not the only one -- lent themselves to making a specific issue out of that point, that broadening point with regard to digital equipment and its application. Nothing happened from the last time, nothing. It isn't understood yet, he's going to separate human resources out from instrumentation and control. The man-machine interface is going to be split again.

If that's the way it's going to be, let it be that way. But I don't know what in the hell this group does. I don't know what we are for.

MR. MOLZ: What about the Electrical Research Institute, are they studying this problem?

MR. BURSTEIN: Yes.

MR. KINTNER: They have some research that bears on this.

MR. BURSTEIN: But they are not going to make an application. They are not going to submit a design, except through the advanced reactor AP-600 or SBWR. So far as I know, whoever submits that design will include some kind of instrument control system. From what we have heard, it would presumably include digital systems.

MR. KINTNER: Sure it does. It has a lot of rules, or at least requirements in it that are intended in this direction. I don't know why, if the National Academy is going to study this subject of the question of the

Committee, instrumentation control of modern digital systems, shouldn't also be asked how that relates to the human operators. What is the objection to that?

MR. BECKJORD: We discussed that point with Arch Wood. His view was that that was really two studies. He felt that there were plenty of issues to deal with on the digital systems in software itself, and that bringing in the human factors was for one thing different people.

MR. BURSTEIN: It was a different commission.

MR. BECKJORD: A different commission, yes.

MR. KINTNER: I will change my letter so that it doesn't --

MR. BURSTEIN: I would object to that.

MR. KINTNER: There's no point in --

MR. BURSTEIN: This Committee approved that letter. You want to convene another motion to rescind that let's start again, but not this Friday.

MR. MORRISON: I don't think we want to try to reopen that subject, because we really can go back to the letter that was written on January 28, 1993, a year ago, that contains a paragraph: "an agency-wide strategic vision of the concept of integration of the human hardware and software aspects of reactor control and operations must be developed and clearly articulated. Such a strategic vision is an essential first step, if NSRRC's recommendation in its

November, 1992 report is to be achieved. That is, criteria to define what is meant by improved safety needs to be established prior to undertaking major expenditures or function allocation research.

The management process must proceed from a shared vision, to the establishment of requirements and to the setting of criteria. Research programs can then be defined and performance expectations can be set for individual research projects."

That dates back to a year ago. I think all that we have done is reinforce that in the report we approved yesterday.

MR. MOLZ: It seems to me that that is necessary for regulation. If people are going to come with these new systems proposed and we think there's a significant safety issue involved -- which I suspect there is -- then you need to have the basis for making the judgment. Otherwise, you just rubber stamp it.

That's the way that mistakes get made. Things that kind of fall -- the Academy does something and EPRI does a little bit, and something gets in the middle. What we are violating with this instrumentation and control is, if this one isn't broken, don't fix it. The other systems all worked for years.

MR. VOGEL: Some did, some didn't.

MR. TODREAS: I want to say something, because I don't think we are going to be talking about this much longer. We do have this letter that is going to go to Eric and Eric is negotiating something. Eric is sitting there thinking, he's negotiating with Wood and he's going to come back to us, so I would like to say something for you to think about as you do that.

I can conceive that as you set this thing up that there are certain practical constraints, certain negotiations with Wood, that you may get pressed to compartmentalize certain things. But you will, in my opinion, make a really bad precedent if the compartmentalization is not cast and framed within a broad overall context of principle, which is what we are talking about, and that whatever this study is, it may be a piece, there may be another piece, and eventually -- not too long -- the whole thing does get put together right.

If this National Academy study gets sent off as the study and its scope is too narrow and the framework and the context of that isn't made broad enough so that people realize it may be narrow by design by that isn't the whole picture, we are going to be lost and frustrated, in terms of everything we have accomplished.

MR. BECKJORD: My thought is that if you send me the letter tomorrow I will take it down to Arch Wood, and we

will talk about it and see what he thinks.

MR. KINTNER: I guess he just has to pass it on to you.

MR. TODREAS: If Arch Wood's motivation is to frame a study that he can get his arms around and he can do and budget in a period of time, his motivation in my opinion is not to look at nuclear power to envision the future systems and figure out what's really right to do and how to do it, you have to push him on that and hold him to it. That's going to be tough.

MR. BECKJORD: That's a big order.

MR. TODREAS: And, get the job done in 13 or 14 months.

MR. BURSTEIN: Is there anything more to be said about human factors at this point?

MR. UHRIG: Maybe to just come back to something that Dave said here.

MR. BECKJORD: But you don't disagree, to raising this with Arch Wood.

MR. BURSTEIN: I think it's essential. I think that Neil has said exactly what the issue is. If it's an incomplete study and not defined as to its limits, then I think it will be deficient and people will label it as such.

MR. MORRISON: I suspect that even if it is that, what we will really have proved is what we were talking

about yesterday, that you have wasted another eight months or a year to get started.

MR. BURSTEIN: It appears that that's on the horizon anyway. I think with all due respect to the frustration of our coming Chairman, it's unavoidable at this point because the Commission has so decided.

MR. KINTNER: It has decided what?

MR. BURSTEIN: Decided to what for the NAS to give us a report, which will say pretty much what you just said in your letter.

MR. KINTNER: If I understand correctly, he's trying to carry out the Commission's direction, and he's going to carry it out in terms of his negotiations with Arch Wood, not to include the --

MR. BURSTEIN: No, that's not the case.

MR. KINTNER: It isn't?

MR. BECKJORD: The ACRS pressure on this, as I understand it, has not related to the human machine interface, the person-machine interface. It was on that basis that we opened the discussions with Arch Wood's Commission.

What you are telling us in the letter as of yesterday is that it ought to be in there. I will go back and talk to him about it, and see what we can work out. I don't think that Arch is not inclined or that he feels

that's not an important aspect. I think he was thinking in terms of framing this one study and responding to it. If we are wrong about that, then we should go and fix it.

MR. BURSTEIN: I think you ought to pay very close attention to Neil's words about what you may expect in that discussion.

MR. TODREAS: You fixed ROSA, you have RELAP5 on the way to be fixed. Here's just another one.

MR. BECKJORD: Wait a minute. I am not sure about that. I just want to make sure I understand.

MR. SHERON: I would want to remind the Committee, that the genesis of the ACRS letter and stuff, from my understanding was, NRR had taken a position early on that in essence required an analog backup to any digital system that was installed.

MR. BECKJORD: That's what the ACRS was reacting to.

MR. BURSTEIN: But you remember, we had a member on this Committee last year by the name of Wood, who spoke very pointedly towards some of these concerns and the factors that Ed and others have elucidated clearly. I don't think it's necessary to repeat those.

MR. KINTNER: Not very clearly.

