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ANN RILEY & ASSOCIATES, LTD.
1612 K St. N.W., Suite 300
Washington, D.C. 20006
(202) 293-3950

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U.S. NUCLEAR REGULATORY COMMISSION

NUCLEAR SAFETY RESEARCH REVIEW COMMITTEE

Holiday Inn-Crowne Plaza
1750 Rockville Pike
Rockville, Maryland

Thursday, November 8, 1990

The Committee met, pursuant to notice, at 8:00 a.m., David L. Morrison, Chairman, presiding.

PARTICIPANTS:

David L. Morrison	Mark Cunningham
Frank Coffman	Andrew Murphy
Brian Sheron	Farouk Eltawila

PARTICIPANTS [continued]:

Larry Shao	Ralph O. Meyer
Herbert Isbin	Sol Burstein
Edwin E. Kintner	Spencer Bush
Eric Beckjord	Richard Vogel

PROCEEDINGS

[8:00 a.m.]

MR. MORRISON: I'd like to call to order this meeting of the Nuclear Safety Research Review Committee. In accordance with the requirements of the Federal Advisory Committee Act, this meeting has been announced in the Federal Register and is open to the public. Since it is public, we will be on the record for the entire meeting. I hope that doesn't inhibit any of our discussions since we have a fair amount of ground to cover today and tomorrow.

I believe each of you has received a draft copy of a report that I pulled together based upon our last meeting and submissions that the various Subcommittee Chairmen made to me. If you haven't, let me know. Did you get one, Dick?

MR. VOGEL: I don't think so.

MR. MORRISON: It was supposed to have been given to you if you checked in here last night. Maybe you didn't check in. I hope I conveyed the idea in the memo covering the report that this is, indeed, a very first rough draft and I hope we will consider it that way.

In my opinion, this report is probably different than any of the other reports that this Committee has prepared. I believe it will be subject to a much wider audience than our past reports. It seems to me that Eric has been the principal recipient of our past report and

although he's shared it with others, we have taken him as our audience and tried to make recommendations that would be very specifically useful to him.

Since this request to address the research program content and strategy for NRC came from the Executive Director, certainly he will want to review this and I'm sure the Commission will review it. The fact that it has a strategic implication, I wouldn't be surprised that it would be used by the Commissioners and perhaps even by Eric in preparing the budget or perhaps defending this in front of Congress.

I think that behooves us to make sure that the report is of high quality. I think because of that rather broad audience, it should be as pointed as we could make it. Let's see if we can eliminate a lot of the ambiguity that we often write into reports. I hope that we can arrive at a consensus here, even though we've had not quite a full Committee with us this morning, but who had input from the other members who are here today and certainly their comments were included on the transcript in the previous meeting. So we have some sense of where they're coming from.

The agenda for today will be certainly a very loose one, in a sense. In general terms, what I'd like to try to cover this morning is, first of all, what should the

report contain. I threw out a strawman outline to try to identify some points of content I felt would be useful to cover. I think we need to discuss that so that we're on the right track on what the report should be.

Secondly, I think we need to spend some time addressing the question of NRC's research mission. That's the first point that I put in my memo to you. What should the mission as regards research within NRC be. What I did in the draft report is I pulled together a statement that we could use as a strawman to go forward.

I think once we've defined that research mission, we ought to then apply what are at least the relevant priorities and the various elements of the missions.

Perhaps the second broad topic in the report, a discussion of the procedures. That perhaps is not the most precise term that one could use, but I felt we had a lot of discussion last time on user needs and closure, balance with a program, how are these achieved. Although it isn't dealing with the content of the research program, per se, it certainly reflects on the performance and how the research gets done and whether it's going to be a successful program. So I think we need to spend some time doing that.

I wouldn't be surprised that we'll consume the better part of the morning in those items. After we get those couple items away, I think we need to look back into

the Subcommittees and the five-year plan, which provides sort of guidance and perhaps cross-check on what our sense and mission should be, because I think within the program plan we should make some priority assignments as we see them, again, vis-a-vis what we feel the mission is.

The Subcommittee reports are more or less embodied intact in the document that I gave you. I will admit that the one on human factors, I reduced the end pages that Dave Wood sent me, and it may still be a little long for what we wanted. I have Dave's report if anybody is interested in reading the whole human factors arguments that he makes.

I think finally when we get down to the late afternoon or tomorrow, we need to see what drafting needs to be done and where the report needs to be put together. I'm sure there can be some staff available to help us when we get down to that point. At least the first part of the meeting will just be the individuals that are here. About the middle of the morning we expect the Division Directors or their representatives to join us in the meeting.

So that's sort of the plan I have for today.

MR. KINTNER: What is the schedule for completing this? Eric has written a letter of pleading for careful review of whatever comes out and recognizing that a number of people won't be here today, is it intended to make one more draft and circulate it in a semi-final form?

MR. MORRISON: That's my intention; that is, to make a final draft depending on how far afield we are from the consensus by the end of the day. I'd like to get that done within about a week or ten days. It'll take perhaps a week to take a look at it. I think that will still come close to meeting the end of November.

Is that still a good date for you, Eric?

MR. BECKJORD: That's good.

MR. MORRISON: I'd like to, for a slightly longer time, since Neil doesn't get back till the 3rd of December, let him have a chance to read it. So we can spill over a few days beyond that if we have to. I think we'd all value Neil's comments.

MR. BURSTEIN: Do I understand you to day, sir, that the final report should be finished at the end of November?

MR. MORRISON: Close to that, or within a few days in December.

MR. BECKJORD: A final draft for review.

MR. MORRISON: Yes.

MR. BECKJORD: If I get it by the time of the Christmas holidays, I think that would be good. I'd rather receive them before than after because people often are away and if it's after, it's likely to be some time after. So it would be most useful for me mid-December to December 20.

The next budget cycle begins right after the first of the year and that's my reason for liking to have it by the time that begins because that's when the report will have its greatest impact, if it's available for those discussions.

Let me say one word about our schedule today. We have a couple of commitments. One is a high school conference. Brian Sheron is going to be there this morning. He will come as soon as his son's teacher's conference is over. Larry Shao will be here at 10:00 with several of his branch chiefs. Serpan cannot be here because he's overseas.

So if we can concentrate your questions to us on the engineering and on waste this morning, then the Sheron will be here with his people this afternoon. We also have a Commission hearing this morning on the human factors program. So Coffman and his people will be at that meeting at 10:00.

So I think we can cover the whole spectrum with no difficulty and that's what I would suggest.

MR. MORRISON: Any other general comments or thoughts?

MR. BUSH: Eric, I watched the human factors go up and down like a yo-yo for about 15 years. It would be a high priority item one year and it would have a big effort and then it's wiped out the next year and then it turns around and does exactly the same thing two years or three

years later. Usually what happens is very little comes out of it. They spend some money, but not much.

Is there a definite policy now to pursue that?

MR. BECKJORD: Yes. Yes, there is.

MR. BUSH: Otherwise, it's kind of a waste of time.

MR. BECKJORD: My parting advice to the people who are giving the human factors presentation yesterday was, gentlemen, that program is funded now, just be careful what you say; you can un-fund it in three minutes. But it is funded and I don't see anybody who is after reducing it. I think the problem as I see it at this point is that I think some very good starts have been made, but now we have to push through to get some conclusions that will demonstrate that it is going to be a useful program.

I think that's the challenge at this point.

MR. MORRISON: Just to sort of close that one, from my perspective, it seems to me that's our job today and tomorrow. We collectively believe that the human factors program needs stability, it needs to be larger than what it is or it's satisfactory where it is.

I think that's a response that we're obligated to make to the EDO's request on what the content of the program is.

MR. VOGEL: Eric, you opened yourself up to a

question. What is it that they shouldn't say?

MR. BECKJORD: This whole point turned on a question relating to the motivation for doing the work originally. I felt it just should be clearer that the work is being done primarily as a result of the general knowledge that the PSA studies have shown, that human factors, human error, human performance is a very large part of the risk. I think that's general knowledge and that's why the program is being funded.

MR. BURSTEIN: I think we're also pushing some of the frontiers, if you will. Our answer to that concern about the importance of human responses or behaviors to situations and the impact on safety resulted initially in a very massive emphasis on one thing only, and that was training, training and training. We now have twice as many people doing training as we have doing operating and maintenance.

It's a disaster in lots of ways. We've got full simulator implications of control rooms and panels and functions. It seems to me that there is a relationship with the progress and the state of this art and its applications. We have been going off looking at some very -- I would call it desire, but perhaps because we don't know any different, we're investigating everything and the idea that out of this background will emerge some obvious areas that we can focus

on.

At this stage of the game, it's a little difficult to anticipate perhaps where this leads us, but it is certainly something that needs to be looked at, recognizing that this is an emerging skill, it's an emerging area of information and knowledge, and I don't think we can predict what it's going to do for us, if anything.

If it does one thing, that's put some of these earlier responses, like training, into a perspective that is more manageable than it has been up to now, it would be more than useful.

In dealing with this, Eric, there has been the philosophy that we discussed at some point in time, and that is if you can't get a satisfactory resolution of the human factors contribution to risk, if that continues to make a very significant impact on risk, should you eliminate it? Should you eliminate the human from the process? In some of the advanced reactor systems that are being proposed; for example, I know in the liquid metal programs the entire control philosophy is based on a non-intervention for safety reasons by manual operator manipulation.

Even the data is not important to the plant's safety either because of its physical characteristics or its natural or some safeguard features. That is an alternative that I think perhaps we need to keep in some kind of

perspective.

The purpose of this discussion, from my viewpoint, is to emphasize, again, the emerging knowledge base in this human factors area that I think some people, as we have heard from discussions and proponents, believe that we now have a capability of solving all of our human error problems by a scientific approach utilizing human factors concepts.

I think that's utter rot at this point in time and we should be careful not to pursue that exclusively, perhaps via elimination of other options. We need to know a lot more.

MR. BECKJORD: Well, I think you've raised some very challenging questions. There's a point which is made in the draft paper on the shift scheduling, which is one area where the scientific knowledge is pretty good. It's made a lot of progress in 15 year, and, yet, as the comment is made here, the practical application of that knowledge has not extended very far.

That's something of a puzzle to me. That is to say shifts continue to be rotated, if in the wrong direction --

MR. KINTNER: Let me tell you why.

MR. BECKJORD: But there's a disconnect here.

MR. BURSTEIN: Have you got members of the IBEW on your panel?

[Laughter.]

MR. KINTNER: We're getting into a subject which presumably comes later, but I'd just like to add on to Sol's suggestion. One of the things we've said in the next generation of light water reactors, we want to simplify them. Everybody says they're too complex. My instinct tells me that there is significant danger in terms of human operational errors and complexity, but there is no where you can get anybody to agree with you on that because there's no studies which indicate that that's the case.

So I've always thought that it would be very useful to have some kind of a qualitative understanding based on some studies that would say if you have half as many switches to throw, you probably have one-fourth as many errors. Maybe that's not the right ratio, but, anyway, that's just another thought on the same subject.

MR. BUSH: Of course, that doesn't cover the maintenance aspect, which is another animal entirely, which is also very susceptible to human error.

MR. KINTNER: But, again, if you have a quarter as many valves, you --

MR. BUSH: I agree completely. The less you have to maintain, the less the problems.

MR. BECKJORD: Well, I have a thinking on one of Sol's question. I guess I really have a bias on this

question of replacing the operator with autonotisms. The problem with control is control is fine as long as you are able to foresee and predict all of the situations which will be encountered, but control isn't going to work for an unforeseen situation.

So I really think it's the wrong direction to rule out human intervention. If human intervention is going to be effective, it also has to be alert and knowledgeable and you can't keep it alert by -- it's the same problem that the airline, aircraft industry has faced all the way along. If you have a pilot who is along for the ride while everything is being done automatically, then how can you expect him to take over in the moment of extreme trial.

But I think that's a question that comes up really in the advanced reactor area.

MR. MORRISON: Well, this is a question we'll get back into several times during the day.

MR. ISBIN: I wasn't clear, Eric, on your participation. Will you be here also this afternoon?

MR. BECKJORD: I'll be here today and tomorrow. I may have to step out once or twice, but I expect to be here the whole time.

MR. KINTNER: I have a question which maybe is dangerous at the outset, but having been somewhat in the position you're in at times and having committees like this

looking at what's being done, I very often had thoughts that if I could get them to express, it would have helped me a great deal in doing my job a hell of a lot better.

I think you've been very cautious not to in any way suggest how we can help you, but I don't think it's unethical at all to say that one of the things that this Committee could do responsibly is to help the Director of Research do his job much more effectively in the way he believes it should be done.

Is that an unfair question, Mr. Chairman?

MR. MORRISON: I don't believe it's an unfair question. I would only put just a slightly different skew on it, Ed. It seems to me that if I look at the charge that was given to us, that we were to take a look and see what the content and strategy should be, we shouldn't be totally tied to the current program.

On the other hand, we have a real group of professionals who have spent many years developing this particular program, so we shouldn't ignore it. There's a lot of advice that gets in there. Now, obviously we probably have all slightly different views of what research within NRC should be and what its purpose is. At the end of the day, Eric is the guy that's responsible for making sure that it gets done appropriately. So we should listen to him and assist him in that sense, unless there's wide difference

of opinion between what we think and he's saying. Then we have to reconcile that somehow.

I'm agreeing with you, but just with a slightly different skew.

Let's take a look at, just for something as a strawman, the couple pages of the outline there. I put it under really four major topics; requirements, what do we believe the requirements are, our statement of what role of research at NRC should be. Secondly, the comments on the procedural issues that effect both the content and how the research program is conducted.

Third, using the five-year plan as a statement of what Eric and his staff believes needs to be done. Do we agree with that and, if so, do we agree with the priorities that are in there, are there some obvious gaps in it, what's the change in the emphasis that might be required. Then, summarizing what are our general recommendations to the NRC, to the Executive Director and to the Research Office.

Does that encompass what we want to say in outline form?

MR. KINTNER: It seems to me a good outline. I have just one question. On research program content, there's a section, Containment Performance and Protection from Radiation. Does that come from some program plan nomenclature?

MR. MORRISON: Yes. That's one of the four or five major items.

MR. KINTNER: Because it seems to me that containment performance in and of itself was a very discreet separate subject of radiation protection. I presume that means the public.

MR. BECKJORD: Four years ago, one of the key problems that was presented to me was to explain the research program and how it should be used. Before that time, the program was not organized in these categories. In fact, it was presented as a program and there were a lot of elements.

I rearranged them to put them into essentially this structure. When it went to the Commission, radiation protection was separate from containment performance, and the Commission attached the two. And I never had an explanation as to what the reason for that was. Now, I believe they have departed from that again. It is shown in the same place, but's recognized as a different category.

MR. BURSTEIN: It's not entirely unrelated.

MR. KINTNER: Any damage to reactor core is also protection for the public, as well. All these are public protections.

MR. BURSTEIN: The whole NRC is so constituted.

MR. KINTNER: Right. Containment performance, as

I see it, is a very precise subject.

MR. BECKJORD: I think the thought came from the Level 3 of the PSA, that after the containment leaks, then you get to a calculation of dose. I think that's why it developed along that line.

MR. BUSH: Dave, could I ask a question? How are you defining mission? Mission means different things to different people.

MR. MORRISON: I've wrestled a lot with that word, Spence, and I'm not sure that it's the right word, but I think I took my lead from what both Tom Murley and Eric Beckjord presented at our last meeting. Each had five or six or seven areas that they thought were within the mission of research. If you can suggest a better label, I'm more than happy to accept it.

MR. BUSH: I don't mind that one. The reason I asked the question really is that when you get to priorities within missions, you'll have a spectrum. You'll have a given mission and you might have a very high priority or a very low priority. It's contrasted either between missions or among missions. That's why I asked the question.

Presumably, if we meet the EDO's request, we would, I presume, be establishing a higher priority to a degree at least.

MR. MORRISON: I think there are two levels of

hierarchies and they probably come together, but I look at there's the -- for lack of a better term right now -- a mission priority where -- at least in the draft we talked about being able to reduce the uncertainty in some of the regulatory decisions that are made.

I would equate that as if we were a company that was out there making some particular product, that's really the engineering aspect of the job and you continue to critique the product to make sure that it's right. It's well beyond just applied research. It's engineering support.

On the other hand, there are some things that if you look down the list and say, well, what should I be doing to anticipate future problems, that's kind of probably in the -- those are more basic or exploratory research side. But I think there are priorities among those two categories; how much do you put in the engineering side, how much do you put in applying the research side, how much do you put in the basic side.

You say, okay, I've agreed on those priorities and now the second page of the outline addresses the plan where Eric and his group is researching, things relating to the integrity of reactor components. What are the priorities within that, am I working on the right problem.

MR. VOGEL: One of the things that bothers me

about this outline is that the amount of effort going into advanced reactors does not fall out so that you can spot it. At least I would find it of interest to know just how much was going into that and how much was going into other things.

As a matter of fact, I think the program plan sort of buries advanced reactor work into various items so you just can't pull it out. Now, maybe --

MR. MORRISON: I can view that from two ways. One, that it's in part I think our role to suggest where it should be on priorities and how it fits with the current program. On the other side, I sense that the Commission itself has not made up its mind as to how to approach the subject of advanced reactors. So they can't give any guidance to Eric in the research program and saying this is what we want to do over some timeframe, what are the technology requirements and where does the research come in.

That decision I don't think has been made.

MR. BECKJORD: The Commission has not endorsed a research program for advanced reactors.

MR. VOGEL: That's why it's not identified as such.

MR. BECKJORD: Well, it was identified in the five-year plan at the beginning of this year as a -- there was a paragraph in there which said that much more attention

was needed in research on advanced reactors, and that it was a notice that it would be incorporated the next time around for the purpose of running it up the flagpole, and nobody objected.

So it, therefore, will be included. There will be much more attention in the next five-year plan to it, and we are preparing a -- we have a research draft plan which is nearly done now for the water reactors and we have two draft reports out; one on the MHTGR gas reactor and one on the sodium liquid metal, which include a quite a discussion on the research needs for those plants.

So I think we have the pieces in place and you'll see it in the plan the next time around. The Commission is actively considering the whole question of advanced reactors now from the point of view of licensing review and certification, and they have received several Commission papers. The most recent one just went in or is on its way in on the level of detail required for licensing reviews for these reactors.

I expect that we will give them the research plan as soon as Jim Taylor at EDO has received it. We haven't given it to him yet because it isn't quite ready and we have to review that with Tom Murley and Jim Taylor. I imagine, the timing, it will probably go to the Commission early perhaps in January.

One other point. The radiation protection and health effects program was moved. It's budget category was shifted to the fifth category, which is resolving issues and developing regulations. I think it was this last spring when it was finally changed.

MR. KINTNER: It can stand alone now in your view? Is it a separate item? In other words, in writing this report, should we treat them together or separately?

MR. BECKJORD: Well, I think these are -- the basic outline follows the structure of the program and I think we can address it. It really is a separate item. I think it stands on its own. So you can address that.

MR. BURSTEIN: Doesn't it do that in the five-year plan?

MR. BECKJORD: Well, it appears under this fifth category.

MR. MORRISON: These are exactly the same categories in the five-year plan. I saw you pull out that document. That's the right place to find it.

MR. BUSH: But there are subsets, for example, the structural integrity is in a different area than the containment safety, for example.

MR. MORRISON: In fact, the containment model tests out at Sandia are in that containment performance category even though the work is done in a different branch

than does most of the work in that category.

MR. BUSH: Yes. Engineering has one responsibility and the other is --

MR. BECKJORD: The loading for the containment comes out of the accident branch.

MR. BURSTEIN: Dave, there is one perhaps fundamental thought that occurs to me and I support these in the general outline as being the direction that we should go in. We are to some degree also responding to a National Research Council report which you recall is revitalizing nuclear safety research. That was issued a short time ago.

Among the things in there, it talked about the need for a regulatory research philosophy. I think this is what you mean by Commission and perhaps establishing or confirming that, indeed, the Commission and its staff have responded to that and some of these other things and we do have at least some better definition of this mission and direction and philosophy than was here.

I think you distributed copies of something either in this forum or some other. I received this some years ago from the --

MR. KINTNER: How old is it?

MR. BURSTEIN: 1986 is the original.

MR. KINTNER: The basis for this.

MR. BURSTEIN: Yes. The basis for this Committee

was --

MR. BUSH: The original one was a bigger document.

MR. BECKJORD: Originally we gave out copies of that. Now, we may not have followed through on that. Ed, apparently you haven't seen that before. We can certainly provide a copy for anybody who doesn't have one.

MR. BURSTEIN: It would seem to me, however, in carrying this just one step further, that we ought to revisit -- some of us ought to look to see whether this outline is not inconsistent with what has been addressed earlier and whether, indeed, we've achieved some kind of response; that is, we being the Division of Research, has not, at least at the Commission where appropriate, responded appropriately to some of those comments.

MR. VOGEL: It seems to me we should revisit that document and make sure that we've disposed of the issues which --

MR. BURSTEIN: Exactly.

MR. VOGEL: One way or another.

MR. MORRISON: Who needs copies of that document? Ed needs copies, Spence.

MR. BECKJORD: We're out of first revisions, so I have to give you a xerox.

MR. BUSH: Dave, there's one thing I couldn't find in here. It may be there, but I haven't seen it, and I

think it's a very significant item. It could represent some change. There are several programs that are examples of this, and this is the fact that the NRC has made specific efforts, and I think successful efforts in what I would call shared research.

Historically, they seem to think that they have to go back in the old days where they wouldn't believe anybody so that they would do their own work. Now, and I can think of a dozen programs at least where there is shared research and there's tremendous leverage in some instances. In some cases, there's a factor of ten, 20, 30. That means that for every million dollars you put in, you would be needing another ten or 20 million dollars from other places.