MR. BURSTEIN: What may have motivated the ACRS is a very limited part of the question as this Committee sees

it. We think you ought to be aware of it, because you are only delaying for another year or two the inevitable realization that this is something we have to deal with as a system, and to have some kind of a strategic view of over the long haul. There's just no other option. You can't buy analog systems anymore, so you are going to have to deal with it.

MR. BECKJORD: I guess I would just come back once more. Maybe I need to discuss this with you at some greater length. The concern that I have is when you ask us for an over arching strategic vision and we start to go to work on that, that people in the organization may read that as a request to specify in some detail what the design principle is and the design goals of this thing ought to be.

That's very difficult for us to deal with in a way that is not going to become overly prescriptive.

MR. UHRIG: Aren't you really talking about what Dave mentioned here before, getting clear back to the general design criteria? This is a change of direction. This is the one difference, the major influence on safety. It may be some sort of change in the general design criteria to accommodate this new technology.

MR. BECKJORD: That's right. I think that's a valid way for us to approach it.

MR. UHRIG: It's a mechanism to bring this in

somehow.

MR. BECKJORD: Is there anything that we should do to the general design criteria.

MR. BURSTEIN: That would be responsive to this environment, of a strategy in a fundamental regulatory document.

MR. UHRIG: That's well within the scope of what your responsibility is.

MR. BECKJORD: Yes, I think that would make sense.

MR. BURSTEIN: It is a mechanism --

MR. BECKJORD: That is not being prescriptive.

MR. BURSTEIN: Yes. GDC's are not prescriptive.

MR. BECKJORD: Yes.

MR. BURSTEIN: Neither are strategies, as a rule.

MR. UHRIG: Usually not.

MR. BECKJORD: We will try to do it.

What we have in mind in this phrase here, technology for advanced reactors including the non-AWR, is pretty broad. I think the near term -- let's face it, what we are talking about is the near term and the expectation of what will be required in a Commission decision on the CANDU. Clearly, we will have to be thinking more about core physics and that type of thing.

As we look to the other advanced reactors, then there are clearly the technologies, the sodium and high

temperature gas. I have to tell you, I don't think that's near enough on the horizon for us to be doing something specific about staffing up in that area. We have a lot of other things to do.

MR. BURSTEIN: I think I, for one, would agree with you. I am also aware of many discussions -- and we have touched on this use of mixed oxide fuel and different fuel cycles -- clearly, there are many movements afoot through the political or other processes to utilize these stocks of recovered weapons materials, either uranium or plutonium, or both. And their use in non-light water reactors is gaining momentum in a number of quarters.

Several reports have been made and several others are due out shortly. It would seem to me that your office is aware of these. The extent to which you set aside any resources is another story. I guess at this point I can't suggest that you don't. It helps us respond to one of the Commission's questions, about whether we are ahead of the events or not. The answer is that we can't be with these resources, as I see it.

That's one of those issues that we identified as likely to come down the road in the next few years, for which we will have to have a quick response at the time.

MR. BECKJORD: If we are increasing our core physics capability, thinking of light water reactors and

possibly a CANDU, does that address what you have in mind in these advanced fuel cycles, or do you think somebody is going to come in with an application for a license for a non-light water reactor to burn?

MR. BURSTEIN: One of the ideas associated with waste disposal was the burning of actonides, is one example. I think that may have died temporarily, but it may resurface next week from other sources. I don't know of any such programs. Maybe your physics work would be enough from which to spring these other needs or disciplines.

MR. TODREAS: I think definitely the strategy is, you build up for your basic needs that you can see now, and then there's a whole plethora of these other things that are possible. Most of them will never materialize, and you can probably cover them.

The other big thing though is, I think it is fuels and materials, clad corrosion, the fuel itself in terms of burn up and things, but you have that covered from the extended burn up program. If you take care of the basics --

MR. BURSTEIN: Are you talking about core materials or other materials?

MR. TODREAS: You have a different fuel for them, but you stick it in. There's zirconium clad, and you still try to go to high burn up. All that is covered under the fundamental disciplinary base of existing light water fuels

taken to higher burn up.

If you do a good thorough job of getting your fundamental capabilities for light water reactors and commercial light water reactors and the directions they will go to, I think you can cover these other things.

MR. BECKJORD: Should we go to the next page, then.

The critical disciplines, there are a bunch of disciplines here. I think that as I see it, we will be maintaining capability in these areas. I would expect that we would maintain capability including staff capability, certainly, in the thermal hydraulics and transient analysis, PRA and reliability for risk based regulation, severe accident analysis and containment performance including the structural performance of the containments, materials and structural performance for vessel components.

MR. TODREAS: Can I stop you at that point?

MR. BECKJORD: Yes.

MR. TODREAS: Those are the four reactor engineering fundamental disciplines, before you get into the others.

MR. BECKJORD: Right.

MR. TODREAS: You don't really have a fuel materials.

MR. BECKJORD: No.

MR. TODREAS: That was actually the point I was making. If there is anything reactor based on plutonium disposition, a lot of that will involve fuel forms or new fuel forms with diluents to get rid of the U-238 so that you don't breathe more as you go in. We do have the extended burn up direction for existing light water reactors, so I think maintaining fuels capability, fuels performance capability, that's the inside and the outside on the cladder.

MR. BECKJORD: Okay. Yes, I will accept that. There are additional areas that geological sciences, there's two aspects of that. One is the seismicity related to reactor siting and also to the response to seismic disturbances, structural response to seismic disturbances. That is one part of it.

The other part of it is related to the high level waste repository.

Human factors I think is an area where we have to maintain a critical mass. Radiation protection and health is another one.

MR. KINTNER: Health effects, who handles that in RES?

MR. BOULETTE: That's under the Division of Regulatory Application.

MR. KINTNER: How many people handle health

effects?

MR. BOULETTE: He has 20 people.

MR. KINTNER: In health effects?

MR. BECKJORD: No, we have -- there is a Radiation Protection and Health Effects Branch which deals with these questions that is very much involved with the Nuclear Material Safety and Safeguards because of decommissioning.

We have sponsored a low level of research but I think important work in health effects and it relates to low level exposures. We have done work on the exposure to the fetus. We have supported a radiation biologist at the University of Colorado on low level effects.

It is not a lot of money but in several instances the results have been important enough to interest other people in getting involved in it.

I think we will certainly continue to have a radiation protection capability and a small capability to be able to manage the level of effort that we have in health effects. It is not a large amount but it is important.

Now the question is, do you maintain a critical mass in each one of these areas. As I see it, my expectation is that we clearly maintain the critical mass in the reactor disciplines and a small group that we have in seismicity and structures.

We will maintain some capability on the Staff in

human factors and in the radiation protection part but I think that we will also, part of the plan has to be to rely on laboratories and to the extent that we can, universities, for experts as well, because we can't cover the whole front ourselves.