This is significant because what it is is I'm not going to carry the burdens of the world on my shoulders, I'm going to interface with EPRI. It doesn't mean that you're going to affect your positions or anything else, but to a degree touch on this decoupling of research and regulation. It seems to be it's a very important issue because what it amounts to is what one has to look at the value of a program and even though it may be an immediate value, there's a high leverage factor, I think that's a factor that one must consider.

MR. VOGEL: I think one of the big advantages of these shared programs is to achieve what one might call the

grass roots consensus from the technical people as to what the problem is and what the solution is so that you don't have somebody second-guessing you.

MR. BURSTEIN: Is the place to discuss that in this outline?

MR. BUSH: One place is it's kind of a subset of what's in the last paragraph on Page 4. I think that's a very important issue.

MR. MORRISON: I would suggest that if that message is as important as you imply, Spencer, I'm not saying that it isn't, but perhaps we would hit it twice. One would be if we look at Page 2 and the first item there, provides an independant technical basis for the current safety margins included in regulatory research decisions.

I did not try to elaborate on that. I think we probably need a paragraph that elaborates on that, and that kind of sets the stage for how much can be done outside the NRC and how much must be done inside of NRC. Then in the third bullet, or whenever that list is you're referring to, Sol, we could hit it again as another way of getting --

MR. BURSTEIN: It seems to me that's the mechanism. I agree you ought to highlight it, but how do you get there might come out in those later.

MR. BUSH: I just think that it's a point that we should make because I think it's a very important point,

because now what we're doing is we're taking advantage to a greater degree by a little money of the research of the international scene, as well as of the national scene.

MR. KINTNER: I was going to make the same comment when we got to Page 2. I can maybe even add a little to what you said. It seems to me that one of the specific duties of the Research Office is to be sort of a center of gravity, the gravity, the encyclopedia for all safety research done worldwide by whomever, almost their first function.

The reason for that is as it's developed, the NRC research program is itself not generating the majority of the information that's being used or being developed. I would think that it ought to be a part of the mission, almost to be the center of gravity, the encyclopedia, the central focusing mechanism for the collection of all the information and its digestion for the first order of business before you decide what you're going to do for yourself.

Now, maybe I'm feeling this so strongly because I don't know what's going on in the rest of the world. I've just joined this group. But I really think it deserves to be said somewhere, maybe the way Spence has suggested or maybe the two ways that you said.

MR. BUSH: In fact, there were reports. In fact,

I participated in them and there was funding from NRC research to look at the programs overseas that had an interface. In fact, I visited half a dozen countries in Europe to find out what was going and this report came out under Stevenson & Associates which looked at -- it didn't look at the whole picture, it looked at specific ones, more in what I would call the item of system integrity.

But we did look at the work in Germany and France and the United Kingdom and so forth, as well as in Japan, etcetera. That report is now a few years out of date, but it's still got that point.

MR. BURSTEIN: There is no question that getting to know what the rest of the world is doing is of fundamental importance in the U.S. Nuclear Regulatory Commission, but I would hope that Ed's statement didn't reflect an implication that the research area of NRC has to do all the research or agree with it or in some way endorse or review it or other massaging of that data worldwide.

It cannot fulfill that function and I hope that's not intended in any respect.

MR. VOGEL: Defying these programs, international programs is always a lot of give and take. You frequently end up supporting something that is maybe a little less impressing in the judgment than somebody overseas. They had different problems over there. So the emphasis is a lot

different.

I was somewhat distressed by the problem at EPRI; of course, I'm detached from them now at this point; but we had one expert in international programs, Frank Rahn, he's not out of the circuit and has been put at INPO, and it really is quite an art to negotiate these international programs. You end up struggling with occurrences and all sorts of contractual problems.

I'm a little bit concerned as to the strength of the international programs.

MR. BURSTEIN: In a broader sense, what you bring up, Richard, is worrying a lot of us. The limitations on funding available to the Office of Research of NRC is matched by the limitations on the funding for research in every other area of the universe. Yesterday, if I recall correctly, in the Wall Street Journal, there was an article appearing I believe on the front page in the lefthand column of feature stories about how a -- I think it was a biochemist or geneticist who is giving up research in order to solicit funds to support his laboratory.

The Electric Power Research Institute, in my view, is falling on very hard times because while the needs for research continue to grow, the utility officers who are directors of that cotton-picking outfit have decided to trim the budget. That is repeated in numerous instances around

the globe.

Work on the high temperature gas reactor in Germany, for example, is very disappointed. So we have a worldwide problem that I think may bear some acknowledgement within this Committee report. I'm not sure how we do it except to wring our hands some more. But the private sector and the public sectors and the academic sectors -- God knows academia isn't contributing anything to research. Maybe it's better to put up football stadiums because they bring more money in than R&D programs.

We don't have any winning teams out there. But it is a significant impact on the level, total level of activity that we need to address. That brings up the other question. That is do we still have the same needs for additional information that we had ten years ago, 15 years ago.

When is enough? I think there is a legitimate question that says how much more do I have to study this bloody thing before I have a yes, no or some other kind of answer.

MR. KINTNER: Sol, that raises two questions in my mind. One, is the specific root beer safety research program worldwide coming down as fast as it has in the United States in the last ten years or is this then an argument which ought to be in this report with regard to the

resources made available to our NRC's research program? It seems to me that's a good question.

The second reaction I have is with all the subjects of global warming, etcetera, etcetera, etcetera, and with the seemingly increasing reaction against nuclear power worldwide, does that say -- presumably the reaction is because of concerns on safety, does that say that safety research worldwide ought to be growing rather than decreasing, no matter how much you know now?

I would think -- I'm jumping the gun here a good deal -- but I really have a sense there are a hell of a lot of questions we don't know about the safety of our reactors which are rapidly influencing both the present operations, public attitudes, cost of operations in terms of O&M and training, and in looking at future reactors in terms of such things as containment design, hydrogen systems and so forth.

We really have not exploited fully all the things we need to know, I don't think.

MR. MORRISON: It seems to me that we're dealing with a very difficult issue of judgment. I think that's what it is. On one hand, it's a technical judgment that someone has to decide a piece of research that is being done somewhere other than by NRC under conditions that may not be exactly what you'd like to have if you were in charge of funding that program or scoping it out and setting the

objectives.

Those are slightly different, but are they adequate to give you the information that you need, and that's sort of a technical judgment. But the issue that worried me a little more, reflecting on our last meeting, is who makes the final judgment on the research program within NRC, maybe getting back to when is enough enough.

Is it your responsibility, Eric, because you're given the money and say spend it wisely and come back with the results we need, or is it the user that keeps beating you on the head for the need on that, or is it somewhere at the Commission level where you sort of lost touch with what the connection between the need and the performance is.

I do have a concern, I expressed my own concern in there that although I'm very supportive of the user need process of identifying what needs to be done, I'm concerned about the extent that it's going to, especially in the waste area where it sounds like there's almost daily or weekly meetings, I say who's running the research program between the users and the research people, and I worry about that as a procedural issue.

But I think it's all tied up into this broad judgmental one. Where's the judgment, who makes it?

MR. BECKJORD: Well, it's my job to recommend the budget, what goes into the budget. The decision on the

budgets is finally made by the Commission. There are generally during the year about three iterations on this. Initially, I'm going to mark, and I've put into the budget the programs basically on a rank priority basis. The things that we can't fund we don't undertake or we defer. Generally, we defer.

I think that in my experience over the last four years, the changes that have been made after I send the budget on for the review of the Executive Director of Operations and for the Commission, those changes have been relatively modest. I think in any one year I can't recall a displacement of more than $2 or $3 million of funding. Generally, that's happened in waste once. I think waste is the major example.

So I think that I can say that for the most part the Office recommendations have been accepted. Now, what has happened has been, over most of this time, a succession of sharp deep budget cuts. Not so much as a result of the Commission's determination that the work isn't needed, but simply a response to the general fiscal situation of the budget.

This year we came out somewhat better. The total research budget is up, was passed by the House this year at $94 million. Following the President's signing of the bill a couple of days ago, the agency is going to lose $10

million of -- I think it was from 475 to 465. It's very close to that.

So there is a net reduction of $10 million. Research finally, when all is said and done, will take somewhere between $4 and $7 million of that.

MR. KINTNER: Of the ten?

MR. BECKJORD: Of the ten, yes.

MR. BUSH: It sounds unfair.

MR. BECKJORD: That's always been my view. But when you look at the structure of the NRC budget, there are several categories of expenditure. The first one is the rent and certain security bills and things like that, telecommunications, that have to be paid. I mean, those are committed expenses.

The second category is people. Most of the NRC budget is for paying salaries, the salaries and benefits of the 3,100-odd employees. The third category is a category which you can call -- over which there is the power of decision, and that's where it -- most of it is research and some of it is so-called technical support. Murley has about $25-$30 million, something like that, that he can spend on current needs to get engineering analysis and support. Bernero also has some technical support.

Those are the things, when a budget cut comes along, that's what gets cut because at that point there are

only two choices; either you cut people or you cut the funds, over which you can make a decision. So it's not surprising that we take a large part of that cut.

But what I'm saying is that this year, in spite of all of the budget difficulties, we've come out pretty well because a $5 million cut is no great difficulty for us.

MR. BURSTEIN: Is this out of the $90 million?

MR. BECKJORD: Yes.

MR. BURSTEIN: $90 million was the FY 1991 request.

MR. BECKJORD: That's $90 million plus the high level waste. See, the high level waste, Congress put that in a separate category. So the total is $94 million.

MR. BURSTEIN: I see.

MR. BECKJORD: That's our budget. We will, as I say, take between $4 and $7 million, but there won't be any cut in the high level waste part of the budget. So the $4 to $7 will come out of the $90 million.

MR. BUSH: It's an unfortunate situation because the organization I guess I could call under the high level waste situation in the sense that it's very difficult to come to grips with what you should be doing.

MR. BECKJORD: When all is said and done, I think we will get some more money on high level waste. I think I wrote a letter today that there was some prospect of getting

the $2 million which would enable us to respond to the comments, among other things, that were made by the Committee at the meeting that we had in June, getting work done on tectonics and volcanism.

That hasn't materialized yet and I don't think it would be $2 million, but I think we probably get some more money in this Fiscal 1991 for work in those two areas.

MR. VOGEL: One of the philosophical mistakes --

MR. BECKJORD: It was carry-over money.

MR. VOGEL: One of the philosophical mistakes in managing a research program is that then you've got a political problem. When one goes into the laboratory and tries to solve it, it generally doesn't work.

MR. BECKJORD: That's right.

MR. VOGEL: And this, at least in the early part of the waste program, seems to have been a problem.

MR. BECKJORD: Just a comment on the international scene, it's very mixed when you look around the world. I can summarize it pretty quickly. In the United Kingdom, the whole nuclear enterprise there has taken quite a beating, including their work on safety research. Also, there is a major change in the organization of their whole nuclear activity which formally took place around April.

But the health and safety executive is taking over the budget responsibility for much of the work in nuclear

safety. I think they will -- it's probably going to take them a year or two to resolve all of their organizational questions and it may be that they will be putting more resources on the nuclear safety questions when they've done that.

I met with the French and the Germans. We had a three-way meeting early this year, and it's interesting that when you look at our budget and their budgets, they are about of the same order of magnitude in dollars as of the dollar value at the beginning of the year.

MR. KINTNER: Each country or combined?

MR. BECKJORD: No. About $100 million each, of that order, $100 million give or take a little. Now, the French are putting -- a lot of that money is in this Phebus experiment on the -- they want to develop more information on the source term and what the behavior is in the primary system plate-out and that type of thing. After many years of discussion, we did reach agreement with the French. We are participants in the Phebus program and they have joined our severe accident research, and I think that outcome has been a very good one. It's going to be good for us and it's going to be good for them.

But, as I say, in their case, a major part of their resources are going into that Phebus experiment. It's a very extensive experiment.

MR. VOGEL: Incidentally, I spent six weeks over there reviewing that program.

MR. BECKJORD: Well, we should talk, review that.

MR. VOGEL: I don't know what kind of conflict-of-interest problems I might get into. I hav. no ongoing contract.

MR. BECKJORD: We can certainly receive information on the subject. You don't have to advise us on that one. You can tell us what's happening.

With respect to the Germans, they have a very active program. Really, I guess there are two comments to make there. One, the new responsibilities as a result of the unification of the two Germanies, I think, are putting a very severe stress on them because the resources, most of the resources are in what was West Germany and they've got to figure out what they're going to do about the East German reactors.

They did make an initiative. They have had an initiative underway for more than a year to extend the use of the UPTF, the upper head plenum test facility in Manheim, which was designed originally to test the flow in the upper plenum for the large break in the pressurized water reactor. The concern at one time was that under certain conditions, the emergency core cooling water which was injected would not go down to the bottom of the vessel.

MR. BURSTEIN: The upper head injection.

MR. BECKJORD: Upper head. But it would go around and go out the break.

MR. BURSTEIN: Bypass.

MR. BECKJORD: Bypass. And that question has been resolved. Now they have the facility and they have developed a program for testing some features relating to accident management. They came forth a year ago with $100 million program, and then they trimmed it down to $50 million, and we've had a lot of difficulty with that because we felt that we couldn't justify joining that program.

Herb has participated. We've kept him advised of the status of the discussions on that, and our position to them is that we will -- if they go ahead with it, we can give them a modest amount of calculational support, but that we would not be able to participate at the roughly $16 to $18 million that they wanted us to put on that experiment, because it just wasn't --

MR. BURSTEIN: But we have gone in the other direction. Here is a case, if I may take off on that just a moment. You were party to a design in the mid-1960s for upper plenum injection of emergency cooling water. We were compelled to disconnect those connections and that system because we would not demonstrate in the early 1970s that it would be effective.

MR. ISBIN: I don't think that's quite true. Prairie Island, Kewaunee --

MR. BURSTEIN: Point Beach, have all been disconnected.

MR. ISBIN: No, they haven't. Prairie Island hasn't been disconnected and Point Beach. But at Kewaunee, they went through a special review. Westinghouse did an extended analysis.

MR. BURSTEIN: I think you're right. They are not disconnected. We'd take no credits for it.

MR. ISBIN: Well, you took a penalty initially.

MR. BURSTEIN: Okay. My concern is that here we are nearly 20 year later and the Director has told us that we now have that issue resolved. But who cares? We have not been able to perhaps answer the questions by experimental verification or other means, analysis or what, and so we went another route. The concern arises should we continue to spend money chasing the details of a phenomena whose perhaps additional information will be of limited or no value to us.

I apologize for my inaccuracies, but in some cases we shut them off and we didn't take credit, and in another case apparently we took a penalty. I guess we must have had three different reviewers.

MR. VOGEL: I wonder whether this work applies to

the advanced light water reactors or not.

MR. BECKJORD: I think the conclusion of it is really you can put water in that comes up from below or you can put it in from above, and it all works fine. I think that's the bottom line.

MR. ISBIN: The approach that I think research is taking is good. Their participation, if they do participate in this TRAM, the transient reactor accident management program, is very modest, and Brian had some very serious questions as to what value this program would have to our reactors. The Germans had other points of interest. They had different requirements.

This is a place of cooperation and it's modest.

MR. BECKJORD: I should make clear to Sol that what the Germans were proposing was not to extend, not to do any more work.

MR. BURSTEIN: I understand. Now, we've got to find somehow a way of keeping it going.

MR. BECKJORD: Yes.

MR. BURSTEIN: And if we have to invent some new questions.

MR. BECKJORD: There are several problems with it, but the most important one is that the pressure that it can operate at is -- I think it's about 300 psi, maybe a little higher than that. It is not useful for depressurization

given that.

MR. ISBIN: Sol, what was disconnected was the hot leg injection.

MR. BURSTEIN: I know. The other thing that I had was the main coolant system depressurizing connections.

MR. BECKJORD: Let me mention just one other thing, two other things. We have a very broad agreement with the Russians and they have done some interesting work in water reactor safety and in severe accidents. We will be cooperating with them.

It appears that their budget situation is far more serious than ours as a result of what's going on this year. In fact, what they are trying to do is to keep alive the Kurchatov Institute by doing contract work. They will do it at just an unbelievably low price. So I expect that we will probably be working with them to try, maybe take a program and try it as a test case to see how it works.

MR. BUSH: I see $1.5 million in 92 -- is it 1992 it starts? I thought I saw that.

MR. BECKJORD: You're right, but I can't remember whether it was -- I thought it was 1991.

MR. KINTNER: Two questions. Do you feel that you have access to all the relevant safety research being done worldwide now, Japan, France, Germany, Soviet Union? Do you have agreements and relationships which really make that

information, wherever it's generated, available to you?

MR. BECKJORD: My answer is a qualified yes.

MR. BUSH: You don't have all the seismic, unless you got it just in the last year. The Japanese seismic work, I know they've been holding onto that for a long time.

MR. BECKJORD: There's a difference between -- the U.S. is unique among almost all other countries in that the work that we do appears on the public record. The work that is supported by other countries generally has some kind of commercial protection.

In cases where we have a direct agreement with them, we take care of that. It's an even exchange. We get full access to the information that we are involved in our funding directly or in a cooperative program. There are cases where we're not involved and we don't get all of the information there, but we get some of it because of the contacts that we have.

MR. KINTNER: Osmosis.

MR. BECKJORD: Yes. Papers are published and meetings are held.

MR. KINTNER: Should you have more informal agreements, more --

MR. BECKJORD: We have a lot of agreements.

MR. KINTNER: I know you do.

MR. BECKJORD: We have more agreements than I --

MR. KINTNER: Should you, in your judgment --

MR. BECKJORD: We have more than 50 international agreements on --

MR. KINTNER: Should you have better access to any research anywhere in the world than you have or are you satisfied with what you --

MR. BECKJORD: What I'm saying to you is it's really pretty good now.

MR. KINTNER: Okay.

MR. BECKJORD: The big area --

MR. KINTNER: So the answer is no, you're satisfied.

MR. BECKJORD: The big missing area was in France and we resolved that problem.

MR. VOGEL: I have a suggestion. It seems to me that the NRC would have better access to foreign information if they made sure, for example, in attendance to OECD meetings that senior people are sent to the OECD meetings and that they are sufficiently senior that they command the respect of the international community.

My observations in attending OECD meetings over the years is that there's no continuity of NRC attendance. One guy would have attended and then somebody else would be in Paris and then another guy would --

MR. BECKJORD: Which meetings?

MR. VOGEL: I was thinking of Working Group No. 4. One really needs a continuity of participation in these international bodies in order to get them --

MR. BUSH: CSNI has had pretty consistent attendance, I think.

MR. BECKJORD: Well, I'm the Vice Chairman of CSNI and they have more meetings than I can attend. I get there twice a year. We have a representative on each of the working groups.

MR. VOGEL: It's the working group that I'm thinking of. With all due respect to the CSNI, it's at too high a level to get involved.

MR. BECKJORD: Well, Sheron has been on Working Group 2 since I've been here. He is now Chairman of the senior group on accident management. Jack Heltemes was the representative on one and since he's moved to research, he's moving out of that, but I think that probably -- I think Ross is going to take his place.

In Working Group 3, Serpan has been Chairman for ten years. He will be, I think, probably stepping down this year. Working Group 4, Eltawila is on Working Group 2 and has been there since he took his job on. We have had some lack of continuity there because of job changes.

MR. KINTNER: Can I ask another general question?

MR. BECKJORD: Yes. And Joe Murphy has been on

Working Group 5 and Jocelyn Mitchell on Working Group 4. So we've been pretty active on those.

MR. KINTNER: Just a follow-on to Sol's comment about where you inject water. Is there any sense in the research program management that there is a benefit to determining places where changes could be made in regulations, in the way regulations are applied, in the way designs are allowed, which would make operations cheaper, construction cheaper, plants simpler, training less necessary?

In other words, is it a viewpoint only that your only purpose is filtration and veto as compared to improvement in terms of the end result of producing electricity?

MR. BECKJORD: We have a task to go back and review the regulations on reactors from the beginning and to weed out those which are unnecessary or counter-productive, and to upgrade --

MR. KINTNER: So there is some sense that you have another function that's positive, as well as not being strictly negative.

MR. BUSH: In the five-year plan --

MR. KINTNER: -- might very well believe that --

MR. BUSH: I've heard your question and I've heard his answer.

MR. KINTNER: He didn't answer me.

MR. BUSH: But, no. Ed, in the five-year plan, presuming that it will be complied with and I think it will be, there are two or three items there that I would say that if a new plant were to be built, I think if they were implemented as indicated in the five-year plan, I would estimate that you would reduce the construction costs and design costs by $1 to $200 million.

MR. KINTNER: You're making that estimate on the basis of what you know, because it doesn't seem that way on the other end. It's a little bit off the --

MR. BECKJORD: Leak before break, primarily. Is that what you had?

MR. BUSH: That's right. And the pipe whip problem, because you save a tremendous amount of money.

MR. BECKJORD: I think that's a good number.

MR. BUSH: You get rid of 75 to 80 percent of your snubbers and a large number of your supports, plus all of your garbage that's attached there to handle a pipe break. That's a tremendous amount of money.

MR. BECKJORD: I worked with people at Stone & Webster about five years ago on this question and going through the several piping systems, they're estimates, they made a pretty thorough estimate of the savings and they came up with a figure of about the same order of magnitude.

MR. KINTNER: That's the sort of thing I'm thinking about. I don't want to drag a red herring across here, but I do think this is a subject which may very well provide a little light. This is a new report just out in August. I don't know whether research did it or some other part of the NRC.

MR. BECKJORD: It will say there on the front cover.

MR. KINTNER: It's CR-5575. I'm really was amazed at some of the comments made in here and I think they are pertinent to the research program. The benefits to risk of intentional operator depressurization cannot be judged conclusively. We're making specific intent, it's considerable length to depressurize in ALWRs.

The addition of a cavity fighting system yields a slight reduction in risk, but may increase the probability of DCH failure in some sequences. We're putting in a cavity flooding system as a major feature. Improvements in hydrogen control systems are of no benefit in terms of risk. And we've been working hard to improve the hydrogen systems.

Gradual overpressurization by non-condensible gases, including steam, is not a threat to containment integrity for Zion. Now, this is Zion and they say this has got to be looked at, but I think it does apply generally to plants with more volume rather than less.

But this is one of the sequences we're studying to death and they're saying it's almost the extreme case.

MR. VOGEL: Who wrote that?

MR. KINTNER: EG&G, and it's dated August. So I got it and read it carefully because I wanted to understand where could we do more to make containments better. I couldn't find it in here. I don't know whether that's your report or somebody else's.

MR. BURSTEIN: I guess, if I may focus back on where we were on our outline. It seems to me that we have expressions of material in the five-year plan and in this 1986 report of the National Research Council that might help in looking at pieces of the outline, but, in my view, it does not distort what's now listed in these two pages, Mr. Chairman.

I would suggest that they form a suitable basis for this Committee's report. I don't see any errors that I would call errors or omission and I think it covers the programs pretty much as we generally hit on one or two of them around the table this morning.

I think it might be appropriate for us to proceed with either an approval or comments on this outline.

MR. MORRISON: I certainly think we should proceed with getting some comments on those Pages 2 and 3. I appreciate your endorsement, Sol. I did try to look at what

was in the plan and I would say that that is consistent with what is on Pages 2 and 3. I did not look at the National Research Council report in that same sense. I may bear a little more examination of that report to see if there's anything found there.

MR. BURSTEIN: I think it's also a very useful treatment of the NRC's research philosophy in the first few pages of the five-year plan, which may be helpful.

MR. MORRISON: Maybe a place to start is in that philosophy that's in the plan. A question to you, Eric, is what is in the draft plan that we have something that is well accepted within the Commission as a statement of philosophy?

MR. BECKJORD: Yes.

THE COURT: You've certainly wrestled with it over the last couple years in trying to refine it.

MR. BECKJORD: There's been very little discussion on that for two years now. I think it's well accepted. I was just going to say, just to finish off the international discussion, the other thing to mention is the Japanese, the financial picture is very different with the Japanese.

As you may know, the attitude in Japan toward the question of severe accidents is one of great care and caution because of the concerns they have with their domestic acceptance. However, they are evidently willing to

spend large sums of money outside of Japan studying these questions.

We have had discussions with them underway for a year now on containment testing and on hydrogen testing, high temperature hydrogen tests. It appears that we will know in March if their budget has been approved for this, but if it is approved, they wish to enter into an agreement with us. It will be a cooperative agreement and they will supply a great deal of money to do scale model containment testing of prestress, post-tension containments and also hydrogen detonation and combustion.

MR. MORRISON: Well, let's return to the items that are on Page 2 -- Page 3. In addition to the review of the five-year plan, these six items are a combination of the presentation that Eric made to us in the last meeting, plus the six items that Tom Murley mentioned at the meeting with him the last time. It's not the total list, but I've taken a little license with some of the words.

Do we understand collectively what we mean by them?

MR. KINTNER: I still say it seems to me there should be some reference here to collecting and providing resource in terms of world information on safety research. It doesn't mention that in any way, unless it's buried in independent technical basis. Again, I repeat, my own sense

is that the research organization should have that as one of its first and foremost missions, to be the U.S. experts in whatever is going on in safety research worldwide, and use the basis for that to judge what ought to be done here.

MR. VOGEL: One thing that I sort of missed in the five-year plan was essentially the ligature, certainly --

MR. KINTNER: Maybe that's what it is.

MR. VOGEL: Whatever you'd want to call it.

MR. KINTNER: It would be the center of gravity first and foremost.

MR. MEYER: I don't know how much I'm supposed to speak up here, but doesn't this get at the heart of the charters of the Department of Energy and the NRC? I've been listening to your comments and wondering whether some of that isn't what the Department of Energy is supposed to be doing rather than the NRC.

MR. KINTNER: For safety research?

MR. VOGEL: That may be. The next question is are they doing it and is whatever they're doing available.

MR. MEYER: I don't think it's my part to do more than to suggest that you might discuss that topic. I'd just suggest that you put that on the table and discuss it among yourselves.

MR. KINTNER: I'd feel a little bit uncomfortable if the NRC were to delegate this to some other organization.

You really have to know yourself what's going on.

MR. ISBIN: I suspect that some of the Committee members are not giving good credit to what Eric has been saying. From my point of view, the NRC is maintaining a current involvement with international research. We've talked about this. This indicated the OECD and some of the activities there. And Ralph, in some of our previous meetings, has informed us on his activities and how he's been able to leverage the research on source terms.

MR. VOGEL: I agree with you, but the visibility -- the five-year plan was not --

MR. KINTNER: I'm not suggesting they're not doing it. I'm suggesting it should be recognized somewhere in this.

MR. ISBIN: Well, recognition, okay. But to have it as a first mission or a key mission I think is a little out of place. This is being done.

MR. VOGEL: One needs to use this kind of information as a departure point for your five-year plan.

MR. MORRISON: At that level of detail, it seems to me that would fit more into the second chapter then on terms and procedures. This, to me, is really a statement of a philosophy of mission and the number one item is to provide this independent technical basis, and that is right out of the philosophy statement that is in the five-year

plan.

It goes on under that statement, the information should be independent in the sense it is not derived solely from information provided by the licensees and that it has received peer review by experts who did not perform the research. It doesn't say anything about domestic, foreign, whatever on that one. The research required for this purpose is mostly oriented to the problems that are foreseeable in the near term.

That I think is the sense I put behind putting that item down there. It was also one that Tom Murley had at the top of his list, what are the safety margins, what technical basis is necessary to confirm that those margins, indeed, exist.

I think it's a matter of procedure as to how you get that information and that may be an issue that we should deal with in the second chapter, and be sure that all international is being covered. I think in your sense, Herb, you're comfortable with this.

MR. ISBIN: I'm comfortable with this. I would like to --

MR. BECKJORD: I feel that we know what's going on and I think we have to know what's going on. I hesitate a little bit at having a mission which requires us to catalogue and be the repository for everything, because that

implies a somewhat -- I mean, if that were realized, why, we would have to put expenditures into proving that we had mined everything and documented it and recorded it and put in a repository.

That would require a substantial investment of funds to have a library of all of this information.

MR. VOGEL: I would feel comfortable that in the five-year plan, in each segment there is one paragraph summarizing the worldwide status of the problem.

MR. BECKJORD: We can certainly do that.

MR. VOGEL: I feel it needs to be done, myself.

MR. ISBIN: Dave, could we go back to Page 2 and Item 2 in the second paragraph, the three main purposes? Eric, I've talked to John briefly about the wording, to anticipate problems of potential safety significance in which new and expanded knowledge can assist NRC in pursuing its mission.

I have some difficulty still understanding what you mean by anticipating problems of potential safety significance.

MR. BECKJORD: I would say that it's best explained in terms of examples. I think direct containment heating is an example. That came up -- Ralph would know -- what, about five years ago and a meeting with -- between -- I believe Sandia was involved in the meeting. Was it a

working group out of EPRI? Bob Henry was involved in that.

MR. MEYER: I wasn't there.

MR. ISBIN: This is one example that's been given, I agree, but there are only a few more examples, I think, that one can give and to list this as a major purpose, one is always looking for problems in terms of safety in anything that we do. But to word it as anticipating problems of potential safety significance for operating reactors now, somehow, to me, isn't mission No. 2.

MR. BECKJORD: Well, I guess I don't know how best to put this.

MR. ISBIN: It's the wording and it's the phrasing here and what you really mean by this, that the thought --

MR. BECKJORD: Is it the word anticipate?

MR. ISBIN: To anticipate.

MR. BUSH: Crystal ball is what you're saying.

MR. ISBIN: Right. I mean, as a mission No. 2.

MR. BECKJORD: Well, I think we agree on the interpretation of the wording.

MR. ISBIN: This underlies anything that anyone does in terms of safety. You're looking for implications.

MR. BECKJORD: Let me tell you why it's there and see if that helps. If you go back in the enabling legislation, the work that the NRC can do, it comes down to almost a phrase. It's confirmatory research. To me,

confirmatory research is pretty limiting because if you do only what is confirmatory, then you're basically reviewing a proposal or a license application, and there may be some question in the technical base in which the applicant says, well, here's the basis for -- here's the technical basis for the design of this system.

Either its basis includes data which is recognized and understood and accepted all the way around or it may be, in some cases, proprietary data and, hence, not so well known and not so completely accepted. Confirmatory research would be to examine that and see if it's important that it be verified with information which is separate from proprietary information base

But if you take that approach and do only that work, then you're not looking for -- you're not taking a proactive stance in looking for problems that can arise. I think that the analysis of data from the operating reactors has proven the importance of doing that in terms of the precursor events and the interconnected system loss of coolant accidents. There are a lot of examples like that and that was not -- to look at that is not confirmatory.

I think it is anticipatory, it seems to me.

MR. BURSTEIN: Are we looking for a definition of anticipatory research?

MR. MORRISON: I wonder if you aren't really

seeking the justification really for the second part of that sentence, expanded knowledge, and you're really talking about, in effect, the text on Page 4 of the plan. It talks about exploratory research is frequently required to provide new knowledge. Expansion of this knowledge could help to recognize that perceived situation and prepare for dealing with it. I think that's what you're trying to justify.

I think what you're saying here is I better have anticipate in there; otherwise, somebody is going to shoot down because we're chartered only to do confirmatory.

MR. ISBIN: But, see, confirmatory research has always meant an open-ended approach; that, indeed, you look at the problem as it was originally posed. But in the course of your experimental work, your eyes are open and you're not really devoted to confirmatory research if you see something there which needs to be pursued.

This has been the justification of the use of confirmatory research for as long as I can remember. Spence, we talked about this on ACRS a decade or so ago. So it always had that implication that it isn't simply confined. You're doing it in an open-ended way.

MR. BECKJORD: Well, I guess there may be another -- I think the reason that it's there has to do with discussion of budget examiners, because the budget examiners' approach is always to narrow, narrow, narrow,

narrow. When you narrow scope, you can cut budgets, and the budget examiner's job is to cut budgets.

My feeling was it was important to include that notion to make the point that if you follow a strictly confirmatory approach in doing research, you may not be looking at the important problems and you need to have somebody who is thinking about what the important problems are in every area. That's the reason for it.

MR. MEYER: Does risk assessment enter in this part of the picture at all? Risk assessment, in a way, is searching for weaknesses and strengths.

MR. BECKJORD: Searching for and anticipation. I mean, I'm not looking for that synonymously and maybe it's a word, maybe it's a schematics problem.

MR. ISBIN: Somehow it created a problem for me.

MR. BECKJORD: If we remove it, if we substitute some other word or phrase for anticipatory, does that --

MR. ISBIN: That helps me tremendously.

MR. BECKJORD: All right.

MR. ISBIN: If this is a budget item that has its orientation on this basis, I would yield, but --

MR. BURSTEIN: It's the exact words out of the five-year plan.

MR. ISBIN: That's what I objected to.

MR. MORRISON: Now it like becomes a mechanical

issue, in a sense. Eric is willing to substitute something, but I don't have anything that I can quote. What do we want to do about that? Or maybe just even add a sentence at the end of that, your interpretation of what it means.

MR. BUSH: You can always cite it as a quotation in there which doesn't say that we accept it or reject it, just cite it as a quotation.

MR. VOGEL: What I would wonder about on Item 2 is the methodology with which you identify problems. You can look at precursor events or you can look at the PRAs or whatever. Is this sort of a formal mechanism?

MR. BECKJORD: Yes. There's a very formal mechanism for the definition and acceptance of generic safety issues. The source -- the issues are gathered from all over the place, from a study of the LERs. Anybody can say, hey, this is a generic issue. So they have come, as a matter of record, from the industry, from within the Commission, and from the intervenors.

Once an issue is put on the table, then it is reviewed and classified according to its risk significance and to how many plants it applies and so on and so forth. Then it gets ranked. If it is accepted as a medium or a high priority generic issue, then we go to work on it.

There is a list of more than 900 of these that have developed over a 20-year period and in the process of

working that inventory down. All of the ones, the high and the medium priority, work on those will have been completed by 1992. The rate of new issue generation is decreasing. I guess you can conclude from that that all of the things that are likely to happen have already happened, and the things that are less likely to happen will continue to crop up. But since they're not very likely to happen, they won't crop up very often.

So the arrival rate of new generic issues has fell off.

MR. BUSH: Couldn't we just cite it -- I agree with you -- as a direct quotation from Page 4-4? If we cite it from there, we don't necessarily bless it.

MR. MORRISON: Unfortunately, we've got two 2's under discussion, I think. Herb was addressing the 2 in the second paragraph on that page and Eric at least responded I think to 2 at the bottom of the page.

MR. BUSH: What I'm saying is the words that are here are to anticipate problems of potential safety significance, which is just exactly for which we were expanded. That's a verbatim citation from 4-4. If we simply cite it as being there, as the philosophy, then we don't bless it or anything. We simply are citing it as a statement from there.

MR. BURSTEIN: It's the following paragraph,

however, on Page 2, which says this Committee concurs with this philosophy.

MR. BUSH: That's a different animal. If you get rid of the first paragraph, then you can decide whether you concur or not. If you change this to the, then you get around that problem.

MR. MORRISON: Why don't Herb and I put our heads together and see what we can do with that second paragraph, since he's the one that has the discomfort with it. Let's return to the list at the bottom of the page. I guess, Dick, your question was really with regard to the generic issues of how one defines those and how one identifies and what's the procedure? That's what Eric answered.

MR. VOGEL: No. I was thinking on Item 2 --

MR. MORRISON: I thought you --

MR. VOGEL: But that's all right. It seemed to me that your answer fit both and I believe that anticipatory research is related to generic issues, at least in my mind.

MR. BUSH: I won't get into timely resolution. I've seen some of these issues that were around when I was in my early years at ACRS. So that puts them back quite a while ago.

MR. VOGEL: Were they high priority?

MR. BUSH: Yes. They were high priority and they still haven't been resolved.

MR. ISBIN: Even generally.

MR. MORRISON: So we're basically satisfied with the first two items at the bottom. I think No. 3 will engender a fair amount of discussion. Before we get into that, why don't we take about a five or ten minute break. I think, because several of the comments that came back from the Subcommittees felt that this technical capability -- maintain the technical capability. We probably ought to throw that out on the table and discuss what some of the issues are to know whether we really want that statement as something the Committee endorses.

So let's take about ten minutes and come back.

[Brief recess.]

MR. MORRISON: Let's reconvene. When we adjourned for a few minutes, I left the issue hanging of the item No. 3 at the bottom of Page 3 with regard to maintain technical capability to deal with regulatory issues as they arise. Two questions. One, is this -- the Committee believes that that should be a part of NRC's research program. Perhaps before we try to answer that, the question is how do you go about maintaining such a capability.

I probably ought to draw up then maybe a couple points that I discern in both reading the transcript as well as looking at the Subcommittee reports. I think there were some comments expressed in the transcripts from the prior

meeting that the technical capability perhaps should be within the Office of Research itself and not simply being maintained by contractors.

The second thought was, well, now that the capability could be maintained through contractors, if that's the case, there's a question whether it should be at the labs or whether it should be perhaps independently maintained at universities.

Each of these have a cost associated with it and we were talking about funding as one of the overriding concerns, there's not enough money to go around. If we go back to this particular statement of the purpose, then are we willing to put our money where our mouth is and show how it can be supported or just let it go by the boards and have that as an exercise to the Office.

I think there are a variety of issues involved just in this particular statement. We have to make sure we're comfortable with that statement.

MR. KINTNER: Is anybody objecting to the statement, per se? It seems to me patent that the NRC should have that capability. Is anybody questioning that or only how it should be provided?

MR. BUSH: I think it's a given that it's only when you begin to define what you mean by it that it's a problem.

MR. MORRISON: Okay. So hearing no negative comments, we'll take the statement as a given. Spence is right. When you get into the planning of how you do it is the real critical aspect. Let's discuss that for a few moments to just make sure we are clear with the statement and comfortable with the statement.

MR. VOGEL: I feel that it should be within the NRC. It's very hard to cover all bases within the NRC because of hiring problems and so on. It seems to me one reach is sort of an insoluble problem that you have to work around when your expertise is part National Laboratories. They have a conflict of interest because they're very much interested in keeping the funding.

I just think you have to recognize it's complex and do the best you can.

MR. ISBIN: Dick, you also had a suggestion at the last meeting in which you certainly need to have expertise within the NRC, but you must augment it through other resources because of the work loads and a variety of problems, that perhaps one way of getting a more cooperative input would be to consider the possibilities of having staff people go to National Labs and National Labs people come to the NRC in some type of an exchange, if this were at all possible.

This would be broadening from the individual's

point of view and certainly it should be helpful. I thought your suggestion was good in that regard.

MR. VOGEL: Good, but when you get right down to it, I'm not sure how practical it is. When you start moving people, it's sometimes not very easy.

MR. ISBIN: Well, people take sabbaticals and it's of limited time, it might have some usefulness if this could be arranged. Do you think it has merit, Eric?

MR. BECKJORD: Well, yes. I think it has merit. There are practical difficulties. We looked into this several years ago and it's, for one thing, very expensive because you have to pay to bring people in here for a term. You have to subsidize housing and that kind of thing.

There are also some real issues about bringing people into work within the NRC as to what you can put them to work on. They can't be responsible obviously for a contract at their home laboratory and that kind of thing. We have a number of assignments, bringing foreign people in for a term, that type of thing, for a year, six months to a year, sometimes longer.

We have one person off on sabbatical now who has been in the university who is coming back in January. So I think these things are possible, but not on a broad scale.

MR. BURSTEIN: In order to maintain technical capability, do we agree that that needs to be in RES? The

NRC as a whole, I think we're saying, needs to maintain that capability. Does it also follow that that should be part of the Office of Research responsibility or are there other branches of NRC, other offices, facilities that should provide or could provide that capability that would be promptly available as needed.

MR. BECKJORD: I don't think it's solely a Research Office responsibility. Murley and Bernero and Jordan, they all have needs for expertise, and I think it's broader than just the Office of Research.

MR. SHAO: Usually, the Office of Research comes under -- a little bit deeper, because they have a lot of daily problems. So usually you have to go a little bit deeper, so that when the time comes, they can do research.

MR. BURSTEIN: How about outside the NRC; is there capability out there either in universities or labs or contractors' offices that can be relied upon to respond when needed?

MR. BECKJORD: In general, yes.

MR. BURSTEIN: Or do we need to maintain some kind of a contractual relationship to maintain that and continue to have replacements for departures from those.

MR. BECKJORD: As a practical matter, you have to have ongoing research programs which employ the people who have the knowledge. You always have some coming and going.

There's a movement of people through programs. The Department of Energy has expanded considerably in the last couple of years. We have lost people working on our programs to the DOE programs. That's just a fact of life.

We had a team working on the risk assessment to do the 1150. It was quite a large team at several laboratories. Sandia had the biggest role, but other laboratories were involved. Now we have a smaller effort on studies of which we -- I think we talked about already -- the low power and shutdown risk studies.

We still have a group at Sandia that's working on it, but it's a smaller group and people who were working on PRA and on the 1150 study, many of them have gone off and are working on other non-NRC projects. If we had a big need, I suppose we could get some of them back, depending on what the loads are, but you have to compromise on these things.

We can't keep a team such as did the 1150 study because we spent more than $20 million on that project over a five-six year period and it's just the money isn't there to do that.

MR. ISBIN: Have you identified any specific areas in which you think that the technical capabilities are limiting what you can do?

MR. BECKJORD: Well, I think I would have to say

today that I think the limiting factor in most cases are the funding resources.

MR. ISBIN: Not the people.

MR. BECKJORD: Not the people. We have been able to get people -- I mean, there are a few exceptions. I made a fairly broad statement. We have two concerns in the severe accident program. We need some work, people, laboratories. We have been discussing that and the needs depend on the direction of the program.

There is also a different matter which is the loss of experienced personnel through retirements. We have lost some experienced people who have gone to better jobs at the Department of Energy. So we have some specific needs now that we are intending to fulfill.

MR. BURSTEIN: But it's primarily funding.

MR. BECKJORD: Yes.

MR. BURSTEIN: But I guess the basic question is perhaps how we maintain this capability. No one is speaking about having a fire department that sits there and plays checkers all day waiting for a future issue to arise, that we do have productive capability employed in some activity which would then suffer by the reassignment to an emergent new issue.

That, as you said before, is a juggling act that you have to provide. Whether they come from inside RES or

from inside NRC or other places is perhaps of little significance at the moment, except as it relates to budgetary requirements. But I guess the question or the answer to the question, have there been any new arising issues where the capability available to you as Director have not been adequate, I gather your answer to that was no.

MR. BECKJORD: We have been able to find people, maybe not as fast as we want, but we've always been able to get a response until now. Maintaining technical capability is something that we mention. It's important. It's always very difficult to -- it's very hard to get funding for a fire department, to use your words.

That is the least acceptable answer in the budget discussion itself. As a practical matter, I think we have to find a way with our ongoing programs to keep people involved who have the backgrounds that we're likely to need. Up until now, I think that's worked pretty well.

If Graham-Rudman had hit either last year or this year, this situation would be different.