The final two that are listed here, environmental sciences and economic analysis, we really do not have. We have a couple of people who have capabilities in this area and I would expect that we would maintain the level at about where it is in those two areas, but we have work going on at Battelle, Northwest, and a couple of other places -- at Oak Ridge in the environmental assessment area -- and we will attempt to maintain our ties there so that we can put together a project to do an environmental assessment, which occasionally we have to do and also economic analysis.

MR. HATCHER: How are you going to be able to, if you take most of the people from the outside, how are you going to be able to evaluate the work that they do, say you have one discipline that is totally lacking?

MR. BECKJORD: Well, I think, and what Neil pointed out, is that fundamental reactor disciplines I think that we have that capability. When you come to some of the others and certainly the environmental aspects, we don't have that kind of expertise and that is the kind of thing that we expect to get from laboratories and universities.

I think you can do that. I mean you can put teams together for specific projects and that is far more efficient, doing it that way, than trying to maintain a high level of capability which you can't support.

MR. HATCHER: I was thinking more not in terms of doing the research in-house or doing activities in-house but just being able to evaluate the results.

MR. BECKJORD: Well, you can do that. I mean if you have access to people, you can go talk to people who can evaluate it for you.

MR. HATCHER: Or you could, I suppose, put together a review team from the outside as well?

MR. BECKJORD: Yes. We do that on -- I mean even in areas where we have a lot of capability, in severe accident analysis, there are problems there that we really don't have the kind of in-depth expertise that is needed to focus on some of these, the steam explosion problem, that's a highly specialized area, so we go out and we form groups to work on it and we interact with them and we elicit expert opinion that way.

MR. HATCHER: Thank you.

MR. BECKJORD: Well, this page right here is the ways that we're going to do those things.

We are, as you have heard, we are going to build, we intend to build the core physics capability and the

digital instrumentation control capability.

Commissioner Rogers is one who has thought about a technical knowledge function and he has advocated that Research get more involved as becoming a repository, not so much a repository, having a group of people who are aware of where the cutting edge is in each one of these important areas. He is pushing very hard for us to get more involved in that.

MR. TODREAS: Does he say how to do that? I mean does this go back to writing papers and doing original technical work?

MR. BECKJORD: The last discussion I had with him on that subject he did not include that in the scope as he saw it because he recognized that we --

MR. TODREAS: -- we could only go so far.

MR. BECKJORD: We could only go so far, yes.

MR. BURSTEIN: This is part of the discussion, Mr. Chairman, we need to have, and that is is there any other way besides doing the work of maintaining expertise?

MR. MORRISON: That's a good question. Did you want to comment on it or shall we solicit that in writing from the committee members?

MR. BURSTEIN: We might get some fuller expressions if you hold out long enough.

[Laughter.]

MR. MORRISON: I think it is a very valid question.

MR. TODREAS: I don't think the person here in RES to be that has to be doing the work. I think if he's got a task that is of sufficient depth that's laid out as his agenda and he's got enough money to contract people and he technically follows and directs their work, stays on top of it, he can integrate all that and for a good period of time that he is engaged that way, if he is motivated and intelligent enough he can stay at the cutting edge.

MR. BURSTEIN: Is that the only way?

MR. TODREAS: Probably not.

MR. UHRIG: Well, there has always been this review function, the various DOD research agencies have people stationed around the world where they spend their full time going out and assessing technologies in specific areas and this is one way to at least stay up with what is going on. It doesn't perhaps keep you at the forefront but at least the agency had a knowledge of what was going on, so that is one approach. Research has people in London and Paris and Moscow and wherever.

MR. MORRISON: I think that is one dimension but I was thinking Sol's question and Neil's response dealt with a much narrower issue of a person who spends all of his or her time in managing contracts rather than being in the

laboratory or at the computer trying to do something.

Is there a difference in those skills --

MR. UHRIG: Oh, yes. Brian this morning alluded to a technique that he is implementing which I think has some hope to help this problem, concentrating the administration among a couple of people to give the others time to get in depth, more in depth in studying the technical areas. That may be a valuable strategy. I think it is very well worth trying.

MR. BECKJORD: I guess I think we are at kind of a juncture right now, on the one hand with the resource question, which we talked about this morning, and on the other hand with the basic question of how to maintain the key technologies and how do you maintain expertise in them, and then what about the new ideas that are forthcoming?

I think that it is a good time to be thinking about that and to see what we can incorporate and make part of the capability of the organization.

I don't think that we can do everything that the organization has been doing and to take on a lot of new activities and somehow accomplish this realistically with declining resources, but I do think it is an appropriate time to look at the opportunities and develop a new list of priorities and say, okay, here are the four, five things we are going to concentrate on and there are a bunch of other

things that we are going to drop and we are going to concentrate on these and do a good job.

I think it's a good time to put it on the table.

MR. MORRISON: Sol, I would submit a very simplistic yardstick to measure this is that this is a regulatory agency and the science and technology is done in support of regulation.

Your science and technology is lacking if those that are being regulated win more cases than they lose.

MR. UHRIG: Well, I don't think it is a win or lose situation.

MR. MORRISON: But if your design criteria, if your judgments are overruled all the time because the other side can bring greater science capability to the table than you have been able to do, I would certainly question whether there is enough science and technical capabilities within the agency.

MR. BURSTEIN: But there is one other thing besides science and technical capability that enters in. That is authority, and there is one side of that table that has all the authority and the other side don't have "nuttin," so --

MR. MORRISON: That's why there's lawyers.

MR. SHERON: That's the way it should be.

[Laughter.]

MR. BURSTEIN: I think this has been a fantastic discussion. I would like to continue it, but I think we've got an hour left, Mr. Chairman, if I may say so, and I think we could ask Eric if there is anything more that he needs to add to this phase before we get into whether this committee is properly qualified or other sacred cows that might surface.

MR. BECKJORD: No, I don't.

MR. MORRISON: This finishes your discussion on the technical backgrounds?

MR. BECKJORD: Yes.

MR. MORRISON: Well, we've talked. I don't think I need to say more about that, George.

The last point on your last viewgraph though I think may be worthwhile considering, because it seems to me that's something that at least in the couple meetings that I have been present or at with the Chairman on the value of developments from outside the nuclear field as well as within, I had the sense that Chairman Selin very much believes that maybe NRC does not have to develop a strong capability in digital I&C because you can get that elsewhere.

MR. BURSTEIN: That is probably true of most disciplines, Mr. Chairman, I might observe, and yet when we talk about this business of independence and objective not

motivated by these extraneous events, it's hard to come by.

MR. MORRISON: The context is certainly different in the nuclear industry than it is in many others. Unfortunately, the digital I&C has been developed in other industries and applied well in advance of when the nuclear industry got it so it's a question of flagging and leading in this particular area.

MR. BECKJORD: Well, it seems to me that if you try to define the capability that is needed, I don't think you need the kind of capability that is involved in developing improved software or in new systems configurations but I do think you need to have people who understand it well enough so that they can pick out what the problems are and find out if the solutions that are offered are reasonable and what the proofs, you know, what should be the proofs.

MR. HATCHER: If I could add, one thing that is inherent in all this discussion as I perceive it is the question of whether or not we proceed as a group, that the technological advances in the near future and the far future may be not made in the U.S.

Are we willing to accept that, or do we need to maintain that kind of edge? This was brought up once before, and also I think that should we concede that maybe the French for example, who are going ahead with a major

nuclear program or actually already have, and are in the process of getting ready to export their technology and other things as well, should we just concede to them that they are going to be the developers of the next generation of nuclear reactors, nuclear technology if it ever comes back to the U.S.?

MR. UHRIG: Even if this happens, Bob, you still have to have an independent capability, the ability or access to the expertise to assess that in terms of U.S. regulatory goals.

MR. HATCHER: Right.

MR. BURSTEIN: And also it is going to be licensed in the U.S.

MR. UHRIG: Yes, and the licensing is going to be done here, no matter where the technology comes from.

We buy digital instruments from Japan all the time now. In fact, there are things you can't even buy in the U.S. --

MR. HATCHER: TV sets.

MR. BURSTEIN: Mine come from Singapore.

MR. ISBIN: I would suggest that somehow we have gotten the thought across that the French and others are far ahead, but if you look at what is going on in CSARP, you will find that that is not really the case at all.

MR. BURSTEIN: Exactly.

MR. ISBIN: That's not the case.

MR. BECKJORD: If you look at the advanced reactors, that's not the case either.

MR. ISBIN: Right.

MR. BECKJORD: And I don't know about thermal hydraulics -- Brian?

MR. SHERON: Like I said, you know, if somebody comes in and tells somebody, gee, the French are ahead, and that is how the rumors start, we have no knowledge.

I have heard two different stories. I have heard one that the French could never get the CATHARE code to run until they finally joined our CAMP program. Once they joined the CAMP program, then they got their hands on TRAC. Once they got their hands on TRAC, then they learned, you know, how we did it and the like.

My understanding right now is the only thing they have really been able to run is like a small break LOCA, which is basically a sophisticated hand calculation and that's about it, so that's the other side that, you know, they are not really ahead, okay? it's just been this, golly, they've got this big team working on it and all this so therefore people must think it's something great.

I haven't seen any evidence that says that the CATHARE code is heads and shoulders better than ours or even a little bit better.

MR. HATCHER: Maybe I chose -- I just chose the French because they have this large civilian reactor program to generate what? 80 percent of their electricity now or more with nuclear, but choose another country if you would in terms of technological advance, Japan perhaps. That was basically my question, not specifically to France.

MR. SHERON: Well, one of the things we have observed with foreign countries is that for example in Europe, many of the Europeans, I mean they are about five years behind us in many respects in terms of waking up to what certain issues are.

We are always on this problem because we have put an issue to bed, we think we have, and then the Europeans for whatever reason, the "not invented here syndrome" or whatever, go embark on a big program and then all of a sudden everybody comes back at us and says by god, do these people know something that we don't? They must think there is a big safety problem. Why are they doing all this research? What is wrong with you, NRC?

And we try and argue, hey, we put that one to bed some time ago but a lot of times it doesn't sell because the Europeans don't want to hear that, so they are going to say oh, no, you didn't, you didn't do a good job -- we are going to do a good job and we get sucked in.

MR. BURSTEIN: That is an interesting

characterization but I'll have to discuss it with you out in the hall later. I have known only a few things that we have ever put to bed, if you will forgive me, and for some reason or other they seem to still be building nuclear plants over there and we ain't and I'm not sure that regulation doesn't have a role to play in that arena.

I would like to suggest we change the subject before I --

MR. MORRISON: I was just going to suggest that too, before we get off too far that way.

I would perhaps like to spend the next 15 or 20 minutes trying to get any views that the Division Directors that are with us have on this question the Commission phrased "Is the program staying ahead of the problems or is it trying to catch up with the problems?"

We touched on it a little bit this morning but I don't think enough or at least each of the three divisions didn't respond to it so I would appreciate any thoughts you have on where you think the program stands.

MR. SHERON: I can start and just say I think we are in some areas I think we are a little bit ahead and we are looking ahead. We have tried to but sometimes the technology tends to outpace us. Digital I&C I think is one of these.

We started this, Bob will remember, some time ago,

before it really became a big hot item and once though I think everybody started waking up to the fact that utilities were doing this, then all of a sudden we somehow were perceived as being behind.

Another area where we got ahead --

MR. BECKJORD: So are you saying we are -- where are we in digital? Are we ahead or behind?

MR. SHERON: I would say we are right about even now, okay? I think we were ahead a couple years ago. We took the initiative to go out and try to find out where the problems were. We did a survey and the like.

MR. BURSTEIN: I will be interested to get your reply to our letter.

MR. SHERON: Another area where we got out ahead was on LOCA and shutdown risk, before that ever became a big item. We had started back when the PRA branch was over in our division. We had already decided we were going to go low power and shutdown risk on the 1150 plants and we started that before it ever became a big issue.

As usual, it became a big issue because we didn't have all the answers at that time, you know. So I think, you know, that was an area that we got ahead on.

MR. ISBIN: Except the program initiated in France with follow-through in German, and 1150 didn't address this.

MR. SHERON: Yes. We know 1150 addressed full

power. And, yes, it was, to some extent, it was some of the French results that prompted us to get moving on it real quick at that time.

I think in the other areas I can't think of anywhere where we are way behind. We can always think of things that we should have done, you know, in retrospect, if we started that way back.

I mean, I'll tell you right now, for CANDU, I should have started CANDU work four or five years ago. If I was ready to say am I ready for when this plant is going to commit; am I going to have an independent audit code, am I going to have a policy on severe accidents on this thing or whatever. I should have started a long time ago, okay? But it doesn't happen. I should have started on AP600, okay? But I can't because I have no design information, okay?

So all of these, you know, especially in this area with these new designs, we are always going to be playing a little bit of catch-up because we are dependent upon getting design information from the vendors, okay, or the applicants, and unless we get that, okay, we are just -- we can't get ahead of the ball, okay?

To some extent we are being paced by the industry and how fast they feed us with information that we need to do our research, but, like I said, I don't know of any areas that I would say I'm really behind playing catch-up. I

think we are sort of even right now.

MR. BURSTEIN: Has anybody ever told you you got too much money in the budget?

MR. SHERON: Oh, everybody tells me I have too much money.

MR. BURSTEIN: Okay.

MR. BECKJORD: I said I couldn't think of a nicer person to have too much money.