MR. KINTNER: One of the thoughts that comes through in this 1986 report is the idea of technical excellence at the Center. I mean, I read it that way, anyway. The question I would is in terms of maintaining technical capability, is it your intent, is it the NRC's intent that the maximum practical would be people who are on

your payroll, drawing NRC paychecks, or is it more that any way you can find it, as long as you can pay for it, it's okay. They're two extreme holes here.

It really seems to me that one of the problems the government has, the Department of Energy, anywhere else, does not have sufficient resources, technical competence of a highest order with that intent. In terms of the Department of Energy, you saw it, I saw it, it was deliberately thrown away. Maybe they're getting it back now, but too much dependence on contractors and laboratories and so forth as compared to real experts on your own payroll, and I just wonder whether there is, in fact, a philosophy, a policy, an intent to, wherever you can, maintain this capability internally.

MR. BECKORD: We can't maintain the total capability that's needed internally. The Research Office is primarily -- in the research area, its job is research management. We certainly have expertise in the research areas, but most of the people who are in the Research Office are managing research projects and research contracts as opposed to actually doing the work.

Most of the work we get done on the outside. Now, our own people have to be able to understand and interpret the results, apply the results, and it's their job to plan the programs that are going to respond to the needs. But

with few exceptions, we do not do the bulk of the research.

MR. KINTNER: I know you don't do that, but the question is whether you are smarter than the guys who are doing it. One of the difficulties is --

MR. BECKJORD: I haven't really sat down to make that measurement as to if they were smarter.

MR. VOGEL: That was the point I was to make. Whether you have technical capability or not is sort of a subjective -- is a subjective judgment and the lack of technical capability sometimes only rather belatedly becomes obvious when the contractor strays from the objective or doesn't do a good job or whatever.

So it's very hard to know where you stand on those technical capabilites.

MR. ISBIN: There's one other thing to be said about it. It really takes different talents or talent and experience. It seems to me that what the people in the Research Office have to provide is the knowledge of the regulatory framework in which all of these things are being done. You don't normally expect that in people who are working on a contract. This question comes up again and again and we spent a couple of days last week having long discussions at one of the laboratories on one of the programs, pointing out how the results of this program will be used and what is needed in terms of verification and

validation of the results in the computer codes, that what they needed in order for us to use the answers in a regulatory environment.

So it seems to me that the people -- I can't -- you can't expect somebody on the outside to do that. So the people in the Research Office have to supply that background and make the bridge between doing research on a project and assuring that the results are going to be useful in a regulatory framework. In some cases, that means that you have to go through a public hearing process and entails a whole bunch of things.

MR. MORRISON: Let me ask a question which I think really deals perhaps in a timeframe basis on much of the technical capability. One is a long-range capability from simply a technology base. I think we as a Committee and I think the Subcommittee have also addressed perhaps this subject and thermal hydraulics, what needs to be maintained in that area since there has been a declining program and perhaps not much immediate need to have that as a part of the NRC research program.

Once a whole set of critical experiments were over and done with, we feel fairly comfortable there. On the other hand, thermal hydraulics is probably going to be a technology base that one's going to have to draw upon in the foreseeable future. So you go the whole way back to the

resource base which starts at the university and community. You have the right kinds of people coming up with the experience like we needed ten years ago or whenever the time is.

I think you could probably ask a similar set of questions for fields like geohydrology and human factors; where do you get those kinds of people. There just aren't that many academic programs dealing with it. That's sort of a real long-range tech base issue.

The other side of it is you talked about the last part of that phrase, the regulatory issues as they arise. Then what sort of a time scale are we talking about. It surely isn't days or weeks. It must be years to get any regulatory issue resolved. And looking at the entire pool of technical manpower in the U.S., you ought to be able to tap that somewhere within a couple year timeframe.

So I think there's a timeframe issue there that relates to how one does this.

MR. VOGEL: One has to be careful, too, in balancing and not over-encouraging universities to train too many people.

MR. BECKJORD: That's not a current problem.

MR. VOGEL: I'm thinking of the high energy physics situation where in the past, I don't know what it is now, but in the past they trained so many high energy

physicists, it didn't match up to the number of machines they had. It was a very awkward situation for the poor guys to struggle through a written thesis on the subject.

MR. BURSTEIN: The nature of this expertise is perhaps another question. You mentioned a wide variety of disciplines, I think, because obviously you have to anticipate specifically where you're going to find the needs. But you do have a formal program, if I understand what was said earlier, in reviewing operating experience, literature, doing other things, precursor analyses, to have a feel for where issues are likely in this unlikely environment to surface.

Does that give you any potential handle on the types of capability that --

MR. BECKJORD: I think we know what the types of capabilities are. You can almost run through the program structure and it tells you right there --

MR. BURSTEIN: But that is what is presently on the staff, addressing present issues, for the most part.

MR. BECKJORD: Right. Yes.

MR. BURSTEIN: So there's really been an unknown future, an unknown degree of expertise.

MR. BECKJORD: I think you can extrapolate -- I'd say two things about it. One the materials and the component pressure boundary problems aren't going to go

away.

MR. BURSTEIN: Well, we'd hope you would achieve closure on some of those.

MR. BECKJORD: Yes.

MR. BURSTEIN: I'm teasing.

MR. BECKJORD: So I think you can project forward the needs. The other thing is if you have really -- if capable people coming out of the schools are working on the programs, they can take on new problems. Herb was here at the Water Reactor Safety Meeting and that week I saw three young graduate students five years ago who are now professionals. Two of them -- they're working all different places. One is working in EG&G in Idaho. One is working in SAIC.

These are young women. I knew them because they were in courses that I taught. They're really doing -- I'm amazed at what they've done and the level of competence that they have developed. They are working in areas where they had some general training and they've picked it up and all three of them are stars. The third one is our budget examiner on the waste program. She was a student four years ago. Less than that; she was a student four years ago and she was a student up until about a year ago. Now she's a budget examiner.

So if people have a good background, they can also

adapt to new situations.

MR. MORRISON: My sense is we probably have a lot of the issues out on the table that are under that No. 3. Let's move on to No. 4. I want to come back to No. 3 as we get to the bottom of this and see just where they should be in terms of a broad priority focus within the list. I made no attempt to order these in terms of decrease in priority, but we may want to do that, just simply the way we list them and report them because most people think that the first one is obviously more important than the last one.

No. 4, then, develop new and improved methods of safety analysis.

MR. BURSTEIN: This goes in partial response to Ed Kintner's question about some of these activities would hopefully simplify regulatory activities and perhaps even modify or improve regulations themselves, or is it to validate existing or older methodologies. What is the purpose of new and improved safety analyses if the present ones have served adequately their intended purposes?

MR. ISBIN: Well, one response, certainly you should include NUREG-1150. We have the Committee's report which indicates that this is a marked improvement. There are certainly additional things that need to be done and these are noted. You have methods and are attempting to resolve safety issues such as ROAAM. This is on the melting

of the Mark I liner under conditions.

This is a process whereby new information can be used to improve the findings. It's an ongoing process. These are all new methods and I think these are examples of what has been done and the kinds of things that you plan to continue to do. I'm sure Ralph can mention things on the source term.

MR. BECKJORD: I think it applies as well in the engineering area, certainly in aging and reactor vessel areas. There are some new methods which you'd expect to develop to deal with aging. Isn't that a fair statement?

MR. SHAO: Aging to predict residual life.

MR. BURSTEIN: Oh, you're going to get me one of those meters that I put on the side of the vessel.

MR. SHAO: Aging in general, we are thinking of developing a methodology to predict residual life of various components. One important thing is the so-called risk age base risk analysis. Right now all the PRAs -- no aging factor. Just some examples.

MR. BURSTEIN: That sounds like more work to me rather than less.

MR. SHAO: But the aging -- we found out that through maintenance, the aging -- no change. If you don't have good maintenance, the aging effect has a lot do with this.

MR. MORRISON: I would sense that as a Committee we feel that this is a valid mission on the research program. Now perhaps to our favorite topic of the last couple of meetings, the advanced reactor safety. I don't know whether those are quite the right words. Those are ones that I picked up. I don't know whether that's the way you expressed it, Eric, or whether it's the way Tom Murley expressed it.

MR. KINTNER: When we talk about this, are we talking about liquid metal gas only or are we talking about light water as well?

MR. BECKJORD: I think we're talking first and foremost about light water advanced designs. I expect that there will be applications for gas modular gas reactor, but my own sense is it's likely that the first ones that come in will be the water. So the plan has to include both the water, advanced water and non-water.

MR. KINTNER: But safety performance requirements, is that like a safety goal?

MR. BECKJORD: No. I think of it in terms of the --

MR. KINTNER: Core damage frequency?

MR. BECKJORD: Well, it's the core damage frequency, it's containment performance, it really runs across the spectrum. Both the advanced boiling and the

advanced pressurized water reactors have a number of innovative features. So we really have to decide at some point what is required of these new features.

We know that certainly in the case of the non-water reactors, what they've shown so far is that the core damage frequencies are very low. I don't know whether they will, in fact, be as low as some of the claims that have been made about it, but they are much lower than currently operating reactors.

So one of the consequences of that, people who were working on the gas reactor came in with a no-containment concept because they said they didn't need it, and I think that's a fairly controversial matter. I don't think it's as simple as that. In the case of the water reactors, the Commission has asked for a recommendation about containment performance criteria.

MR. KINTNER: Beyond the .1?

MR. BECKJORD: Well, they haven't specified what any numbers are or anything like that. They just asked for --

MR. KINTNER: But right now regulation is using .1, but if you could come up with something better, propose it and we'll talk about it.

MR. BECKJORD: Yes.

MR. VOGEL: Does the NRC have any obligation to

review the plans on the production reactor?

MR. BECKJORD: No.

MR. KINTNER: That's another Commission, isn't it?

MR. BECKJORD: The only tie-in on that is this matter of the gas reactor that's proposed and the production reactor, which is going to be first. Well, the Chairman addressed that matter a couple of weeks ago when he was at a press conference or I guess it was a luncheon speech. What he said on the subject is, well, if the intent is that the production reactor is supposed to be any kind of commercial prototype, they better come to us early to get a review of it.

MR. BURSTEIN: It's only my view, Mr. Chairman, but in the light of what the initiatives coming from DOE and the industry are, I wonder if that doesn't have a higher priority than No. 5?

MR. KINTNER: What has a higher priority?

MR. BURSTEIN: This fifth item.

MR. KINTNER: That's what we're talking about.

MR. MORRISON: Eventually, I think it should be higher than what is up there.

MR. BURSTEIN: That's what I'm saying.

MR. SHAO: I have a comment on No. 5, too? Why do we need the word performance. Why don't we just say develop advanced reactor safety requirement? We do we need the word

performance?

MR. MORRISON: I think that's a good question, Larry, and I'm going to get back to Ed to see if that's really what we're hung up on. I'm personally -- about the word requirements, because EPRI certainly came out with a requirements document and we spent a lot of time on that.

MR. SHAO: Yes.

MR. MORRISON: Perhaps there are a better set of words to get at what we want to --

MR. BURSTEIN: But they also were performance requirements. They were not design or engineering or other requirements.

MR. KINTNER: But that leads to another question. In a very simplified way, it seems to me present containments have no performance requirements on them and they just sort of came out of the area -- double-ended pipe break which was artificial and now it's got a type and there's no real performance in terms of mitigation.

The NRC has said we're going to sign sort of an arbitrary one or .1 and you prove that you can meet it, but if there is a place in terms of total safety to the public, where there is a vacuum, it's understanding how does one design a containment for safety, considering all the potential reasons why the containment won't work or radiation escapes.

We, in a very dumb way, are trying to come to grips with that in the LWR program and we find it extremely difficult to write down a set of engineering criteria for containments. But my own personal opinion is that it would be of great benefit to do that, that somebody somewhere ought to do it. It's a very difficult task, obviously, because it has so many inputs to it, but if you examine the question of public safety, the real ultimate subject in public safety is what does a containment do under any circumstance inside it and how do you design it to optimize that capability.

That's a very, very ill-defined subject and one which somebody somewhere ought to be working hard on and they are, and that's one of the reasons I asked the question that I did. I don't know whether research should be doing it or who should be doing it, but maybe nobody. Maybe you just say plant one and forget it.

MR. BECKJORD: Well, what will happen on that, Ed, is that I think the ACRS -- the Commission asked the ACRS to look into this and they have -- it's on our action list, too. Out of this will come finally a Commission paper, a proposal when the Commission decides either it's okay or, no, we want you to go do some more work on it, and this is what we'd like you to do.

MR. VOGEL: It's sort of like the old business of

sending somebody to go get a rock and he comes back with a rock and you say no, that's not the one I want.

[Laughter.]

MR. BECKJORD: That has happened in the past.

MR. MORRISON: I'm looking for a word or a phrase. It seems to me given the current status of advanced reactor development and what's going on in DOE and what the industry is doing, the sort of uncertain position right now within NRC, what do we as a Committee want to have as the words relating to advanced reactor safety. Is it performance requirements or is it something else?

I do hear it's wanted on the list and higher on the list.

MR. BURSTEIN: Personally I don't care whether that word is in or out. I don't think it makes any difference.

MR. MORRISON: Performance?

MR. BURSTEIN: That's right.

MR. MORRISON: How about requirements?

MR. BURSTEIN: Yes. Somebody has to set some groundrules and it's going to show up in some kind of regulatory framework. I think it has to be a requirement someplace.

MR. BUSH: It's going to cover design ultimately. It's certainly going to cover instructions and operations,

accident review.

MR. MORRISON: I would think performance should be in under that set of circumstances. We're talking about safety performance. We aren't talking about -- well, I guess we are talking about safety requirements.

MR. BURSTEIN: I think it's safety requirements.

MR. MORRISON: Does anybody have any problem with striking performance?

[No response.]

MR. MORRISON: Do you have any problem, Eric, if we strike performance?

MR. BECKJORD: No.

MR. MORRISON: Eventually it's going to end up on your lap. Let's do that. Now we can raise perhaps the same question on Item 6. Is that all right as it stands?

MR. KINTNER: Don't you have to add safety in there as well?

MR. MORRISON: It's a good guess.

MR. BURSTEIN: That's a logical addition. I have no problem with that.

MR. ISBIN: Why do you use the word disposal instead of management?

MR. BURSTEIN: I think the term management is a very much broader issue in the sense -- and some of it is already covered in the sense that certain on-site waste

matters are within current regulatory provisions and that there's a whole new area of concern that has not been addressed prior to the National Waste Disposal Act requirements and their amendments. It seems to me that this smacks of a new phenomena, a new activity; namely, a deep geological repository.

MR. BUSH: I don't think so. I can read this thing to cover the whole --

MR. VOGEL: You don't dispose of it.

MR. BURSTEIN: That, again, is language out of the Act.

MR. VOGEL: That's right. We can redefine the word disposal. What do we do, shoot it out into space? It's got to be someplace.

MR. BURSTEIN: Well, if somebody proposes that, I suppose that Eric will find NASA helpful in doing his job, and we'll get the deep seabed people in the next go-round. That's, I guess, the only way I can respond to it. My understanding is it was intended to deal with the geologic requirements of the Waste Policy Act.

MR. VOGEL: I like the word management better because, at least in my mind, that includes such things as above-ground storage.

MR. BUSH: Which we'll be using for the next few decades.

MR. BURSTEIN: I have a pet peeve on words like management. I don't know what the hell that means. People have called me, among other things, a manager for a long time and I don't understand what kind of tasks that involves, except telling somebody else how to do something.

[Laughter.]

MR. BURSTEIN: But when you start getting into requirements for managing a program, that sequence of words implies a lot of unknown things to me. If you want to say the whole thing, you can say waste storage, transportation, and disposal requirements, but I think the word management somehow implies a lot of other things. That can get into the organization and the structure and the corporate entities and every damned thing else under the sun.

If we can get Eric to straighten out the funding mechanism for that, that would even -- that's part of management, too, I suppose.

MR. KINTNER: There must be a precise word, handling or --

MR. BUSH: Handling is a word, but I think there are different ways it can be interpreted.

MR. BURSTEIN: You see, you get me back to where we were before. I handle spent fuel on the time under present regulations, cask designs, and all kinds of things.

MR. BUSH: I thought of that word, but I don't

think it fits.

MR. BECKJORD: Let me ask Larry and our people. If you have a phrase of no more than five words, what are the right five words or less to describe what we're working on?

MR. SHAO: Usually people use management words.

MR. VAGENS: Another choice is just to do away with the word disposal and just say develop waste requirements is what you're doing.

MR. BECKJORD: Do you have a suggestion?

MR. VOGEL: I think we've spent a lot of time on this point.

MR. BECKJORD: Are those words all right?

MR. SHAO: Relate to waste issues. Develop requirements related to waste issues.

MR. BECKJORD: That's too many words.

MR. SHAO: Develop waste regulatory requirements.

MR. MORRISON: Is that all right or shall we go back to this point? Sol suggested develop waste storage, transportation and disposal requirements.

MR. BURSTEIN: I'm satisfied with the word requirements, or regulatory.

MR. MORRISON: Okay. We'll go with waste regulatory requirements. Let's go back to the ordering then of these.

MR. BUSH: You can have real arguments there. You start playing musical chairs with some of these things.

MR. KINTNER: We can move it up to four. In my own judgment, that's about the right portion.

MR. MORRISON: That could put it up as high as three.

MR. BUSH: I think that capability is certainly a goal, but I don't see how I deal with it in very concrete operational standpoint except keep it in front of me as a goal.

MR. MORRISON: Spence, would you accept it at three?

MR. BUSH: I think that's too high. This presumes or makes it sound as if we have a substantial program underway and we're going gung ho on the thing, which is not the case at all. All you've got to do is look at the expenditure background of the thing. This is a policy. You're establishing a policy when you do that.

MR. MORRISON: I would look at it in totally the other way, that this is a prescriptive list rather than a responsive list, which suggests that it should be given a higher priority and unfortunately is not reflected in the current program.

MR. BURSTEIN: I guess it's fair to say that the first two are in the right order. I guess I would then tend

to move as Item 3 the advanced reactor requirements, and Item 4 waste disposal, and then the improved safety analysis, and the last item the technical capability.

MR. BUSH: I would put waste disposal above advanced reactors personally because that's an issue that the reactors face right now. Advanced reactors is one of those pie-in-the-sky things that may happen and may not happen.

MR. BURSTEIN: We've got some applications for those.

MR. KINTNER: This is a matter of interest. Maybe some of you know, it's not to be made public, but on Tuesday, NPOC is going to announce a total program plan for moving towards a new reactor.

MR. BURSTEIN: Nuclear Power Oversight Committee.

MR. KINTNER: To take the steps necessary in all areas to put an order on the books for a new reactor.

MR. MORRISON: Is that going to be a statement at the American Nuclear Society?

MR. KINTNER: At the end of that meeting, they're going to have a separate meeting. It's been worked on for nine months.

MR. BURSTEIN: Again, I don't know that it makes too much difference whether you have waste or advanced reactors first or secondly in the order there. They're both

pretty close. But I do think that they ought to be moved into the middle compared to the other two.

MR. ISBIN: Why don't you make waste three, then?

MR. BURSTEIN: That's fine.

MR. MORRISON: Advanced reactor safety No. 4 and safety analysis to five and capability to six. Unless there are more comments on that requirement section, what I will do is, after I get the transcript, reflect some of the discussion and maybe put one or two or three sentences under each of these bullets just to make it certain what we're talking about there, what we arrived at around this table.

What I would suggest we do at this stage since most of the staff is here now, we could perhaps move to the priorities, what I've labelled as priorities chapters, and take advantage of the talent we have around the table to help us address the items that were in there.

Set aside for a moment the Page 7 on priorities, but move to starting on Page 8 with the reactor component integrity and structural integrity, and see whether the information we have here is what we want to present, what more do we need, or is this something that we perhaps don't need in the report.

MR. BUSH: I would only comment that if you start with eight, it won't agree with Page 7.

MR. MORRISON: We can pick that up later.

MR. BUSH: I think the first thing is to decide whether you agree or disagree with what's on the other one, and then on that basis you can pick up the priorities.

MR. KINTNER: You say the highest priorities are given. That means in the present program they are or your judgment in the Subcommittee was?

MR. BUSH: Realize that this one is only under the heading reactor component integrity and containment and structural integrity. In other words, those are a subset within that particular situation and it does not bear upon severe accident, etcetera, etcetera. So it's within that format only.

MR. KINTNER: Highest priorities are given to programs. Is that the way it is now or the way you are proposing it to be?

MR. BUSH: You could make it --

MR. KINTNER: Should be given.

MR. BUSH: -- more specific. You could make it should be if you wished to. In other words, those, to a degree, tend to agree, but not completely, and so this would be -- when I wrote it, I said it had to be my opinion because I hadn't had an interface with the others, but this is based on quite a few years looking at this program.

MR. BURSTEIN: And really this is the way it is.

MR. BUSH: This is the way it should be, in my

estimation, because it's not the way it is.

MR. BURSTEIN: I'm sorry. I misunderstood.

MR. BUSH: For example, you'll notice that piping integrity, if you go to Page 9, is not -- in other words, reactor vessel safety and piping integrity are not necessarily the same thing, and usually they are some type of subsets.

MR. VOGEL: I wonder if we should be so definite on these priorities. Maybe we should lump them in a more general way. It seems to me that some of these things

MR. BUSH: Each of these is a block of money.

MR. VOGEL: That may be, but some of these things are interrelated one with the other and it's very hard to separate them out.

MR. BUSH: I guess I thought this was what the EDO wanted.

MR. VOGEL: Well, I don't know.

MR. BUSH: But maybe not.

MR. VOGEL: I feel just a little bit uncomfortable -- for example, we're on Page 9, the seismic research applications and structural integrity, aren't they sort of related to plant response -- how can you separate these out and establish priorities?

MR. BUSH: They're different items that are in the five-year plan of the program, as such.