MR. BECKJORD: Well, for ahead, as you claim on everything, you got too much money, you've come to the point.

[Laughter.]

MR. BECKJORD: We are behind on some things, CANDU, as you mentioned. I guess I would include the Digital I&C in that category. Electrical cables, aging electrical cables, I think we are behind. I think in some other important aspects of aging we are ahead.

I think the pressure vessel fracture mechanics, I think we are head. I think in the annealing we are basically in the position that we are going to, to the extent that we can, will be using Russian result.

MR. SHAO: Yes. Russians have a lot of practical experience, but they don't have any regulations that we have developed. In the piping area I think we are ahead; the vessel area, we are ahead. In most of the aging area, we

are ahead, except in the cable area I imagine we could -- the cable area, maybe we are a little behind. In the seismic area I think we are ahead because other countries are very worried about probablistic approach.

MR. BECKJORD: No, we are not ahead until we resolve the seismic energizer.

MR. SHAO: Yes, the seismic energizer, but we have the methodology here. It's mainly, we have started the probablistic approach maybe ten years ago, and other countries really don't have this kind of -- even don't have any kind of curves. We have two sets of curves trying to make it do.

MR. BECKJORD: I think we have a hard time arguing the case that we are ahead there until we've got one hazard curve.

MR. SHAO: And IPEEE, Individual Plan Examination for Extended Events, but other countries just follow our criteria in this area.

On the ASME Code for Section III and Section XI, they have been using throughout the world. They have been using Section III and Section XI for inspections, so I think we are a little ahead on the ASME Code.

I think in general we are mostly ahead; in a couple of areas I think we are behind.

MR. MORRISON: Joe, do you have any comments you

want to offer?

MR. MURPHY: Yes. Basically, the research that's done in our division is we're scoring in it. I think in general we are proactive and ahead of the game. Our problems tend to be twofold.

One is there's a certain amount of limitations that's displaced were I think our models exceed the data. What we are really lacking in, in information readily available to us, is causal information. As you get to the more sophisticated types of common cause failure dependency analysis, you need to know not only the failure rate data, but also what caused the failure, and that is not well-reported in any of the existing systems.

There is an effort underway right now between AEOD and IMPO to generate more information in selected areas that I think can correct that, but that's one of the weaknesses in PRA right now.

And the others are aspects of human factors. The human reliability analysis, that's a little harder to get our hands around, and I would say in that areas we're state-of-the-art, but it probably needs some improvement.

MR. BECKJORD: How about the PRA without the human reliability?

MR. MURPHY: I think the PRA without the human reliability, this is an areas I think we do lead the world.

We're up to snuff on that. The other countries rely heavily on what we are doing, and I think we've had a very good relationship along that, but if the basic methodology was sound, if there were a few things we should have done earlier, I'd say it is more in the applications area. We could have developed more of the techniques you could have used for things like greater QA or things of that sort.

We have, I think, led the -- again, have done excellent work that is being copied by a lot of countries in how to optimize technical specifications and that sort of thing. Other countries are a little faster to put it into practice than we are, but we have developed the methods.

MR. KINTNER: Did you say you are ahead of the curve on risk-based regulation?

MR. MURPHY: I'd say we are probably ahead on the tools for risk-based regulation, but not ahead in terms of the philosophy and in trying to implement it directly in our regulatory practices.

The other countries, I think, have tried to move faster into risk-based regulation. Sometimes they haven't done it all that well.

MR. KINTNER: But that's not research, necessarily. The Agency may not be ahead of the game, but you've been able to feed them everything they need?

MR. MURPHY: I think we have the tools to get into

the game, let's put it that way.

MR. SHAO: One thing I would like to mention, and ASME may not have a very good reputation, but whenever we go to international conference, the conference also is, what is the NRC doing? What is the NRC thinking? So at the international conference the NRC has a very good reputation mainly because of our research.

MR. MORRISON: Coming back to the risk-based regulation from a philosophy standpoint, is this something that's truly within the domain of NRC to approach a risk-based regulation? EPA is struggling with the same thing; FDA has been struggling with the same thing; and, obviously, Congress enacts all kinds of laws that have nothing to do with risks, they simply have to deal with whatever the political entity may be. Are you going to be superseded by, perhaps, Congress, or can NRC do anything about risk-based regulation?

MR. MURPHY: There is a joint -- among the Agency committee that is looking at the very top structure of how risk is used in various agencies, it's little things, to some extent, that really make a difference, like standardizing terminology. What's risk to NRC and what's risk to FDA are different things. We have probability built into our, and they don't into theirs. So that there's -- there's an attempt at that level to get involved.

But the British, for instance, have a regulatory system that is much more risk-oriented than ours is at the present time. I think it is important to be aware of what other countries are doing. Not necessarily that we copy them, but to be aware of the strengths and weaknesses associated with what they are up to.

MR. MORRISON: What's the prospect of this task force moving beyond just simply agreeing on definitions, really dealing, then, with concepts?

MR. MURPHY: To be honest, I'm not close enough to know.

MR. MORRISON: Who is your representative to that?

MR. MURPHY: Bob Bernero.

MR. MORRISON: Bob Bernero? Any reaction from the committee? Any suggestions?

MR. BURSTEIN: I get the impression, Mr. Chairman, that you either, except for a very few isolated incidents, the Staff feels that it's keeping pace or slightly ahead, which indicates that they ought to be able to take a reduction budget in research.

[Laughter.]

MR. TODREAS: I wouldn't mind at all to have a list compiled, maybe from the records, but that they could look it over before it gets pinned down too much. Have us take a look at that in a week or two of contemplations,

because it is a very important compilation.

MR. BECKJORD: Yes, where they think they're ahead.

MR. TODREAS: Yes, where they think they're ahead and where they think they're behind. They've done the best off the top of their head, but I'd like to have them look at it a little, and let us see.

MR. BECKJORD: Why don't you guys each draw up a list? I made my list. You draw up your list, and then we will put it all together. That is probably quicker than waiting for the transcript.

MR. MORRISON: I got a very good reaction to that question here. You must have thought a little bit about it before you came here too.

MR. TODREAS: The discussion was comforting; one of the few.

MR. MOLZ: The discussion was what?

MR. TODREAS: Comforting.

MR. MOLZ: Oh, comforting.

MR. TODREAS: Yes.

MR. MOLZ: Well, especially considering that there was no major disagreement or no disagreement expressed by the Committee. I don't know whether we expressed agreement either, but at least we didn't express disagreement.

MR. TODREAS: With a few exceptions like the

instrumentation and control issue.

[Laughter.]

MR. BURSTEIN: One of the fortunate things that happens is that sometimes the schedules that would have created the shortages, the defaults, get stretched out, and all of a sudden congruence appears, so we are grateful for those opportunities, I suppose.

Does that mean, Mr. Chairman, that since we are ahead or keeping even that we have both the skills and are doing the right things since we are not falling behind and we don't have any challenges we haven't really met, except as those noted, and it also goes to the competence and the working on the things we are supposed to be working on?

MR. MORRISON: Sol, the only feeling I have -- I'm comforted, but I think this may be the high water mark.

MR. BURSTEIN: Are you telling me I'm going to feel worse later?

MR. MORRISON: Yes. I think we see a lot of potential erosion, and if -- if we get swamped with a lot of tough waves, we may not be in that great shape.

MR. BURSTEIN: That's an important point. I think that's a very good observation.

MR. MORRISON: It sounds, based upon the entire discussion we've had to date here, that there's no resilience in the system whatsoever. If a person gets sick

or a person leaves the organization, we may not have the capability to cover an essential area.

MR. BOULETTE: Well, all four divisions indicated some real tight constraints, but I thought that that was going to be rectified to some extent by a reorganization or reshuffling.

MR. BECKJORD: In principle.

MR. BOULETTE: In principle.

MR. MORRISON: Well, let's turn for a few moments then to the question of the Committee's skill needs that Eric's introduction yesterday -- and I think he mentioned that the openings that we have now, what we are going to try to fill over the next several months, maybe some of those coming up over the next year or so, what's the feel of --

MR. KINTNER: You skipped sacred cows.

MR. MORRISON: I thought I'd ask you all to send in your sacred cows rather than embarrass you or the Staff by having discussed it in the open.

MR. BURSTEIN: Aw, shucks. I've been waiting for two days for that.

MR. MORRISON: You son-of-a-gun. Well, they will show in the published records.

MR. BURSTEIN: I'm sure.

MR. MORRISON: We need to look at ourselves as to what do we think, as a Committee, we really need to have.

MR. BURSTEIN: Does the Staff have a reaction as to whether it finds voids in the Committee's talents that it is looking to for help, and that we are not being responsive or are unable to supply?

MR. MORRISON: That is a good question. I have not been bashful about answering questions today. Put it to them.

MR. BECKJORD: I think there is a tendency of a number of committees like this one to be critical of the Agency they are supposed to be serving, and I think we are trying at the same time to do that in a constructive or a way that would help manage the business better or more effectively, if you will, or somehow provide some of our experiences to assist the office in discharging its obligations.

I guess I am asking whether or not the office, its staff and management, has found areas where the Committee is lacking in capability, in discipline, or experience, somehow, so that it is not able to provide that assistance and response that the office needs?

MR. MORRISON: Well, I think the one area that occurs to me is in prospect with Spence Bush, who will be retiring.

MR. BECKJORD: The particular materials one?

MR. MORRISON: Yes. Materials, yes.

MR. MOLZ: What about the human factors? We had a person -- Dave Wood was on for a short period, and then he resigned, right? There must have been some thought that that area would need it.

MR. BECKJORD: Yes.

MR. MORRISON: I certainly can give you my opinion while the Staff is conferring. I do think we need someone that has the kind of background that Dave Wood had. It is rather hard to find such a person that kind of spans both parts of that, and maybe Bob Uhrig has a comment along those lines.

MR. UHRIG: No. The name that I could come up with is a man who used to be at Oak Ridge, and is now an independent consultant in the human factors areas. It's Paul Haas. I don't know. He was at Savannah River for a while, but I don't know what he is doing now.

MR. MORRISON: I was really addressing do you feel we need someone in that area since you're --

MR. UHRIG: I don't feel confident to say, although, I've only -- even if I stayed clear to the end of the term, I've only got about a year a half left. You may want to get somebody who has both areas.

MR. MORRISON: That would be nice if you could get a two-for, but it is probably difficult.

MR. UHRIG: I don't know anybody at Oak Ridge who

is dual.

MR. MORRISON: Yes. I don't think we are looking for names. It is the kinds of skills that we need. If there are some pulls that we perceive.

MR. UHRIG: There just aren't many peop'e who really have expertise in both areas.

MR. KINTNER: But we really need somebody with diplomatic skills.

MR. BURSTEIN: You're going to replace me?

[Laughter.]

MR. KINTNER: Better personalities. Well, Staff didn't have -- Eric tried to a little bit, but the Staff didn't answer the question. Maybe they never thought about it. It does seem to be this group is -- we've said many times, and I think we believe we are trying to be useful to get your job done in a better way.

As you look at these -- I know it is a lot of work putting it together -- it asks all sorts of embarrassing questions. "What could we do differently to be more useful?," and that does include the question of what kinds of special capabilities should we have that give you confidence in the kinds of things we come up with. You don't need to be afraid to answer rather bluntly.

MR. MOLZ: We won't change our report, or anything like that.

MR. KINTNER: Nobody here is that sensitive.

MR. SHERON: I will go first, if you want. I'm not that bashful. It was said, I think, you know, human factors -- someone with a background in human factors would be helpful in terms of overseeing or reviewing the human factors research program. I know when Neil leaves there will be a big void in the thermal hydraulic area, the advanced reactors, which, I think, is something we would very much like to see on a committee.

Just as an observation I just -- as you said, don't be bashful. I've always sort of been concerned because, you know, with the exception, I guess, of one or two of you, your involvement with the Government, you know, in terms of the bureaucracy has been minimal or nothing, and I always get a little bit concerned. I feel that you don't understand some of the constraints that we are constantly under here.

MR. BURSTEIN: That's deliberate.

MR. SHERON: I know it builds up a level of frustration because I understand where you are coming from, and I say, "My God, that makes eminent sense, but I can't do a thing about it because of, you know -- and then yet, they don't understand, you know, I can't do this because, okay, and so forth.

I mean, for example, there are certain things we

can do and certain things we have to rely on the NRR people to do, okay? We can -- that makes sense, but it is not our job in the Agency to go forward and do something like that. And I feel frustrated because I can't feel I can be responsive to you, okay? And I don't want to come at you with a bunch of excuses of, you know, "Gee, I can't do that because." Okay?

MR. BURSTEIN: That's another sacred cow. The belief that you are unable to change. And it seems to me, fundamentally to the future, to recognize that we are going to have to change the way we do business. You see it all around you.

MR. SHERON: Yes, but you are not going to do it from the inside.

MR. BURSTEIN: Maybe not, but it won't hurt to have a receptive inside.

MR. SHERON: I think, maybe, you've got a receptive inside. It is the -- I mean, I haven't had that much experience with bureaucracy, and I often sound kind of cocky about things like downsizing and --

MR. BURSTEIN: Don't universities have bureaucracies?

MR. TODREAS: You can tell them to go shove it.

[Laughter.]

MR. TODREAS: Especially if you go to jail. Yes,

you can.

MR. BURSTEIN: We are going to have a whole bunch of applications for positions, I can see here.