MR. VOGEL: Are we bound to follow that?

MR. BUSH: No. I tracked the five-year plan.

MR. VOGEL: I guess the thrust behind the comment is that at a later date somebody might take your priority list and look at it too liberally when you're cutting budgets or whatever and you end up in strained situations.

MR. MORRISON: I think your points are well made on that particular item. We don't want to get down to the individual project or task level in trying to set priorities. The question is what is the most comfortable level for the Committee as a whole to deal with.

MR. VOGEL: That's a good way of putting it.

MR. MORRISON: And I really look at the five-year plan as this is a snapshot in time, it's something concrete that we can look at and know that a lot of thought has been given to it. People have been involved in the programs for many years have at least set in motion what seems to be the right kinds of activities or we should comment whether they are the right kinds of activities.

But in terms of priorities, I think general areas are better than specifics and leave it to the staff, then, to do their thing on it.

In terms of specifics, are the four on Page 8 at the level of aggregation that you can't really deal with those four without dealing with the five on Page 9.

MR. BUSH: The priorities are effectively, if you, as I interpret it, if you -- you have to differentiate between what would be a high priority and a medium and possibly a low priority, to make a conscious effort on the basis of the work that's gone before. This gets back to Sol's point. Have we done enough on some of these things, and that's been the reason why piping integrity tends to be low.

If we haven't achieved partial closure on piping integrity, we should make a revised GDC-4. That's just a fact of life, in my estimation. Now, that doesn't say there isn't some work that has to be done on it, but it certainly -- I can't do it, and the same thing is true now in -- one reason the seismic is a little less there is that we have done a lot of work on seismic. For example, it has dropped on the EPRI list from No. 2 priority to about No. 8 priority or No. 7 priority.

MR. BURSTEIN: I think there's a question as to, again going back to this fundamental, what size groupings you're going to prioritize. The five-year plan lumps, for example, reactor safety and piping integrity together.

MR. BUSH: Yes. I split them out because this is the way it's split out here at the Division of Engineering five-year plan, the reason being that if you had to take a cut someplace, I assume this is a possibility, then you have

to ask yourself does pressure vessel safety have the same significance as piping integrity.

MR. BURSTEIN: You're going back to Richard's question.

MR. BUSH: Yes. I mean, I approached it with a certain philosophy in mind and you can disagree with the philosophy. I suspect, based on what's happened in the last year or so, that I could put Larry on the spot and say that he would probably put more emphasis on pressure vessel safety than piping. I'm just guessing, but I suspect that's the case.

MR. SHAO: Yes.

MR. BUSH: I guess that it's philosophically you have to make a decision because obviously I think they have to be consistent from section to section to establish what philosophy we use.

MR. MORRISON: It would be my suggestion to use the breakdown in the five-year plan that Eric gave us. I'm assuming that the Commission is familiar with that. Certainly the EDO must be familiar with it -- rather than trying to go down to another level of detail, including tel categories that are on Page 7 and the top of Page 8. So one deals with the whole subject of the integrity of reactor components, and this is simply just four sub-areas of that. I think that's what you're saying, Sol.

MR. BURSTEIN: That's right.

MR. MORRISON: That's where I get a breakdown financially, that's where I get some topics that are discussed in the plan and several paragraphs that would follow that.

MR. BURSTEIN: That's exactly right.

MR. MORRISON: So I don't confuse the reader who may be having a plan in front of him.

MR. BURSTEIN: The others are the ones that Spence delineated and are carried on in the body detail of this plan. They're not made up out of thin air. They're here, but you have to look a little deeper for them.

MR. BUSH: Of course, that's what happens and that's the other reason they did it this way, is if you do it that way, what you basically end up with is you have two high priority items and that's all you stay with, because what you end up with is to have a high priority item for integrity and a high priority item for containment. That's the situation you run into.

MR. KINTNER: What's wrong with what he's done?

MR. BUSH: I think we have to at least discuss how we do it because it impacts on the other sections, obviously, because what happens is that if you've got one high priority item in a group here, what's going to happen in that case is that that's going to tend to control on the

thing. It may represent a third of the money, but it's going to control the whole issue.

MR. VOGEL: For example, on Page 8, I would feel comfortable in saying that we have four high priority items and these are rather than saying it's one, two, three, four with regard to order of priorities.

MR. BUSH: If you want to make these bullets, I don't care. What I was doing was -- actually that's the way it's going to end up, I think, because those are -- the others, if they're bullets and you leave them in this order, people want to presume that there's something about a rank ordering there, that's their -- the paragraphs that follow tend to a degree to establish a hierarchy anyhow because, see, I talk about --

[Simultaneous conversation.]

MR. BUSH: The first priority within the subgroup because, type of thing. In other words, that's where the malfunctional reliability is, etcetera, and some of the other stuff, and, after all, this is how you implement what you do. If you've done the research, you've now got to get it over into a regulation.

If you want to, we can do it that way. I guess the question really is what will EDO want.

MR. VOGEL: I would feel comfortable if the phrase in order of priority were taken out and we could have

bullets there, and this leaves more flexibility for the staff in terms of future budget.

In addition, I don't think one, two, three and four are necessarily separable either. I think that idea carries through --

MR. BUSH: They are blocks of money.

MR. VOGEL: I mean technically separable.

MR. BUSH: Well, obviously, aging reactor components and structural integrity interface because there are aging aspects of structural integrity.

MR. MORRISON: Eric, do you have any feeling on the level of aggregation that the EDO and Commission should deal with in light of the research budget?

MR. BECKJORD: You're asking whether it should be more detailed than this?

MR. MORRISON: Well, I think that what we're dealing with, if we look at what I have on Page 7 of the draft, it breaks the research program down into five major areas, and then goes down just one level in subheading there, looking at the integrity of reactor components, the reactor vessel and piping integrity is lumped under one element.

What Spence and the Subcommittee looked at, they've broken down another level and at least separated those two and several of the others are separated that way.

What he's saying is that while the -- if the reactor vessel is a high priority, then the piping is a much lower priority item.

So if you leave them together, it's kind of hard to address the priority of aggregate. On the other hand, when you separate them, the list gets considerably longer. What's the EDO and the Commission used to looking at, in the aggregate or are they down into the disaggregated levels?

MR. BECKJORD: Well, they've never received a report like this before.

[Laughter.]

MR. BECKJORD: I guess I wouldn't -- my feeling is that the Committee should give its advice. I would suggest not getting into a lot of detail in the structure because it's going to be harder to deal with. But in terms of distinguishing between reactor vessel and piping, I don't see any problem there.

MR. BURSTEIN: But that's as far as you would go, though.

MR. BECKJORD: Yes.

MR. BUSH: You mean handling it as an entity or splitting it? I'm not sure what you meant when you said it that way.

MR. BECKJORD: If you want to split it, the vessel and the piping, there's no problem with that.

MR. SHAO: To reenforce what Eric said, Eric says cut $3 million out of your program, I want to cut the piping program. We would look into why you cut a high priority program, because if Eric says cut $3 million, I have to look for money. I have to cut a high priority program because there's piping there.

MR. BUSH: That, I guess, is one reason why I did it the way I did it, and I confess I didn't have much interface because I guess I flubbed-a-dub in writing for the thing. But the intent was to try to consider if you had a medium to medium-low priority, you might decide, all right, this is where I'm going to -- I'm not going to take the whole thing out, but I might decide that I'll take approximately 25 to 50 percent of the money out of that one place, as a for instance.

There's another reason, and I won't justify it necessarily, but because of the fact that the Subcommittees didn't have general responsibility, I almost felt I had to do it this way because when you get to seismic and structural research, the earth sciences part over another one, and if you had to do seismic and structural research, you'll either have to fold them in or do something because they aren't stand-alone items, which isn't a really strong issue, but it's just a fact of life.

MR. MORRISON: From what I'm hearing Eric say,

that they will be comfortable at the EDO and the Commission level is consistent with what you've done, Spence, so why don't we take what you have and see if that's the appropriate way to address it.

MR. BUSH: If you want to get rid of the numbers, it doesn't really bother me.

MR. BURSTEIN: If you got rid of the numbering on Page 8, would you then remove the words in order or priority just above that?

MR. BUSH: I suppose we'd have to. The four highest priority programs are all right. You're just developing the first four. This is my subjective judgment as to what they would be for a variety of --

MR. BURSTEIN: But if you took the numbers off, would you then strike the words in order of priority?

MR. BUSH: We'd have to be consistent. I have a little more heartburn when I get to the next ones because here I think they range from medium-high to what I call medium-low, and there's a definite hierarchy in there. But I guess to be consistent, I would have to say the remaining programs are, and the someplace squeeze those words over onto the other pages.

MR. BURSTEIN: I am not sure that that necessarily has to follow.

MR. BUSH: Well, I say this gives me more

heartburn than the first one because the first one -- these tend to be a definite hierarchy, in my estimation.

MR. VOGEL: There's nothing wrong with putting in a special statement saying that something is lower priority than the rest of them.

MR. BUSH: That's basically what is done on Page 10. I could say the remaining programs, knock out the order of priority, and put bullets in there, and then the statements themselves would tend to still support the fact that engineering standards, because of its nature, tends to be moved up to the top of the heap moreso than some of the others. That's fairly straightforward.

Ed, I think you or Sol sat in there. I didn't have the benefit of being able to talk to you. Do you see anything here that gives you any --

MR. BURSTEIN: No. I see that's consistent.

MR. MORRISON: Well, since Herb and Dick and I didn't sit in on it, and you feel comfortable with it, do we need anymore word of the staff or from the Subcommittee that looked at it to say this was the consensus of the Committee, not just of the Subcommittee.

MR. BUSH: Well, I would have to -- so we don't leave out like obvious second choice, etcetera, but that isn't any difficulty. That's just a matter of taking a few words. It will still leave the fact that we have four

fairly high priority items, even though they come in different pockets, are grouped together and we have some other items that tend to be there.

MR. MORRISON: Dick, let me address this to you because you are perhaps one of the newer members of the Committee. Do you feel comfortable with, say, the ones on Page 8 and getting a sense of what the content is or do you need some more words?

MR. VOGEL: With regard to this specific thing, I feel comfortable with taking that phrase out and bullet it.

MR. MORRISON: But the individual items you feel comfortable with, you've got enough sense of what's in those.

MR. VOGEL: Yes. These are fine and they're general enough so that you can cover everything you want to do.

MR. MORRISON: Herb, how about you?

MR. ISBIN: And the contents are to be discussed later.

MR. MORRISON: No. I think we want to deal with the contents of now of these to be sure that the whole Committee --

MR. ISBIN: Not in ranking. All you're doing here is ranking them.

MR. MORRISON: But also relating -- the ranking is

based on the content.

MR. ISBIN: I thought you had another section for content.

MR. MORRISON: No. This is it. The section we skipped over was the procedural one or the related issues of how the program is performed. This is the content of the program.

MR. BUSH: Do you think there should be more words here, Herb? I was going along with what Eric said, that you probably want to make sharp points on this thing and you don't really want to write a page on each item necessarily.

MR. ISBIN: Do I infer, then, Spence, that you are fine that the program is in place are being carried out correctly? Is that what the implication is or are you making any additional comments on the individual programs?

MR. BUSH: As I interpret it, I was trying to establish a priority rather than to worry --

MR. ISBIN: That's what I thought.

MR. BUSH: Obviously, reactor vessel safety, a big chunk of that money is at Oak Ridge. Aging is spread all over creation. In other words, almost every National Lab has a company action.

MR. ISBIN: Are you satisfied with the aging program?

MR. BUSH: I'm a bad one to ask because I've been

too close to it. I've looked at almost all that has come out of the aging program.

MR. ISBIN: I understand.

MR. BUSH: I personally, the answer is yes, but I may be too close to it.

MR. ISBIN: I know, but that's the kind of comment that we need.

MR. BUSH: I know the inspection procedures and technology quite well. Containment, I'm a less aware of the containment programs, though I think I'm reasonably converse.

MR. SHAO: The containment program at Sandia and we've been cooperating --

MR. BUSH: I know pretty much what's going on, but not intimately. I really -- Ed, you were there and we looked at that. I thought they were doing a pretty good job.

MR. ISBIN: I thought so, too.

MR. BUSH: So I have no problem writing that, whether it should be in this section -- it says this is the priority and we think they're doing a good job or a crummy job or something like that. I don't have any problem doing that.

MR. MORRISON: I think I would put it all in this section. Otherwise, we just adding --

MR. BUSH: I don't disagree. So we're really talking about the quality of work. I don't have any problem. I can write probably a couple general paragraphs in the two sections. Some of them are apples and oranges. That's part of the problem.

MR. MORRISON: Or something is simply a sentence or two under each broad category.

MR. BUSH: See, engineering standards support, that's the ultimate product, because you can do all kinds of research, but if you don't convert it to a regulation or to a change in a code or something like that, you really haven't accomplished the purpose. You spent a lot of money, but not showing anything for it. So even though there's not much money, it has a tremendous leverage.

So I think that's very important. Again, I guess I'm close enough to it. I'll pick up the quality of the work and probably do it as a brief one on the knowledge of what's going under HHST and what's going under INPO and so forth.

But you'll have to realize that obviously there's a substantial degree of subjectivity in such statements.

MR. MORRISON: Well, I'll address the question to Sol or to Ed. Do you have any feelings about the quality of programs, especially the aging one --

MR. BURSTEIN: We each have different views about

aging phenomenon, how they should be treated, and why they are not, but that's philosophical.

MR. BUSH: That's a philosophic thing as contrasted to the need for a program and the scope and so forth. That's no problem. I can knock this stuff off. You had another point. Was that the only one?

MR. ISLIN: Yes.

MR. SHAO: I'd like to make a comment on the last sentence. On advanced research, in the five-year plan, engineering would not include any advanced reactor issues.

MR. BUSH: The statement I'm making here is that quite a bit of the work -- for example, a pressure vessel really doesn't know the difference whether it's in an existing reactor or an advanced reactor, but the problems may be less because of lower --

MR. SHAO: In the last few months, we have developed a research plan for advanced reactors, but that would not be incorporating the five-year plan.

MR. BURSTEIN: But it's not here.

MR. SHAO: It's not here, either.

MR. BUSH: I deliberately avoided that issue, because it seems to me the most we can say in this area is quite a lot of the work is directly applicable, and let it go at that for this stage of the game.

MR. BURSTEIN: But if we're going to give advanced

reactors a three priority back in the section we just agreed to, it seems to me that there has to be some comment about elevating its focus here.

MR. BUSH: Except it seems to me if I were doing it in advanced reactors, I would move over into the thermal hydraulics area or something like that.

MR. BURSTEIN: Well, containment design and philosophy is going to be different --

MR. BUSH: Containment design is really -- this is really more of a testing rather than a concept of a design as such.

MR. BURSTEIN: Why are we doing all this testing?

[Simultaneous conversation.]

MR. BURSTEIN: Margins, and the current design approaches.

MR. SHAO: But also containment is important, also the construction. Somehow that has to be looked at.

MR. BURSTEIN: I think there may be more need for research on containment for advanced reactor concepts, particularly the smaller size non-evolutionary passive features, so-called, and we have not -- as I say, we just ought to be consistent between this section and the priorities that we gave this subject in the prior section, which everybody was satisfied with making those consistent.

MR. BUSH: Sol, there is nothing in the five-year

plan basically. There's this other document --

MR. BURSTEIN: That's why I think that's a valid comment.

MR. SHAO: You can put in a sentence that says that this review does not include advanced reactor until the staff develops a plan, and you could put a --

MR. BUSH: I can add the statement in here, which isn't going to get much detail, which says obviously considering the priority or the fact that this is a fairly high priority item, it should be examined or something like that. That's no problem.

MR. MORRISON: That's fine. I think another suggestion that came from Eric, which I would certain agree to, is that we perhaps should have a separate section.

[Simultaneous conversation.]

MR. MORRISON: -- some of the key items in here.

MR. BURSTEIN: That would be the more significant, I think, and you've got to highlight a lot of things.

[Simultaneous conversation.]

MR. BUSH: All this would do -- it would simply be a closure on the fact that, well, we really haven't addressed it, it's an important issue and we let it go at that. Then if you write one on advanced reactors --

MR. BURSTEIN: I think that would solve a lot of problems in all this other section.

MR. BUSH: I have no problem with that. It was just difficult to put it into here on the basis it hadn't even been looked at.

MR. MORRISON: Let's pick that up then after we go through the areas and go back through and say what do we want in the advanced reactor section of the report.

MR. KINTNER: Can I ask a detailed question? Does anybody here know what the National Safety Transportation Board meant when it assigned United Airlines responsibility for that disk blowing up?

MR. BURSTEIN: Sure. It says the guy who does the inspection has got to be responsible for finding it.

MR. KINTNER: Was it a specific lack of training?

MR. BURSTEIN: Yes. They spoke about the methodology and the experience and qualification of the operators and a whole bunch of details, from what I hear.

MR. BUSH: Which, incidentally, in the item that I have here on Page 8, inspection procedures and technology, a big chunk of that that appears, I didn't go into detail here, is the fact that we recognize that our techniques are inadequate in many respects and we are revising it in the Appendix 7-Appendix 8 things that are in Section 11 now, which represent a major cost on there, but we anticipate a very pronounced increase there.

That's the kind of problem you run into, is that

if you don't have some method of calibrating on a real flaw or something, you really don't know what you --

MR. KINTNER: And they didn't have it? Hard to believe.

MR. BUSH: Essentially nobody does, Ed. You ought to face up to the fact that --

MR. KINTNER: Well, we certainly take flaws and check them before the guy goes into containment.

MR. BUSH: What I'm saying is when you calibrate an instrument, you don't calibrate it on the flaw. You calibrate it on a notch or a hole and that bears very little relationship to what you see when you look at the flaw. You've got to depend on the operator to see something in there.

MR. BURSTEIN: It depends on if the operator interprets a scribble or a shadow or something.

MR. BUSH: That's correct.

MR. KINTNER: It's an art, isn't it?

MR. BUSH: It's too much of an art and they're trying to move it into a science, but it still has a long way to go.

MR. BURSTEIN: Even with digitizing is doesn't work.

MR. BUSH: Digitizing just gives you a hell of a lot of --

[Laughter.]

MR. BUSH: Well, if this is all we have on this, it'll probably only take me about an hour to come up with some handwritten squiggles on this thing. What we can do is since it's in the computer, I can either give it to you in handwritten form or I can get a copy myself and revise it and fax it to you or whatever.

MR. MORRISON: Given the agenda and the progress we're making, I think probably tomorrow morning.

MR. BUSH: All I'm saying is I can only give it to you in handwritten form, for obvious reasons.

MR. MORRISON: We can get it typed up.

MR. BUSH: I hear you, but I also know from bitter past experience that there is a convergent problem with my handwriting.

MR. MORRISON: That will be a challenge to my secretary.

MR. BUSH: She can always send it to me, though, and I can revise it. Usually by the second recycle, everything is efficient. I have no problem, except when we get back to Page 7.

MR. MORRISON: We'll get back to that. Perhaps looking at the time -- I don't know what restaurants are in the Rockville area. It may be better to break for lunch now and come back and do the other later. That way we'll get

ahead of a luncheon crowd, if there is any.

MR. BUSH: We might also one question, and I don't think it will take more than about two minutes. That is mine is not -- there's not an awful lot of words there. What we're going to add is -- I presume -- are you going to try to keep cutting back on some of these others, because there has to be some level of consistency, because I have something that's a low priority and it goes on for eight pages. It's out of balance.

MR. MORRISON: It's my view, having put this together, that I'll work on cutting the other. I'm not one for long reports.

MR. BUSH: I think you make your points better if they're not too long.

MR. BURSTEIN: What time do you want us back, sir?

MR. MORRISON: Why don't we figure -- it's quarter of 12:00 now -- 1:00, 1:15. Why don't we make it 1:15. Let's go off the record.

[Whereupon, at 11:45 a.m., the meeting was recessed for lunch, to reconvene this same day at 1:15 p.m.]

AFTERNOON SESSION

[1:15 p.m.]

MR. MORRISON: I'd like to call the meeting back to order. I want to go a little bit out of order in the text just to optimize the use of the staff's time who are here, and move to Page 16 in the draft report dealing with the seismic aspects under the waste disposal and geologic area. There's a page in there on earthquake hazards which was developed by Don Turcotte and that was in response to the Subcommittee meeting that we had on waste.

There is a revised version of that which --

MR. MEYER: It's not here, but it's in transit.

MR. MORRISON: The page that I have in the report is not the latest one. Mel, maybe you'd want to comment a little bit on the differences between what the staff marked up on it in response to the questions from the Subcommittee.

MR. SHAO: Mainly, the latest version would have a little more description on seismicity and ground motion. Then we talk about the difference in the EPRI curves in answer to why they are different and what area we should put -- what we should do to narrow the gap. It was mainly why aren't the two curves -- one is the Livermore curve which was developed for the NRC and the EPRI curve developed for the industry.

This is for seismic sites in the eastern United

States, but right now for the eastern curves, there are some differences. The differences are as far as the ground motion model. So we want to do some research and try to close the gap of the two curves.

MR. ISBIN: And this is really in response to Kouts Committee as well.

MR. SHAO: Yes. In 1150, Kouts mentioned that we should do some research to close the gap.

MR. BURSTEIN: But the gap is really not that significant. And to expend a hell of a lot of resources --

MR. SHAO: Risk. For instance, Livermore can give you a risk of ten-to-the-minus-four and the other is ten-to-the-minus-six. The gap is quite significant in terms of overall risk.

MR. BURSTEIN: I didn't realize it was that significant.

MR. SHAO: They did an 1150 on Peach Bottom and also on Surry. They used both the Livermore curve and used the EPRI curve. The common frequency in one case can be an order of magnitude higher or two orders of magnitude higher, depending on the sites. In many cases, it can be quite large.

MR. ISBIN: And this is done as part of the external events, right?

MR. SHAO: Yes.

MR. ISBIN: IPEEE.

MR. SHAO: But 1150 had internal events and recently they did two plant events, Peach Bottom and Surry.

MR. ISBIN: And what you are now addressing is the seismicity aspect for external --

MR. SHAO: The external event IPE, right.

MR. BURSTEIN: As I recall, the origin was slightly different. It came from the U.S. Geologic Survey. The NRC in November of 1982 dealing with the Charleston earthquake and the fact that USGS or anybody else could not explain the Charleston earthquake based on traditional approaches to seismic analysis, and they said because of this inability, you ought to question the seismic design of all plants east of the Rocky Mountains.

I was Chairman of a group that spent about $8 or $10 million in seven years trying to find out what was really meant and I thought we had achieved some kind of understanding between Livermore and the industry approach.

MR. SHAO: Right. As far as the Charleston earthquake issue, it's resolved. For IPEEE, when you do this analysis, using the Livermore curve and using the EPRI curve, they make a large difference.

MR. ISBIN: But at the same time, wasn't it noted in the Kouts report that in order to have any risk, you need a very severe earthquake, to such an extent that the

neighboring communities are also suffering intolerable damages?

MR. SHAO: Right.

MR. ISBIN: Therefore, where does this leave you?

MR. BUSH: It leaves you with an eight or a nine earthquake is what it leaves you with.

MR. ISBIN: But certainly the differences between the two methods ought to be dissolved.

MR. SHAO: They have to be dissolved, yes. But right now, usually --

MR. BURSTEIN: I think the methodology are pretty close to the same. What it boils down to is a difference in judgment teams of experts. That's all it is. And how the hell you ever resolve that, I don't know.

MR. MURPHY: The difference is that when -- my name is Andrew Murphy.

MR. SHAO: Andy Murphy.

MR. MURPHY: The difference is that for the ground motion, those experts were working on an available database and analysis of that database. That database has grown significantly since the start of that program and will continue to grow as items like the National Seismographic Network are put into place and as organizations like the National Center for Earthquake Engineering and Research up Boston collect more data that we will be able to provide a

more solid basis for making these decisions or for proposing these judgments.

It is that that we are attempting to address with this ground motion database collection and analysis program. It is, in effect, a continuation of what is going on now. We have been given the task to address what was said by Kouts, in addition to our basic justification for this program. So that, in effect, we are going after two birds with this one stone; addressing the problems that originated with 1150 and the basic background problems of what the ground motion in the eastern United States is actually like.

MR. BURSTEIN: If we refer to Page 16, Mr. Chairman, are we now addressing Item 1 on that page?

MR. MORRISON: Yes. It's really Item 1, but somewhat rewritten.

MR. BURSTEIN: I understand.

MR. MORRISON: Item 2 is a separate item.

MR. BURSTEIN: That was what I was waiting to get into.

MR. BUSH: Isn't the second one -- that one really -- that work has really been turned over and you get the data, but you aren't responsible.

MR. SHAO: We won't get it 1992.

MR. BUSH: But I mean effectively the action is underway to make that transition, is it not? Isn't that the

case? I thought --

MR. MURPHY: That is the case if we're talking about Item 1. Item 2 is a separate --

MR. BUSH: I know. I'm talking about the -- really what you would be doing after 1992 is monitoring the information that becomes available.

MR. MURPHY: We would be monitoring information that comes available and carrying out the analysis of that data.

MR. BUSH: That was my understanding.

MR. MURPHY: And if I may use the terms, that includes taking care of looking at weak ground motion, which is usually used for detecting and locating earthquakes, and the strong ground motion which is the portion that is of particular engineering interest to the Commission.

MR. KINTNER: I thought I understood from the last discussion the last time we met that you were working to rationalize Lawrence Livermore and EPRI. Has that been done now? It's done.

MR. MURPHY: No. It is not done.

MR. BUSH: That's the first paragraph, really.

MR. KINTNER: It says they placed reasonable constraints on the seismic hazards. That leads me to think that it's a happy situation. They now have reasonable constraints, everybody is satisfied and go home.

MR. MURPHY: It places reasonable constraints in the sense that we have postulated an upper bound --

MR. SHAO: And lower bound.

MR. MURPHY: -- and lower bound. People are telling us they're too far apart. This is why we are tracking the differences, the rationale, the reasons for those differences, which is addressed by one and two here.

MR. KINTNER: If you can rationalize these on some narrower bounds than the ones you've gotten, it's going to be a big help to a lot of people. Is that happening and when?

MR. SHAO: That's the program we're going address.

MR. MURPHY: That's what these two items address.

MR. SHAO: Normally, the reactors, all the DOE facilities, they use our curve to do their work. Other reactor programs are using the Lawrence Livermore curve and EPRI curve.

MR. BUSH: Andy, I think it's reasonable to say that because of the difference in the two curves, that the uncertainties, when you establish the band, that expands the band substantially, too. In other words, the lower bound is in one position unless you make it -- well, I would say you just reach and grab and say I will do it on this basis, but if you take the two of them where you have two means, you certainly are going to have a much wider uncertainty band.

What you'd like to do is move the two means together and in the process move the uncertainties together.

MR. MURPHY: That's correct.

MR. MORRISON: Larry, do you have the budget data with you on Items 1 and 2?

MR. BUSH: You want the subsets of that. That's the seismic research.

MR. MORRISON: Seismic research. I guess I was really looking at what it's going to entail and the establishment of the National Seismic Network and what it entails in the area of seismic studies.

MR. MURPHY: The basic program we're talking for include both the National Seismographic Network. There will be -- I call it two components that I refer to, the first being the weak motion which we estimated about a half a million dollars a year.

The strong ground motion and ground propagation we're estimating at less than a half a million dollars a year.

MR. BURSTEIN: What does the weak motion give you? Why do you need that at all in the application of such data or phenomena to nuclear plant safety?

MR. MURPHY: The weak ground motion is -- now we're going to get involved a little bit in nomenclature and jargon. You'll forgive me. The weak ground motion

basically provides us with the locations, magnitudes, the source parameters and the other characteristics of the earthquake itself.

It also provides us information --

MR. BURSTEIN: Not with a significant earthquake of a damaging magnitude. You're giving me an answer that says we want to measure everything because it's out there.

MR. MURPHY: No, sir. We're definitely not.

MR. BURSTEIN: You'll have to somehow tell me how that data helps us.

MR. MURPHY: The current networks provide us the capability of recording magnitudes down to Richter .5 and one, particular areas. The new network, the new national network will provide us a capability of about 2.5 to about 3, which is generally the receptability by human beings. So we're talking about those earthquakes providing the weak ground motion, the indication of where the earthquakes are occurring, how large they are, and the characteristics of those earthquakes.

MR. BURSTEIN: You haven't yet told me that an earthquake of magnitude less than five or three or four means anything, let alone one that's down around the one or two.

MR. MURPHY: Yes, sir. What I am telling you is that they mean things not as far as damaging --

MR. BURSTEIN: That's what I'm talking about. Why are they important? Safety.

MR. SHAO: Let me give you an example. A guy had a heart attack. It may not be severe, but it's a heart attack. One heart attack can lead to a major heart attack.

MR. BURSTEIN: It doesn't follow.

MR. SHAO: It's the same way with weak motion and strong motion.

MR. BURSTEIN: I think you ought to rethink that spending more money on the weak motion program --

MR. SHAO: Weak motion is an indication of a strong motion --

MR. BURSTEIN: Now, here we have another argument, and that's when you start taking probabilities, if you start including numbers that are not significant, you get high probabilities of non-significant events.

MR. SHAO: But we are extrapolating data to ten-to-the-minus --

MR. BURSTEIN: This is a fundamental issue and I reject your approach to it and I urge you to go back and rethink it and don't overlook the opinions of about 120 experts. That's what you're doing.

MR. SHAO: The experts look at the weak motion and the strong motion in order to make a judgment.

MR. BURSTEIN: I have said me piece.

MR. MURPHY: May I just take one minute and make a comment and hopefully put it in perspective? I won't belabor the point. The thing to be understood is that the weak ground motion propagates with, we believe, the same characteristics as the strong ground motion. So by looking at the magnitudes threes and fours, which are not damaging to nuclear facilities and generally not damaging to any facilities, we understand how the larger ground motion will propagate. That's one point.

The other point is that by observing where these earthquakes are occurring, we can understand the mechanisms; as we call it, the tectonics of the earthquakes; why they're occurring in these places. We have spent many millions of dollars trying to understand the Charleston earthquake, why it occurred where it did. We don't know. We think we have an engineering judgment and a rationale for resolving your question of eastern seismicity as far as Charleston is concerned, but there still is the possibility that Murphy's law will apply and it will turn around and it will bite us.

So we're just being prudent and keeping an eye on the data that's coming from the National Seismographic Network, using it for strong ground motion analysis, and that's it. We're just trying to be prudent about what's happening out there and keeping our eye on it.

MR. KINTNER: Now, to go back, is there a major

effort on a timely basis to resolve the issue between Lawrence Livermore and EPRI?

MR. SHAO: These are programs.

MR. KINTNER: It doesn't say that in here at all.

MR. MURPHY: The differences between Lawrence Livermore and the EPRI curves come in two basic areas. The first and most important is the difference in the ground motion models that the experts for EPRI and Livermore used. That's the principal difference.

The second difference is in the source zones, the places where the earthquakes occurred. That is a secondary, maybe half an order of magnitude importance down from the ground motion.

We are attempting to address both those issues with the program that we have proposed.

MR. KINTNER: That does say it differently.

MR. BUSH: These words that are here, were these written by someone --

MR. MORRISON: Yes.

MR. BUSH: I presumed that these were Turcotte's words, right?

MR. MORRISON: This is the revised version.

MR. SHAO: This is the revised version.

MR. MORRISON: Don agrees with the revised version.

MR. BUSH: Not much change in the seismic increasing and the seismicity also in the lead paragraph.

MR. MURPHY: That's correct.

MR. BUSH: That next to the last sentence in there kind of clarifies that bound constraints in the long paragraph at the top of the page.

MR. MORRISON: Are there any further questions on the seismic hazards?

MR. BUSH: I thought that Sol had an issue on No. 2.

MR. BURSTEIN: I think we ought to discuss No. 2. I don't understand -- perhaps I was not paying attention earlier in our meetings, but I don't recall very much discussion about the application of these paleoseismic studies. What are we going to do; dig trenches and look at faults or what?

MR. MURPHY: As a matter of fact.

MR. BURSTEIN: Why?

MR. MURPHY: For one thing, in helping us resolve tel Charleston issue. we went back and we did have contractors dig trenches across what were called sand boils, sand volcanos, features associated with the Charleston earthquake of 1886. By understanding what they looked at and what they looked like, we then found in those same trenches indications of previous events, previous

earthquakes that were large enough to cause liquefaction.

By being able to dig carbon-containing materials within those features, we were able to postulate the occurrence of previous Charleston size earthquakes within the Charleston area. The rough recurrence rate, someplace between 600 and 1200 years between Charleston size earthquakes in the Charleston area.

By examining that type of sediment where these were found north and south of the Charleston area, coming up into North Carolina to Georgia, we were able to, in effect, not find evidence of other events other than the ones that were found in the Charleston area, providing an indicator that in that general area of the southeast, going from southern North Carolina into George, that in some sense the Charleston earthquake and whatever its source was represents some kind of a gridding feature.

We had a handle on the fact that it was there, how often the earthquakes were reoccurring there, and there did not appear to be a feature like the San Andreas fault that would effect a large area running north and south. So we're able to localize the earthquake, the localize the recurrence of the earthquake and sort of localize the size earthquakes that occurred there.

MR. BURSTEIN: Are we going to now dig holes up and down the United States to find places where there might

have been earthquakes?

MR. MURPHY: In effect, we are going to look for places to dig holes up and down the east coast of the United States. It is not as random or a hit-and-miss pattern as might be applied by the terminology, which is digging holes. We make use of land site, we make use of geological records.

MR. BURSTEIN: I understand, but, again, I guess I would like to know the relationship of this academic research to discovering unique features of geological hazard to nuclear power plant safety, unless there's a plant there or a proposal to put a plant there or if you contemplate a requirement to be imposed on the licensee that he must do that at his site that you are proposing in order to assure that there are no unique features, and we haven't seen an earthquake there for 100,000 years or so, which, in the past, has not been adequate.

MR. MURPHY: There are two reasons at this time to undertake these studies. The first one is to answer the questions proposed or going out of the Kouts report, where are these earthquakes occurring; let us reduce the uncertainties between the EPRI and the Livermore hazard curves. As a said, I second level item there is where these earthquakes occur, the seismic source zones, and the recurrence rates on these seismic source zones, just as we establish there is a Charleston seismic source zone, it has

a recurrence rate of someplace between six and 1200 years, we would like to be able to do that with the other seismic source zones in the eastern United States.

MR. BURSTEIN: Of which there are how many?

MR. MURPHY: Of which there are how many?

MR. BURSTEIN: Yes.

MR. MURPHY: A limited number. Like the central Virginia seismic source zone, the Charles County area, there's an area in eastern Tennessee.

MR. BURSTEIN: You've got areas all over the place depending upon how you define the source zone.

MR. MURPHY: There are definitely areas all over the place, but they are a limited number of areas.

MR. BURSTEIN: I just, again, question whether this approach is -- and I don't know what it costs, again --

MR. SHAO: That's the only way to predict an earthquake.

MR. BURSTEIN: I'm sorry.

MR. SHAO: Don Turcotte, the Chairman of this Subcommittee, he's a seismic expert, too. He's the one suggesting this. We talked to him --

MR. BURSTEIN: If you talk to a seismologist, they want a guarantee against future unemployment.

MR. SHAO: I'm talking about the Chairman of the Subcommittee.

MR. MURPHY: This isn't his kind of seismology, anyway.

MR. BURSTEIN: Do we have an idea of what the cost is?

MR. MURPHY: We're estimating a maximum of half of a million dollars a year. Currently we're spending about $300,000 because of the funding at the national network.

MR. BUSH: I would raise one question on this one. With all the things that you say under there, a heading of geological studies-waste disposal is not very appropriate.

MR. MORRISON: That's very true. As it turns out, there was another portion of my draft missing.

MR. BURSTEIN: All of this applies not to Nevada.

MR. BUSH: This is a different issue, so it's not really germane to put it under waste disposal.

MR. MORRISON: You're absolutely correct.

MR. SHAO: Earth sciences.

MR. BUSH: It's earth sciences, I have no argument about that, but let's get rid of the word disposal.

MR. ISBIN: Under the Chairmanship of Spence, a Subcommittee was held at Sandia in which this topic was presented and discussed. The Subcommittee thought it was really a very, very good idea.

MR. BURSTEIN: I've given you my two cents' worth, and that's all they are. I recognize that that occurred and

I'm not going to suggest otherwise. I just have said, as I did before, that there is a time to ask the right kind of question and there is a time to achieve closure. It's important to ask the right question, as well as to get the right answer, I think it said somewhere in one of these documents.

I think we can continue to get more information and do more research and all of it tends to help, but I really believe since our basic minimum design features for nuclear power plants generally, as we have validated in both the Livermore and the EPRI studies, validate that no damage will occur from the kinds of earthquakes to be expected east of the Rocky Mountains, even though we may have one or two outliers, whatever that means. Sometimes the additional data doesn't do us very much good unless we can expect that data to show something that has not been characteristic of our history from the past.

I just don't like the idea of spending money because we have a technology that's out there on which to spend it.

MR. BUSH: Can you really say that, though? Because what I've looked at on the New Madrid fault, it indicates -- I would be kind of uncomfortable if I had a reactor within a 100 miles or so of that place. That was a pretty hefty earthquake when you feel it jar things --

MR. BURSTEIN: And none of this stuff is going to help you in New Madrid.

MR. MURPHY: No, sir.

MR. BUSH: That's not true. The second one would certainly do it.

MR. MURPHY: That is incorrect. Let me start off by making one point. The first thing is the three largest earthquakes in the United States are the ones that occurred in New Madrid. The three largest in the United States since Europeans have been in this country. There is nothing in California that is as large as those three earthquakes.

MR. BURSTEIN: I understand.

MR. MURPHY: The other point is that it was this paleoseismic study, the same thing we used in Charleston, that discovered the faults in the New Madrid area and provided us the handle with the recurrence rates of those earthquakes. That was done by the U.S. Geological Survey about six years ago. Those numbers came out again, like in the Charleston area, of approximately 600 to 1000 years between those earthquakes.

This kind of research has definitely put a handle on those kinds of numbers for us and they have been very beneficial to us.

MR. BURSTEIN: Okay. We've said our piece and let's go on, Mr. Chairman.

MR. MORRISON: Perhaps the bottom line question from the Committee's standpoint is maybe two questions. One, is there merit in spending this roughly one-and-a-half to two percent of the research budget in the seismicity area. Second, what's the priority it should be given within the broader context of what we're discussing here in the research program content.

MR. KINTNER: The question still remains in my mind, notwithstanding what was said here on both sides, if I wanted to site a reactor in the eastern United States today, would I be able today, with your concurrence, write down the specifications for seismicity?

MR. MURPHY: Yes.

MR. KINTNER: I can tell you we just tried to do that and couldn't. That came back to this question of EPRI versus Lawrence Livermore. We were trying to write the requirements document, put the seismic requirements in it, and we couldn't do it for that reason. Now, that's then sort of corollary to the question, there's a public understanding, at least I read it on a number of occasions in trade journals and so forth, that the eastern United States is due for a large earthquake and people keep asking the question what does that do the nuclear plants.

Sol said they are, as they now stand, capable of handling any large earthquake that hits the eastern United

States. Is that correct or not or do we have information enough to answer that question?

MR. MURPHY: We have a set of regulations that has allowed us and will continue to allow us to license nuclear power plants. In the popular press recently, there has been a lot of yellow journalism associated with the occurrence of large earthquakes in the eastern United States. Some of that was done for public awareness purposes, not necessarily -- it does not necessarily have application in a license arena like we were talking about.

There is too much speculation associated with it. It does not have the hard and fast science to support it.

MR. BUSH: I have one other question. As far as I can find, there isn't any word in here about $6 million for waste. Are we going to say anything about that?

MR. MORRISON: Yes.

MR. BUSH: Is there something that I don't know about?

MR. MORRISON: Yes. There's part of a draft --

MR. BUSH: It isn't in here. I was wondering because it seems to me that the tail is really wagging the dog.

MR. MORRISON: That's correct. It was my error in not getting that part of it done, but it is in the material that's coming down from Headquarters here. It should be

here probably with 20 minutes.

MR. BUSH: I raise the question because it seems to me there would be a substantial imbalance if we added something like this.

MR. BURSTEIN: As I understand it, the total program is in the order of a $1.5 million. There's about $1 million for Item 1 above and about $.5 million, it will grow to that from $300,000, for Item 2. Both the weak force and the strong motion are about $.5 million each.

MR. BECKJORD: I wanted to address Sol's point about the seismic research. It seems to me that we have devoted a lot of work to nuclear plant accidents, identifying what they are, attempting to determine their frequency of occurrence, and a lot of these things have been dealt with in terms of plant fixes and changing features and changing procedures.

Now, if we look at the external events, and in particularly if you look at 1150, the frequency of the external events leading to core damage is about the same order of magnitude as the present-day other events, the internal events. That is as a result of a lot of effort to improve the internal events side.

If you look at the external events, gest problem is the difference between the EPRI and wrence Livermore studies, and it is true that the -- if you look at

the people who contributed to those two studies, with one exception, they are almost the same people. There was one person who had an opinion on the frequency or magnitude which dominates --

MR. BURSTEIN: And that dominates the Livermore curves.

MR. BECKJORD: Yes. And that dominates the Livermore results. Now, we looked at -- a lot of people have trouble believing that. I guess the reason that we can't throw that away hinges primarily on the analysis which was done of the event in Canada. What's the name of it?

MR. MURPHY: Sagonnay.

MR. BECKJORD: Sagonnay in Quebec. The one person who is far out has the best explanation today for that event. So I think that we have to take that seriously from a long-range research point of view and do what we can to attempt to resolve the difference between the EPRI and the Livermore hazard curves.

That's the reason this is in the budget and we had figured on doing that before the Kouts review group on 1150 said this is something you really need to pursue. That's why it's in there. I view it as a longer range effort. I don't know that we're going to resolve it in the next year or so.

But it seems to me that it's a problem that is

overhanging the whole business and that's one of the things that research is supposed to do, is to try and establish by the best means available what the best answer is.

MR. BURSTEIN: I think that's a very helpful explanation.

MR. BECKJORD: There is also support for this from the National Academy Committee that deals in this area. We've talked to them over the past couple of years, beginning three years ago, about this issue. I'm probably paraphrasing it and making it briefer than -- that is to say the explanation is more complicated than this, but I think they had, the people that we talked to had a lot of difficulty with this difference between the --

MR. BURSTEIN: I think the resolution of difference is, as you say, very important and I guess I think you've characterized it properly, that it's really due to the judgments of one expert out of the several hundred that's been involved in this proceeding.

I would like to see closure achieved here as much as anyone. I am concerned as to whether or not the directions we're undertaking are headed toward that. There is another important aspect of this that I would like to go back to, and that is that maybe it is important that we redo this work if for no other reason than to maintain technical capability to deal with regulatory issues as they may arise.

It is probably an example of RES having to rely on one group of experts versus another group of experts, and what do you do when they don't agree if you don't have some capability inhouse to deal with that. So I think there is justification for support of some of this work along those lines as well.

MR. VOGEL: Didn't the outlier seismologists, during the case of the Quebec earthquake, gain credibility which may have been due to accidental placement of the sensors?