MR. TODREAS: You can tell them to shove it, but then you are isolated. I really think you have to listen to what he is saying relative to on the mix of the Committee. It is good to have a few people who have bent their head in government one way or another because it is very different than the university.

In the university you can still operate professionally on things you want to do, and you can be isolated for a period of time from the administration or whatever. You can't go for all that long, but you can -- you've got a few years of operation that way.

In government, the next day you are up against the wall if you really want to get something done that you believe in.

MR. BURSTEIN: There are some segments that don't have, for example, contractors. Now, that would be a definite conflict of interest, particularly if that contractor is doing any work for any government agency anywhere in the world. But government people would also, maybe, have some conflict unless they are retired, and if they are retired, they don't know anything, like all retirees.

MR. MOLZ: You know, I think inadvertently, maybe, you brought up an example that we could point out that makes jobs a lot harder. This whole concept of conflict of interest that's come up in, I guess, the last 20 years everywhere, assumes that conflict of interest has to be negative.

Lot's of conflicts of interests are used synergistically. If people are sincere, and they get working on two or three things, sometimes they can use that to -- in a positive way.

Now, we've carried that to the point where we are saying -- you hear it on the news all the time -- "We don't even want the appearance of a conflict of interest." And all of a sudden, you can be doing your everyday job, and somebody jumps on you because you don't look right. I mean, things like -- when you have to put up with things like that, you can't do your job. It is as simple as that. You can probably name five or ten other things in the last 20 years.

MR. SHERON: I heard today about, you know, that we should enhance the Staff, but as Eric said, he is constrained with regard to he can't hire because he doesn't have slots. And even if I do, I have no idea how I am going to attract someone, for example, who is knowledgeable in digital I&C to come work for the Government, for a GS-14,

okay, and move into this area, and buy a house or anything. It is just impossible, okay?

When we advertised the one -- for the one slot we did have, I think we only had one or two applicants for the thing, and that was both external and internal to the Agency.

It is very difficult for us to find these top-notch, qualified people who want to come work, especially when times get good. Okay? When there is a lot of money out there and private industry is doing well, they pay better than the Government, it is more exciting work, and we just can't attract them.

MR. TODREAS: I think you have to go at the top and the bottom. I think you got to get more Gallaghers, who, for their own motivation can make it, and you've got a window of tact. You got to go from the bottom with people who can learn from these guys over four or five years, and then build the middle in. That's the way to go for the next ten years.

MR. MOLZ: And not underestimate what young, inexperienced people can do if you can manage to put them in a decent environment, one that brings out some enthusiasm, and that is not so easy to do, but you never want to underestimate that.

MR. TODREAS: It is crucial to put them in the

ranks.

MR. MOLZ: Yes. It is crucial. And in our system, if you don't, they just go sailing off, so that's probably good to in some sense.

MR. TODREAS: Come on, Lawrence.

MR. MOLZ: Surely, you have something to say since you've given up all the positions.

MR. SHAO: I think that Professor Todreas is right. Right now, we are headed in many areas. If we don't have competent staff coming to joint us, there will be erosion going on in the next couple of years, and we go downhill very fast.

I would, personally, I would like to hire a bunch of young people coming from good colleges, good training. Personally, in my life, I've hired a lot of young people, and they all become very successful in the agency. These people are very energetic, want to go ahead, you know. But right now we cannot hire these people.

I would like to hire some interns, people getting a masters degree or a Ph.D or a bachelors degree; they're willing to do something, but right now we don't -- we had an intern program a few years ago, and we have one to engineers, but now they've just stopped this program.

Most people in my division are getting pretty up there. The average age is 55 or 60, and we need some young

blood to take over.

MR. KINTNER: Maybe this is a plan. If I read the numbers correctly, the attrition is almost certainly going to take care of what reductions you have to take over the next two years, and it shouldn't be very hard to convince somebody that you ought to be able to fill in with a few carefully-selected, top-notch, bright, young graduates in at the bottom.

I mean, that's vital to the long-range health of the organization, and it seems to me it could be hard.

Maybe this is one of the things we'd bring up with the Commissioners when we speak to them.

MR. MORRISON: I would agree. Let me put a little different twist on the question that Ed was asking earlier about the skills and how we as a committee can help you do your job better, or at least be able to help in one way or another.

We've sort of fallen in, over the six years that I've been on the Committee, into this kind of a format of having meetings like this or subcommittee meetings like this. Is this the most useful way to have an interaction between the Committee and the Staff?

MR. SHAO: I think it -- I mean, very useful.

MR. MORRISON: You would come in, obviously, with briefings --

MR. SHAO: Yes.

MR. MORRISON: -- and come in with all kinds of comments or questions on it?

MR. SHAO: Talking about the skill that the Committee may lose, I was a little bit worried about Don Turcotte resigning from the Committee, not Professor Hatcher picking up.

I think I agree with Eric that Stan Bush may be retiring soon, I don't know. But I talked to him a couple of weeks ago and he said he is going to attend the next meeting, so I hope he doesn't retire from this Committee, but if he does retire, I think he's --

MR. BECKJORD: He is one of the -- he is completing his sixth year.

MR. SHAO: Six year term, yes. So in that case, I think the Committee has to recruit some people like his experience, especially in the material.

I think the general engineering area, there are a lot of people here that have very rare -- a lot of experience that's sought. They have been working in a plant for many years. So sometimes we see advice from a different angle. It is very good from a practical -- in many cases, from a practical angle, you know.

We are asking why we still have that program? Why are we stilling working on these little details? I think it

is good.

MR. BURSTEIN: Are there other methods of communication and review that have proved effective? It seems to me that the other advisory committees seem to have adopted this same approach, and I know of no significant other arrangement than this kind of format we've evolved into. But if there are some others, I certainly would like to hear about them.

MR. SHAO: In my area, there are only two other committees. One is the ACRS, and one is the so-called -- what do they call it? -- the NRC Internal --

MR. BURSTEIN: The what?

MR. SHAO: For reviewing regulations.

MR. BURSTEIN: Both the ACRS and the Waste Review Group --

MR. SHAO: Yes. The ACRS, we look at -- in our area, they don't look at our area as much as Brian's area, you know.

MR. SHERON: They'll get to you next.

MR. SHAO: So far we have been very lucky. They ACRS never gives us as much problem as much as they give Brian.

MR. BURSTEIN: But do you know of any advisory committee arrangement besides this meeting and format group?

MR. SHERON: The only other thing that I would --

from my experience, the ACRS has done differently is they, many time, will attend certain meetings or workshops that we have. We invite them and they almost participate as participants -- you know, in the meeting, as opposed to just the observers and the like.

But, you know, keeping in mind too that this Committee deals with our programs on a very different level than the ACRS does, and I think it is good because you are filling a void that, you know, they just don't do, which is, as I've said, for example, on the thermal hydraulics, okay?