MR. BURSTEIN: All kinds of reasons like that can be given and probably validated.

MR. BECKJORD: Can you comment on that?

MR. VOGEL: I have probably scrambled this interpretation because this is a chemist's interpretation of what a seismologist told me. Maybe somebody can elaborate on the truth of this allegation.

MR. MURPHY: I would say what they're doing is comparing dots on a graph versus lines put on a graph. Those dots are magnitude versus distance from the earthquake. You might say maybe it's fortuitous that the particular ones for Saguenay were at the particular places to make this individual's model look best.

MR. BECKJORD: Just one other point following up on the comment that Sol made. The paleoseismology, if I can

use that word, has been pretty effective in resolving some questions about the movement along the San Andreas fault, as I understand it. As experiments go, thinking about severe accidents, it's probably relatively inexpensive.

It probably is not an expensive method to employ.

MR. MURPHY: No, sir. If a particular site is not that expensive, you probably know better than I do what the cost for a backhoe for a couple of days is, and then putting several geologists down in the hole --

MR. BECKJORD: That's about $500.

MR. BURSTEIN: Now, that's what I'd like to see.

[Laughter.]

MR. VOGEL: As one who lives about two miles away from the San Andreas fault, I wish you guys would do something.

[Laughter.]

MR. BURSTEIN: Do you remember Dr. Lenehan up at tel University of Glasco who used to write a column in the local Scottish newspaper and they collected all those in a book, and one of them had to do with some things about the fault out there in California. So he titled the book, It's Not My Fault. If you haven't read it, I'll get it for you.

MR. MORRISON: I think we've probably addressed this issue enough at the present time. Let me suggest the following ways to proceed. One is obviously you get a

revised draft which has the staff comments in it. Secondly, I'd like to see, if you could, just add a couple more things into that, Andy, from the front. One is perhaps some reference to the Kouts report which points this out. The second, you mentioned, Eric, a National Academy panel, and that could be another reference in there.

I think this is useful because there seems to be a difference of opinion and maybe is converging somewhat here within the Committee so that we have some independent backup for that. Then I'll sit down or talk on the phone at leas with Don Turcotte to make sure that he can agree on this. That will be pulled into the final draft.

MR. BUSH. Dave, could I ask, in that respect, particularly when you talk about these curves on damage basis, because at that stage, that plant response to ground motion, the seed money you have in may be directly applicable because this is the Taiwan and they are expecting a magnitude seven or seven to eight probably within the next year or two years. They will have a structure sitting there that will simulate at least a portion thereof, which would give us a better indication.

It seems to me it wouldn't hurt maybe to put a slight cross-tie to that one as being applicable in perhaps the clarification or resolution of it. We didn't look at that, but that's a significant item, it seems to me. I

addressed it very peripherally.

MR. MORRISON: Should we add that factor into your section?

MR. BUSH: I could, except it kind of loses its content because of the other one, because it really begins to pull together this business of seismic hazard in the specific sense of a structural response. I think it could be done. What would you say, Andy, as to where it would go? It could go either place. It just seems to me that if you're going to expand this one, a very slight sentence that would cross-tie to the other one might clarify that issue.

How big does an earthquake have to be before I really begin to worry about not just tel loss of my substation, but severe damage.

MR. BURSTEIN: Do we have any target date for trying to achieve this closure or establishing -- eliminating these differences between the two probablistic studies? Is there a goal, an objective, one year, ten years, five years?

MR. MURPHY: It's going to be three years. I would hope that we would be in a position within five years to make concrete improvements on what we have today.

MR. BURSTEIN: What would that do to a license application for a new reactor site?

MR. SHAO: Then we use one curve instead of two

curves.

MR. BURSTEIN: I'm sorry I prolonged the discussion, but I think it's important to hear that if we're going to have to carry this program on for five years before we can achieve closure, I'm not sure -- well, I won't comment any further on that.

MR. MORRISON: Now that we've finished the discussion on that, you have in front of you the real draft that we should have been reviewing. What we're addressing really are the last two pages of this copy that was sent to Don Turcotte and Larry Shao.

MR. BURSTEIN: Should we look at the last two pages?

MR. MORRISON: I would just scan it briefly. I don't think you will find any great difference.

[Pause.]

MR. BURSTEIN: Who operates the National Network?

MR. MURPHY: The U.S. Geological Survey will operate it.

[Pause.]

MR. MORRISON: Sol, the principal difference that you find in the two drafts are on that first page under earthquake hazards, and I think the last two sentences in that first paragraph provide a context which hadn't been in the earlier draft.

MR. BURSTEIN: One of the things that comes out of this paragraph on hazards is about the fifth line from the bottom of the first paragraph, the words but not necessarily bounding. Does that give anybody else any heartburn around here?

[Pause.]

MR. BURSTEIN: I guess that whole sentence troubles me by saying that the studies place constraints on seismic hazards.

MR. BUSH: I guess it's a problem of what do you mean by constraints.

MR. BURSTEIN: Well, I had the feeling that the work was intended to give us an envelope under which we could safely design nuclear plants to meet anticipated seismic hazards. This says we're putting some constraints on those, but they're not necessarily limiting was. I guess I don't know what the heck that means.

MR. MURPHY: The problem gets back to your point that, to a large extent, this study was based upon expert opinion, expert judgment as it exists today. Are they correct or aren't they correct, are they correct on the high side or the on the low side.

MR. BUSH: Wouldn't the bounding value mean the same thing if a little clearer?

MR. BURSTEIN: I think it needs some rewriting and

I'll leave it to others to do that.

MR. BUSH: The bounding value, to me, has a different connotation because it straight automatically says you're locked into something and the bounding value says that I have an upper bound or a lower bound.

MR. MORRISON: Let me suggest a simple change in words in those two sentences, starting with these studies have placed reasonable bounds on the seismic hazard on nuclear power reactors in the United States.

MR. BURSTEIN: That's good. Very good.

MR. MORRISON: And then change the word constraints in the next sentence to read that these bounds provide --

MR. BURSTEIN: Thank you.

MR. MORRISON: All right. While we have this in our hands and Silberberg is sitting at the end of the table, too, why don't we look at th f st several pages of this draft with regard to waste mana ent research programs and we can tidy that part up and let a couple people go back to work.

MR. KINTNER: What is far field transport?

MR. SILBERBERG: That is transport once you've left the immediate region of a repository. Then as you move toward the environment, that's considered far field, as you get away from the immediate bounds of the repository. It's

not a very sharp-minded -- kilometers versus --

MR. KINTNER: They're not talking here about high level waste, then, are they?

MR. SILBERBERG: The term is used.

MR. KINTNER: Do you think that's a likely possibility that you're going to have to worry about this thing moving large distances?

MR. SILBERBERG: Yes. In fact, the EPA standard talks about three kilometers as an accessible environment. If you will, take a fence or a boundary and if you look at the ground-to-water table and the potential for ground water movement, if in fact nuclides did get in, the water table could extend many, many miles.

MR. BUSH: That assumes that you don't have any DF factors.

MR. SILBERBERG: That's correct.

MR. BUSH: So that's a bunch of baloney, in my estimation.

MR. SILBERBERG: No. In fact, the DF factors are being taken into account in the program.

MR. BUSH: Because then what you do is your lighter elements will travel a long way, but they also won't have that long a life in most cases either.

MR. SILBERBERG: But you can put in the half-life -- actually, Dr. Bush, if you forget about half-life and

take those longer-lived isotopes that, in fact, drive the hazards analysis, if you will, those are the ones being addressed. So the others all sort of wash out. But, in fact, the geochemistry tries to take into account the fact that there may be retardation, chemical retardation of the long-lived isotopes.

MR. BUSH: There certainly is evidence. I see the stuff coming out of the trenches and so forth.

MR. MORRISON: Spence, maybe you can repeat your comment. I think that's probably what was missed.

MR. BUSH: Well, I have reservations on movement, unless you make the assumption that it gets directly into the ground water. But if you have a column of substantial length, I don't know how it gets there in the heavier elements.

MR. SILBERBERG: Good point. In the case of high level waste, geologic repository, if, in fact, you have fracture flow, that would represent a bypass. That will represent a bypass from the soil column, if you will. If you use an entire soil column, you're correct, for high level waste.

MR. BUSH: I have a question on the high level waste. I don't care about the low level waste so much. But this makes an apriori assumption that we are going to essentially retain the waste, because that's where the

10,000 year figure comes. If we want the option, if people exercise the option, you could get down to the point at 400 years, you would not have enough activity to worry about.

MR. BURSTEIN: That's if you reprocess.

MR. BUSH: Sure. In other words, this locks one in, basically, as it's written.

MR. BURSTEIN: That's the only proposal on the table.

MR. SILBERBERG: That's all there is.

MR. BUSH: We'll be all by ourselves in the world.

MR. BURSTEIN: We already are.

MR. BUSH: I know it, and it makes me sick to my stomach to see it, because most of these problems are uncertainties and if you cut down your time, then those uncertainties disappear.

MR. BURSTEIN: I don't argue the point. Are we commenting on this waste management research program?

MR. MORRISON: Yes. Let's get our comments out.

MR. BURSTEIN: May I ask if you have the same difficulty I do? On the top of Page 2, in the last sentence of that first paragraph that appears at the top, beginning the fourth line down, while this systems approach should be emphasized, that's a systematic approach. I have difficulty with that sentence, sir, all the way through, and perhaps somebody can help me clean it up a little.

MR. SILBERBERG: That can be cleaned up.

MR. MORRISON: You're speaking from a grammar standpoint.

MR. BURSTEIN: I'm speaking from I don't understand what it says.

MR. BUSH: I think I understand. I think it gets down to what you mean by a systems approach as contrasted to there, which essentially would give you what I'd call a fault tree or an event tree type of thing of all the things that you could look at.

MR. SILBERBERG: And then you integrate.

MR. BUSH: And then you integrate across it.

MR. SILBERBERG: I think Dr. Turcotte made the point of keeping, trying to use a probablistic hazard, a systems approach. In turns out in order to comply with the EPA standard, one, in effect, is doing that, integrating a series of phenomena, as well as the probablistics of what we would call disturbing scenarios, disruptive scenarios, such as volcanos or earthquakes or something like that, which, again, have low probability.

In fact, the technique of performance assessment for high level waste, ground level waste, in fact -- well, just high level waste, is just evolving right now how to do that.

MR. SHAO: But just like the PRA, we're

essentially looking at the whole thing.

MR. MORRISON: Again, let me talk to Don and try to resolve the differences between that and the much simpler paragraph that was written on systems approach in Don's original draft, which was expanded upon here.

MR. SHAO: Don agrees with the latest.

MR. SILBERBERG: But if you have a problem, we can have it resolved.

MR. KINTNER: HOw is what you're doing in the name of NRC relate to what's being done by DOE in the seismicity? Are you just confirming what they're doing or doing enough work to be sure they're honest or what?

MR. SILBERBERG: Let's say both. Mostly, the latter. In other words, so that the basis for making judgments on what they've done, which, in itself, in that field, is still pretty much on the forefront of this.

MR. SHAO: We are looking at areas where we think they are weak.

MR. SILBERBERG: Or where they're not doing enough work so that we could -- if we could suggest that they do more work, but at the same time be able to evaluate it in our own performance assessment. We will not do site-specific work. That's clearly their job. But we might be looking at sites similar or near there that might give us some insights. But certainly there is a lot of data

available. As data becomes available, certainly that would be accessible. We would have access to that, too.

MR. KINTNER: You know why I said that.

MR. SILBERBERG: I understand.

MR. KINTNER: You could go in under some other flat, an Italian flag or something.

MR. BURSTEIN: We speak here about the prohibition for the Southwest Research Institute Center working on low level waste matters. Is that by design?

MR. SILBERBERG: Right now it's contractual. The contract says only high level waste. I think originally, as I understand it, they wanted to clearly keep the focus out of the way so they can concentrate on getting that job done. But, in fact, the contract today prohibits low level waste.

MR. BURSTEIN: Is that due to an administrative --

MR. SILBERBERG: Administrative.

MR. BURSTEIN: -- determination. There's no legal or technical impediment.

MR. SILBERBERG: Nothing legal.

MR. BURSTEIN: Is there any activity in this area that is funded or supported through university undertakings or do you have contracts?

MR. SILBERBERG: In high level waste, yes.

MR. BURSTEIN: High or low level.

MR. SILBERBERG: High or low level, in both.

MR. SHAO: The University of Arizona.

MR. BURSTEIN: I remember that.

MR. SILBERBERG: For low level waste, we're using work from MIT, the hydrogeology.

MR. BUSH: Yes. The CMWRA contracts quite a bit of that money.

MR. SILBERBERG: Not directly. They can do that if they'd like. Some.

MR. BUSH: I thought they had done so because I chaired a committee for them.

MR. SILBERBERG: Ohio State, we have a small amount of work that they've subcontracted to Wyle at Ohio State, but that's probably the best --

MR. BUSH: That work at Wyoming was subcontracted. Does that come directly from -- the Arizona one, there are a couple of them there.

MR. SILBERBERG: The Wyoming, that one may be erased. They called a consultant for that meeting.

MR. BUSH: And he had been the consultant before.

MR. MORRISON: This whole issue of contracting and the role of CMWRA versus universities was addressed at least twice in the Subcommittee meetings from the Waste Management Subcommittees. I wasn't at the second one, I was at the first, but let me report on that Subcommittee. It seemed like the more comfort is gained as long as CMWRA exists in

terms of their competence in being able to deal with it, but I think there still is a feeling in this first paragraph on Page 3 that that's a problem that continues to need some oversight, but isn't totally solved. External peer review mechanisms is recommended.

MR. BUSH: That one I thought actually had been done. This sounds like it's never been done.

MR. SILBERBERG: I think the original context was that because we're depending so heavily on the Center, that there ought to be external peer review. One of the comments we made to Dr. Turcotte was that there was, in fact, for the moment, two avenues for review; one was ACNW and the other was his Committee; and he still felt that some type of -- in addition to that, external peer level review at detail level might still be useful. That's, I think, the spirit of what -- in order to make sure that, in fact, the quality of the Center work is still being maintained at the highest level.

MR. BUSH: And funded by NRC or funded --

MR. SILBERBERG: Funded, I think -- well, I don't think we went that far.

MR. BUSH: Because I thought what we did was a peer review.

MR. SILBERBERG: Of a particular area.

MR. BUSH: Of an area.

MR. SILBERBERG: That's correct.

MR. BUSH: That's right.

MR. SILBERBERG: So that mechanism -- now, except that was done by the Institute.

MR. BUSH: That's why I asked the point, because I don't know from this one. This sounds like it's never been done. It has depending on how you define --

MR. SILBERBERG: How you define.

MR. BUSH: -- the NRC thing, because we looked at the package. It seemed to be it complies with the intent of those words, as an example. Unless you're talking about a peer review committee that would essentially permanently be in place to overview the whole program.

MR. SILBERBERG: I think the spirit of his work on the original Page 17, Dr. Bush, was direct external evaluation. That's the spirit of it. Certainly the mechanism that you cite is certainly a good one, no question about it, and we would encourage that for each individual area.

MR. BUSH: I wouldn't suggest it very often, though, because you get into probabilities on top of probabilities on probabilities, it gets very complicated.

MR. SILBERBERG: I know.

MR. BUSH: The first time I ever ran across it, you take a probability of a probability and take the probability of that.

MR. MORRISON: For the Committee's information, I fulfilled an obligation that we have been talking about for a couple of years of meeting with the ACNW. That was a couple weeks ago. We were trying to discuss what our scope of activities were versus their scope of activities. Fortunately, Larry Shao was there to bail me out on the tough questions that they were asking.

But I think at the end of the day, what we really have agreed upon is we keep one another informed of what we're doing and that we would get copies, we the Safety Research Review Committee would get copies of their letters and treat them the same way as we treat ACRS letters. That would be an alerting mechanism to something perhaps we should look at in a bit more detail.

So I have about a dozen letters that I kept going through to see what we could put on our agenda, but at least we fulfilled the obligation of meeting with them and trying to clear the air with regard to the scopes of activity.

MR. BUSH: Dave's been looking at a lot of stuff. I've read some of those letters. They appear in that little bulletin that comes out every week or every other week. Usually, every third or fourth one has about two or three ACNW area letters.

MR. MORRISON: And they certainly worry about things well beyond the scope of our activities here dealing

with nuclear safety research. All right. Is there anything more that we need to touch here on the waste management?

MR. BUSH: It's too long.

MR. MORRISON: Too long, obviously. The style is different from what yours was, Spence. But when we get into the severe accidents, we'll have a third style to deal with. Let's lay style aside for the moment.

I think that will wrap up, then, the waste and the earth sciences discussions, and allow us then to move back in the draft report to the section on severe accidents.

MR. BURSTEIN: I don't think we should have any.

MR. ISBIN: Have you mentioned anything in the waste, preference to the special budgetary considerations?

MR. MORRISON: I think that would be a good point.

MR. BURSTEIN: I'm sorry. We do define what you --

MR. ISBIN: Well, the $4 million that is obtained for the waste management --

MR. SILBERBERG: The budgetary status for 1991?

MR. ISBIN: The way it operates. The source of money.

MR. SILBERBERG: For the high level waste program, it all comes from the -- let's call it the high level waste fund which was set up. So I can tell you how tight --

MR. BURSTEIN: How painfully.

MR. SILBERBERG: We both know how. That fund, then, is available to DOE, Department of Energy, to NRC. We submit a budget request and then all monies must be accounted for and audited and so forth that are expended on those funds.

MR. BURSTEIN: They are appropriated annually by the Congress in the budget process, even though the source - -

MR. SILBERBERG: Is the funds.

MR. BURSTEIN: -- is the funding.

MR. ISBIN: And it lists the amount specified?

MR. SILBERBERG: No. The amount is, in effect, determined by the agency, which then puts it through the budget process. OMB can comment on it, etcetera, etcetera. But then in the final analysis it's listed as a line item appropriation within the regulatory part of the high level waste program and then expenditures that will then come from that fund. Low level waste is part of the Office of Research budget and out of the way it normally operates.

MR. BURSTEIN: I would guess that the process is identical as far as RES is concerned.

MR. SILBERBERG: Yes.

MR. BURSTEIN: So it doesn't make any difference whether it's low or high level.

MR. SILBERBERG: Right. That's correct.

MR. BURSTEIN: You have to go through the same justification and the same Congressional authorizations and everything else.

MR. SILBERBERG: Exactly.

MR. BECKJORD: There is one difference. We have some flexibility because low level waste is part of the same basic research budget. So we can make some transfers there. We can't transfer on the high level, though. That's a separate account.

MR. KINTNER: Nationally, is that fund being expended as fast as it's collected?

MR. BURSTEIN: No. We're making a profit, otherwise known as reducing the deficit.

MR. KINTNER: You'd like to have the interest on it.

MR. BURSTEIN: I think we've collected something like $4.5 billion to date and we've spent about $2-$2.5. So there's $2 billion of it in loose change kicking around.

MR. BECKJORD: But we're pikers in that player's field.

MR. BURSTEIN: Yes. For $4 million. It seemed to me that there was a question of whether the $4 million was really appropriate for the kinds of data and basic information that was needed to support the DOE program even on the present delayed schedule. Did we address that?

MR. SILBERBERG: Maybe we did, but let me note that in the Fiscal 1992 -- well, in the five-year plan for Fiscal 1992 to 1995, the Commission addressed that by, in fact, increasing, recommending an increase in the budget directly from them to $6 to 1992 and $8 for 1993, as presently constituted in the five-year plan. So some of that has been addressed, I believe.

MR. MORRISON: Good. Well, let's move on then to the severe accident -- anybody want to take a break or shall we move forward? Let's take five minutes.

[Brief recess.]

MR. MORRISON: Let's return to severe accident and systems aspect of the program plan, which was on Page 11 of the report. I would like to request that if we can hold our side comments to the minimum, the Court Reporter here is having a little trouble hearing some of our comments. Secondly, let's make sure that we all speak up so we that we get a nice clean record that I can review and get all the pearls of wisdom to factor into the final report without losing any of the polish on the pearls. If we do that, that will help the Court Reporter.

Herb, I guess you're the representative of this Subcommittee. Neil said you'd be a very appropriate stand-in for him. So I guess we'll defer to you. I think, Dick, you sat in on that one, too, didn't you, the last meeting?

So we have two representatives.

MR. ISBIN: Dick and I will both try to cover the items given here. A number of the items also are Dick's, a few are mine, and most of them are Neil's. We'll try to go through it.

MR. MORRISON: As you go through it, then, Herb, would you give us some sense of the priority, because in some places there just are no further comments and I have a little difficulty distinguishing what the priority was, Neil's draft on this.

MR. ISBIN: I fully agree with you and I think Dick and I are going to have to sit down and try to set the priorities based upon our background and what's given here and our interpretation of Neil's remarks. Would you agree with that, Dick? We will need to do this, I think, separately before we come back to the Committee.

MR. MORRISON: All right. We can pick that up tomorrow morning on the final priorities if you want to do it off-line.

MR. ISBIN: Do you agree with me, Dick?

MR. VOGEL: In the context of my earlier remarks on priorities.

MR. ISBIN: And we'll try to also put it in the format which is compatible with the format set by Spence, if we can.

MR. VOGEL: If that's the standard.

MR. MORRISON: Let's us walk through it and make sure that that is the standard we want to use. My impression right now is that's the standard. What Spence had was a nice crisp one. I'll scratch my head and see how we can get the waste management and the earth sciences in that, but miracles can happen.

Why don't you proceed, Herb?

MR. ISBIN: The first part recognizes that the thermal hydraulics programs have been severely curtailed and Neil has made note of this in his first sentence there. I'm not sure that this needs to be specifically included as such. I think we ought to be addressing what is planned in the future rather than so much on what has been done in the past.