I mean, we go down there, and, you know, we are going to argue whether we formulated the momentum equation right, and whether we got all the right terms in there and everything and the like, but they don't look at it from the big picture, okay? I mean, they don't ask us whether we have the right disciplines or any of this stuff. They don't look at our overall big plan and stuff like that. They want to get down in the nuts and bolts.

Whereas, you all, you know, I think, you know, don't get into the nuts and bolts, but you stay at that, you know, level above looking at more of the strategic approach and so forth. So you are complementary in many respects with the ACRS, okay?

I would just add that I think over the last year, I think, which was -- was this the first year you've tried

the subcommittee approach, or was that actually going on two years now?

MR. MORRISON: No, this is the second time around on the subcommittees. Neil had organized them when we first got started.

MR. SHERON: Yes, but I mean when you've reinitiated the subcommittees.

MR. MORRISON: Yes, about a year ago.

MR. SHERON: Yes. I just want to say I've found that a lot more useful because I think that, you know, some of the subject areas we can have some much more meaningful discussions with a smaller group, and we can focus in on, you know, some specific issues, and really kind of beat them to death, rather than have to do it and then look at our watch and say, "Oh, my goodness. We are going to run out of time in the agenda."

George will tell you that I complained bitterly because I knew I couldn't do code -- maintenance code expertise in 45 minutes. I was demanding an hour and a half, and I was told, "No. By god, it is 45 minutes."

So I would just say that I like the subcommittee approach. I would recommend this Committee stick with it, you know, and then use the full committee meetings to summarize the subcommittee results and perhaps hear some more basic office -- you know, stuff from the office that

pertains across the board.

MR. MORRISON: Yes. One of my concerns in seeing if there is any different format is the fact that you are so tight with regard to internal resources, and by the time you prepare for a meeting like this, you come into a meeting like this and spend a couple days, then we write a report -- and I don't know how many days you take preparing responses to it -- it has killed a lot of Staff time.

And if it isn't useful, if it hasn't added value, then I think we are not doing our job right, but if it continues to add value, even causing you to think about the subject in a slightly different way, that's a positive one, and, perhaps, that's a decision you really have to act on, too, Eric.

MR. SHAO: About two years ago, I raised the issue of that kind of commitment. Even with the other experts here, they may be disciplines you are not quite familiar with. Sometimes do you want to think of using consultants for your Committee or not for certain areas? Which the ACRS does that all the time, they use -- in certain areas they use -- ACRS uses consultants quite constantly. Almost for every meeting they have certain specialists -- specialized consultants in particular areas.

MR. SHERON: Well, we follow what Dave said. I mean, we -- quite honestly, I mean, we -- at least my

division, we spend a fair amount of resources either preparing for or presenting to or responding to oversight committees. I don't say that in a negative way. I am just saying it is a fact.

I mean, on January 4th and 5th we spent two days. I had 13 contractors in from Idaho to Washington to -- for the --

MR. BECKJORD: That's different, Brian. That's not --

MR. SHERON: Oh, no. It is not this Committee, but I am just saying that, you know -- and I am not, you know -- that's why I said I think the subcommittee approach worked find because I know when this Committee was first formed, I think many of the concerns that came in your letters were basically due to the fact that we just didn't have enough time to explain completely what our programs were and the like, and you didn't have the full amount of information.

Most of our response was, "Gee, didn't we tell you about this or that?, or, "We're really doing this or we're really doing that." I think the subcommittee meetings helped a lot because that gave us more time to really expose all facets of our program, okay? So then we weren't getting back letters that had, you know, questions because there was information that hadn't been shared, but, you know, when you

did send back information it was based on, you know, real observations from our entire program. And I found that the letters were much more useful from that standpoint.

MR. MORRISON: Well, I personally felt that this meeting was a good one because of the subcommittee chairman and, actually, the subcommittees' themselves having prepared a report, and with the Staff then being here to be able to respond when there were issues that needed to be elaborated on that weren't covered in the report.

I thought yesterday's session was just excellent in getting all of the program out on the table, at least the three areas that we talked about through the subcommittees.

Well, that's about where I think we should end up. I would ask each of the Committee members to send me any items that they feel are worthy of adding to our report, especially on the sacred cows which we did not discuss.

MR. BECKJORD: Mail in all your sacred cows?

MR. MORRISON: Mail in all your sacred cows.

MR. KINTNER: Would you like everybody to write a short answer, as he would write it, to each one of these questions?

MR. MORRISON: That would certainly be useful, and I think I could take those answers, as well as the transcript, and see if I can prepare a strawman that we could use at the next meeting, as a point of departure for

our meeting with the Commission.

MR. TODREAS: Might that meeting be before May or June?

MR. MORRISON: No. I think it would be setup, Neil, once we've determined when our next meeting was. The Commission would try to adapt to that.

MR. TODREAS: Did we get a date yet, George, or are we still --

MR. SERGE: I don't have all the responses yet, and then I will have to find -- find a common period when most members are available.

MR. TODREAS: So those of us whose terms are finishing are still invited because we a through -- our terms are not over until the end of June. Is that right?

MR. MORRISON: That's my view.

MR. TODREAS: Okay.

MR. BECKJORD: When do their terms expire? When do our terms expire, excuse me.

MR. MORRISON: I think June. We have a -- I am not going back to the Secretary's office to ask. We are going to plan on inviting you to the June meeting.

I think George had a very logical explanation of putting it through June, which was that's when the consulting agreements go, from July 1 to June 30, and that's the term. Bureaucratically, it sounded like a good answer.

Well, unless there is something else to be discussed, we will declare the meeting adjourned. Thank you all for participating.

[Whereas, at 3:28 p.m., the meeting was concluded.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission
in the matter of:

NAME OF PROCEEDING: NSRRC

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Jon Hundley

Official Reporter
Ann Riley & Associates, Ltd.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 2, 1994

MEMORANDUM FOR: James C. McKnight, DMB/IRM

FROM: Sandra R. Young, RES

SUBJECT: MATERIAL FOR THE PUBLIC DOCUMENT ROOM (PDR)

Enclosed is a transcript to be placed in the public document room. This transcript is from the January 13-14, 1994, meeting of the Nuclear Safety Research Review Committee (NSRRC). The NSRRC contact in the PDR for this material is Ms. Michelle Schroll (202) 634-3273.

If you have any questions, please contact me on 492-3711.

Sandra R. Young
Office of Nuclear Regulatory Research

Enclosure:
As stated

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I certify that this transcript covers and is an accurate account of the minutes of the Nuclear Safety Research Review Committee (NSRRC) meeting of January 13-14, 1994.

Signature: David B. Morrison
Chairman, NSRRC

Date: 29 JANUARY 94