MR. MORRISON: A question on that, Herb. In a judgment sense and probably in a priority sense, are we, from a Committee standpoint, in agreement that that curtailment was not only necessary, but desirable?

MR. ISBIN: Yes, I think so. I don't think there has been any disagreement.

MR. MORRISON: So we may want to factor that comment into the text which wasn't there. I wasn't sure even in reading the transcript whether that was an agreement on the Subcommittee's part.

MR. ISBIN: Yes. To my knowledge, I think there is agreement.

MR. BURSTEIN: So, in general, a metamorphous of this area has been well handled.

MR. MORRISON: It simply says you did the job well, but it doesn't say whether you should have done the job or not. That's what I was getting at.

MR. BURSTEIN: You screwed up, but you screwed up well, right?

[Laughter.]

MR. ISBIN: We will also, as part of the priorities, need to rearrange the items. Certainly cooperative testing in international facilities is important, but it isn't the first item, per se. Dick, you ought to join in freely to any comments that I'm making here. But let's take it as he's given it.

MR. VOGEL: Well, I wouldn't make one, two, three as one, two, three priorities, again.

MR. ISBIN: They need to be rearranged, right.

MR. VOGEL: Well, I would say No. 2 is the most important. I'd put it first, but I'd put it in as bullets.

MR. ISBIN: I think that's something we will have to discuss. I'm not sure that that is the first item. It's a very important item. Here, Neil's point of view has been that industry has an obligation and an incentive to do some

of this and it's up to research to see what additional work needs to be done.

MR. VOGEL: By industry, who do you mean? EPRI or General Electric, Westinghouse and all those good guys? Who is industry?

MR. BURSTEIN: All of the above.

MR. KINTNER: The intent is that it will be done as part of the program, people being funded fairly well by DOE and EPRI. We review their test programs. We're going to review it again in about two weeks and assure from our perspective the test program makes sense. So when we put it in terms here that you might want to look at what you do to confirm or overlay, that's, I think, the right way to put it.

MR. VOGEL: Well, my own feeling is that on one, it's sort of a supporting thing to other programs. Item 3 is a continuation of work, hydraulic work to keep the expertise in place. In that sense, I would put Item 2, the advanced LWRs as most the most important program in the area.

MR. SHERON: May I just make one comment? That is that we actually use Item 2 to achieve Item 3.

MR. VOGEL: Yes. So I don't know what more needs to be said on these paragraphs. As far as I'm concerned, what is said in here, with the caveat I just gave, looks

okay.

MR. ISBIN: Brian, your point of view was that you need the expertise in thermal hydraulics in order to determine the type of work that you're going to do for advanced reactors. I thought I heard you say that and I wanted to be sure.

MR. SHERON: What I just said, you mean?

MR. ISBIN: Yes.

MR. SHERON: One, to maintain expertise. I need to provide challenging work to a cadre of thermal hydraulic experts.

MR. ISBIN: Right.

MR. SHERON: We're in a period right now where we are not doing any major experimental work, any major new code development. In other words, we're not developing any major new codes. That would normally be a difficult thing to do because we would not really have any -- this is the kind of work that code experts and thermal hydraulic experts like to do.

In order to keep this cadre of experts challenged, the advanced reactor thermal hydraulic problems or challenges are what will keep them available to us. Does that make sense?

MR. ISBIN: Right, sure.

MR. SHERON: So that's what I meant.

MR. VOGEL: Does that take us to accident management? Moving crisply along, as the old saying goes.

MR. ISBIN: No. I'm still on one. I think we all agree certainly with the importance of the cooperative international programs and this is, indeed, appreciated by research. No question about that.

The second sentence I wonder whether we could drop or am I treading on your toes?

MR. VOGEL: I think it's nice to have that input into the foreign programs, overseas programs to get them to do what the NRC wants them to do. I guess the way this is phrased, if some of our overseas friends read it, there might be just a little problem of nose out of joint. I think one has to assume that everything gets read everyplace.

So I think I would agree with you that it should be dropped or rephrased.

MR. ISBIN: And as Eric has pointed out, you do maintain rather close liaisons with some of these activities.

MR. SHERON: In fact, the Japanese actually have asked us what tests to run on ROSA and we have -- if our writing is unclear in that respect, which I think you've indicated, we will certainly --

MR. VOGEL: The thing I'm worried about is sort of

a diplomatic problem in the sense of making people mad at us. We don't have to to get what we want out of it.

MR. ISBIN: Well, maybe one point of clarification, Mr. Chairman. Really, we're not attempting to rewrite the five-year plan.

MR. MORRISON: That's correct.

MR. ISBIN: So that any suggestions on rewriting the five-year plan are probably not appropriate.

MR. MORRISON: I would agree. The comment here should be really does the Committee support the idea of cooperative testing in international facilities. I think the answer to that was yes, we've kicked it around several times this morning. So whatever additional comments, we'll just simply say we're supporting that, and maybe it gets back to Ed's earlier comments about having a repository for international information.

MR. VOGEL: I would suggest that we delete the last two sentences and just say the Committee wholeheartedly supports this effort and let it go at that.

MR. MORRISON: I think that's appropriate. Neil perhaps had another point that maybe the staff needs to look into, but, for the purposes of our report, that is a gratuitous comment that's made in this draft.

MR. VOGEL: We don't have to say everything that's true in this report. On to two.

MR. ISBIN: Is it our understanding, Ed, that we need industry, DOE, EPRI to carry out an integral test?

MR. KINTNER: That's what we intended, right, as of now, and inspected by everybody concerned.

MR. ISBIN: Somehow I got the impression this wasn't so, that you --

MR. SHERON: Westinghouse is doing a small-scale plexiglass at the University of Oregon. We met with Westinghouse a little bit ago and they did not advise us that they were going to build any kind of integral loop. As a matter of fact, they made the case that they felt separate effects tests would be sufficient.

MR. KINTNER: We are meeting with them, I guess, on the 10th of December in Pittsburgh to review their test program. I know it's the intent of EPRI and the Steering Committee that there will be integral tests.

MR. ISBIN: That being the case, then maybe we could restructure the sentence to reflect that and give your point of view that the NRC is looking at confirmatory work.

MR. VOGEL: We'll have to be careful not to preempt the results of this meeting.

MR. ISBIN: That's why I wanted to be sure, yes.

MR. MORRISON: I think we can make the statement on behalf of our Committee that we believe that the integral tests are necessary as a confirmatory step. Then the

mechanism to get that done should be left up to the staff to deal with either the industry or industry and DOE, however those tests are going to be done. Just leave at the point that integral tests are essential for advanced reactors.

MR. ISBIN: On Item 3, dealing with the Thermal Hydraulic Research Center, I think I was a little bit surprised at Neil's comments here. First of all, let me ask, Brian, has he really interpreted the Center correctly? I have a different impression of the Center.

MR. SHERON: They don't do planning, directing and coordinating of research.

MR. ISBIN: No, I didn't think so.

MR. SHERON: We asked their opinion with regard to what research they think might be useful as input to our planning process, but, in fact, we specified to them what it is they do during the course of the year.

MR. VOGEL: Isn't this generally what's done in all programs. Why are you making it a special point in this particular one?

MR. SHERON: What do you mean a special point?

MR. VOGEL: Make the point very strong that RES is defining -- that's always true of all programs. Is this a matter of discipline in this particular group? That's the way it comes through to me. Like maybe you've had some problem with them.

MR. SHERON: No. We've had no problem with them. In fact, you know Ron Duffy. Ron is, I think, a very good manager who worked very well --

MR. VOGEL: He's a very skilled operator.

MR. SHERON: As a matter of fact, the Center was created in response to a criticism several years ago that the work that was going on in the agency was rather disjointed and EDO, Mr. Stello had asked the staff to come back and recommend how that could be remedied.

A group was put together, this was around 1986 or 1987, and the recommendation was to try and pull together a centralized group that would serve as a center of expertise for the agency.

MR. VOGEL: Then I come back to the point --

MR. SHERON: Which is how this came about.

MR. VOGEL: -- why is it you're making essentially a policy statement concerning the direction of NRC research in this particular thing?

MR. MORRISON: I think maybe I'm seeing it differently. This is Neil's statement and from what Brian just said, what I would say is that we should delete everything in that paragraph up to the sentence that begins creation of.

MR. VOGEL: I'm sorry. I apologize.

MR. SHERON: I haven't spoken to Neil. If he

feels that there was something that led him to this --

MR. VOGEL: Yes.

MR. SHERON: I would certainly be interested because it was certainly not our intent.

MR. VOGEL: From wherever it comes, it looks like a policy statement applying to all NRC programs.

MR. MORRISON: Our objective is not to shoot the messenger down.

MR. BECKJORD: The decision to create this Thermal Hydraulic Research Center happened before I came into the picture. We started to cut back on the thermal hydraulics. I think this was an accomplished fact at that point and there was no point in having -- we wouldn't have that Center today, I think, if we had done it the other way around.

MR. SHERON: As a matter of fact, what we would have had would have been a bunch of small programs. What was happening actually was that when you had small programs, it was difficult to manage it because you were managing that many more contracts. There was difficulty in Idaho being able to move people from one program to another, where if they're all focused in one area.

Basically what we do is we give them a hierarchy program to do. In other words, they have certain tasks and certain tasks are deferrable. So if an important need comes along, we can call them up, get them focused on it right

away, and we know that we will have the resources available. Same thing with NRR. If they need somebody real quick to do some work for them, they can turn to these people.

MR. ISBIN: That was my understanding. It needs to be changed.

MR. VOGEL: It needs to be edited.

MR. ISBIN: Yes. It needs to be changed. So this really comes to the next two paragraphs in which Neil has written to Brian and there are a number of questions apparently that he is asking. We're going to get copies of that letter.

MR. VOGEL: A bunch of questions. He identified the questions, Brian?

MR. SHERON: Actually, the fax came in from Neil when I was up at Brookhaven. I think -- I haven't spoken with my Deputy, but they seem to think that Joe may have assigned the letter to have a response prepared. So it may be in preparation right now. But unfortunately he didn't leave a copy in my in-box.

MR. VOGEL: Are the logistics such that we could see the answers tomorrow?

MR. SHERON: I'll have to call back and find out. Like I said, this would be the first I have seen it.

MR. BECKJORD: I was going to ask Shirley if she had a copy back in the office. In any event, we'll get you

a copy of this tomorrow.

MR. SHERON: There are a few of those I can probably answer right now.

MR. VOGEL: If you knew what the questions were.

MR. VOGEL: Maybe for the moment we could move on to accident management and come back to this.

MR. ISBIN: Are you going to wait for Brian's response?

MR. SHERON: I'm just going to see which ones -- under codes, it says it is not clear why NRC must contain, although they're varying levels of effort, so many codes (6). Further, from the recent experience in CSAU and TRAC, we asked whether all these codes has been put through a verification and validation assurance audit, which presumably NRC demands --

MR. VOGEL: Sorry, Brian, we can't hear you down here.

MR. SHERON: I'm sorry. Presumably, NRC demands of the tools used by its licensees, if not, why not. In addition, if not, and then this raises a further incentive to include NRC maintenance of all these codes because the BNB procedure is expensive.

First of all, CSAU was not a code validation method. CSAU, what that did is it established an accuracy level, I guess you might say, for the code, for the purpose

of changing the Appendix K rule. We are doing CSAU right now for a small break. We did it for a large break and they're now doing it for a small break. Theoretically, you could apply it for every transient that you could think of.

In other words, the answer I get for a large break is not the answer because it's applicable to a steam line break or a feedwater line break. It's a different animal. It is strictly a method of trying to quantify an uncertainty, if that's really what one is trying to do.

With regard to the question of so many codes, six, and I think also on the second paragraph down here it said it is not clear that Item A is being aggressively pursued; A being minimizing the suite of codes RES is maintaining.

We basically feel we have done that already. But six, I think, is the minimum number. TRAC/PWR and TRAC/BWR, RELAP-5, RAMONA, nuclear plant analyzer, I'm not sure if that's actually a separate code, and I think it's COBRA/TF. Each one of these is a unique code. Dr. Shotkin is not here. He's not in the office right now.

TRAC, basically we keep TRAC because it has three-dimensional capability which no other code has. So if you want to do three-dimensional analysis, that is the only code right now that we are aware of that does that. RELAP-5 is a faster running code. It is more user-friendly than TRAC and seems to be good for more production type runs where you

don't need a detailed nodalization or large 3D capability.

RAMONA is a BWR code that has kinetics in it, the 1D kinetics which TRAC/BWR doesn't right now. So it's the only code we have that does combine the kinetics in with the thermal hydraulic transient. The nuclear plant analyzer at Brookhaven is a very, very fast running simulation for a BWR. It was invaluable in assessing this L-transient because it is very quick at running for events like a BWR stability event, which is typically very long running.

I think COBRA/TF, I believe, does detailed inter-channel mixing. We could certainly give the Subcommittee a detailed briefing on the logic behind why we've narrowed it down to these six codes. Our feeling right now are these are the six that are needed. We've sat down with NRR and they agree with us. These are the codes they want us to maintain for them.

MR. VOGEL: The thing that struck me when I read this, I wondered if Neil had maybe been thinking to a time past before this reduction in the number of codes occurred and maybe it was a matter of being out of sync.

MR. SHERON: I'm really not sure. But the six codes, I think, are what we feel is the minimum that needs to be maintained to maintain the analysis capability that the regulators in the agency have indicated that they need.

MR. VOGEL: I've been aware of this minimization

effort and I thought it was fine and I thought it was good, so this statement surprised me.

MR. MORRISON: Dick, from your standpoint, do you agree with Brian that the six is the minimum number?

MR. VOGEL: Yes.

MR. MORRISON: You have no quarrel with --

MR. VOGEL: I have no quarrel with it.

MR. MORRISON: -- what the staff has judged to be --

MR. VOGEL: I agree with the statement here.

MR. SHERON: We're more than willing to meet with Neil if you would like us to go through the logic further.

MR. VOGEL: I think that perhaps only he can explain what he meant and maybe we should get with him on the phone.

MR. BURSTEIN: He is out of the country until the end of the month.

MR. MORRISON: The third of December. So I would suggest that we rewrite this in the context that it has been done and he can see that and the Committee concurs with the suite of codes that have been decided by the staff to maintain or something like that.

MR. SHERON: Under international code programs, No. 3, I sort of interpreted this -- it's really like where are we going after the ICAP progra

MR. VOGEL: Where are we going --

MR. ISBIN: On the list of questions.

MR. SHERON: I'm sorry. On the list of questions. No. 3, international code programs. Both the descriptions in the five-year plan and in SECY 90-158 are not clear regarding relationships between international code assessment programs, follow-on cooperative funding activities, and the new, question mark, international program on modeling of reactor transients.

In particular, Section 90-158, Page 8, last paragraph, states that IPMRT, which is the international program on modeling reactor transients, this plan, as a successor to ICAP, but also some of the cooperative funding activities for code maintenance and development. Are cooperative activities and IPMRT the same or different programs. If different, how do they differ regarding goals; again, identify your plan; should we make it consistent with reality.

Right now our plan is following the completion of the ICAP program. Most of the agreements we have, our bilevel agreements, will close out at the end of 1991, which is about a year from now. We have talked to the people in the ICAP program about follow-on activities. Almost the entire international community uses the RELAP and TRAC codes.

Historically, the reason we had ICAP was because our codes were going in the Code Center and they were being just picked up by foreign countries for free, basically. This was at least about six or seven years ago. The concern was that we're putting out all the money and they're getting all the benefit.

So at least one way to extend that tie and get some feedback, some assistance, was rather than put our codes in the Code Center when they were completed was we would trade them. Originally what we traded them for was we will give you the code and assistance in running it. In return, you give us assessment calculations. Typically it was like 15 calculations for a large nuclear country and a smaller amount for a smaller country.

And if that country had some facilities that they were running, thermal hydraulic test facilities, we would ask them to assess the code against their facility and send us the results. This, in turn, fed into our assessment program and the like.

What has happened is that we've had so many countries join in the program that we have become a wash in assessments to the point that it was costing us more money because every time we got an assessment, we had to have somebody look at it and make sure that they did it right. It got to a point where the codes were getting good enough

that the assessments really weren't giving us any great insights.

So what we've decided is that rather than continue this program past 1991 where we just get assessments back, and since we've also gone into more of a maintenance mode with this codes, we have asked the international community to contribute money, a small amount of money, and that is still being determined. There are a lot of formulas that one could use; a large country pays more, a small country pays less.

It would be sort of a charge per code and we would take this money -- basically, the NRC intends to match it and put it at our laboratories, and this would be the funding that would be used for code maintenance and continued development.

Users of the code which would be using these codes to calculate transients and the like in their country. For example, if they found errors, if they made changes based on observations that they had, if they saw ways to make it more user-friendly, they would come back to us, they would tell us about these and we would use this funding to make those changes in the code and issue new versions of it back to them.

It basically becomes a consortium type of approach, except NRC has 51 percent of the vote. That's

really what it boils down to. I think -- I'd have to talk with Shotkin, but my understanding is these are one and the same programs. That was our plan for international cooperation with the codes in the future.

We had meeting with the ICAP partners, the Water Reactor Safety meeting last month. Most of them seem to be positive towards doing this, although a couple of them -- you know, they're always trying to get a bargain; gee, I can't afford $50,000, maybe you can make mine $10,000 or something like that or, gee, I'm a little country, why don't you charge Japan more. These were the kinds of comments we were getting.

But, in general, I think they were satisfied with that type of an arrangement. So it looks like it will go. That's really -- I think that kind of gives you an overview of exactly what we're proposing in the area of code programs.

Let me skip forward because I don't have the five-year plan in front of me.

MR. ELTAWILA: You have severe accident management before we get into that.

MR. VOGEL: It's all right with me.

MR. MORRISON: I think we covered all the questions that related to the thermal hydraulics. We ought to move back to the draft and pick up the severe accident

management. Herb, that gets back to you.

MR. ISBIN: All right. I'm looking over it again to be sure.

MR. SHERON: Why don't you do accident management, if you want, while Herb is trying to get himself up to speed on the severe accident questions.

MR. VOGEL: I don't know what NRC would do with this comment in the context of our report. But in looking over the accident management plans of the industry, it does seem to be a very complicated structure. I think the two owners' groups and EPRI and it seems to me that there were some other actors.

MR. MORRISON: Excuse me, Dick. Which comment?

MR. VOGEL: This is with regard to the accident management.

MR. ISBIN: Just in general?

MR. VOGEL: In general, yes. I guess NUMARC is supposed to coordinate these groups, but I think it would be a real challenge to coordinate them. How does NRC propose to really, in fact, interface with this industry? It's a complicated situation. Maybe Ed or Sol would like to refute my statements.

MR. KINTNER: I wouldn't.

MR. VOGEL: Are you with me?

MR. KINTNER: I wouldn't argue.

MR. VOGEL: There are three of us that are voicing this. I guess what I'm saying is you've got the problem, but how are you going to fix it.

MR. SHERON: First of all, keep in mind that there are two aspects in accident management. One is that what the industry actually comes forward -- basically, what that is, the negotiations that determine that are more the responsibility of the NRR people rather than research. We sort of set a -- back when we were setting up accident management, who does what to who and the like, the way it sort of works right now is that NRR deals with the NUMARC people and research deals with the EPRI people, EPRI, again, providing the technical support to NUMARC, who are putting together more or less the -- they're doing the coordination with the owners' groups and the utilities.

The industry -- one of the things we were doing, the big thing we were doing under short term was trying to develop what we called a framework for an accident management program, and we identified what the five key elements were, and we were planning on issuing it in the generic letter that articulated to the industry what the agency saw as the key elements of an effective accident management program.

Research was doing the work to articulate those five areas of detail and we had programs at various

laboratories and industry help us. During that time, industry, who first kind of looked at accident management with an, oh gee, here's another pile of stuff they want me to work on, as if I don't have enough, has actually now embraced accident management, as far as we can tell, and it's started up a very active program.

Now they have not only involved NUMARC and EPRI, but now the owners' groups are involved, which was sort of a new wrinkle. And they are going to full-force ahead developing their framework, what they consider to be an effective framework, and we've cooperated very effectively. We've had a number of meetings with them where we have shared the information we've developed.

I told my guys, I said if the industry is really taking the ball with this and running, step back and watch, don't try and do their work for them if they're willing to do it. What that has done is it's delayed. We basically said we're not going to issue our generic letter until the industry finishes their work.

And this is the short-term area, which is identifying basic elements of an accident management program. We're on board with the industry. We're working very close with them, with EPRI, NUMARC.

MR. VOGEL: If you find the right people to work close with, that's fine. That's what I was wondering about.

MR. SHERON: As for the long-term stuff, right now we have a program which is just starting to look at the various strategies. I look upon this as the second phase of accident management. We're trying to understand ourselves what kind of things operators can and might do to either prevent an accident or mitigate it either partly or some part of the way through it.

Some of these involve very technical complex issues which could involve analyses, could involve having to run experiments, and we're still feeling our way along. This is a very new program.

MR. VOGEL: What is wrong; you've got 1150 scenarios and you've got probabilities associated with them, what's wrong with running through these scenarios and thinking what you would do to avoid them. Isn't that accident management?

MR. SHERON: Yes.

MR. VOGEL: It doesn't take in the human factors considerations.

MR. SHERON: That's one of the things we're doing in the research program is trying to include a human factor element. We're also looking at things that are not what I would call the obvious accident management. I think we may have alluded to something here. For example, we are looking at the effects of putting water on degrading core from the

standpoint of what symptoms does an operator see and is there any chance an operator could then take a wrong action based on misinterpreting symptoms.

Things like having a severe accident in which the containment is full of steam and hydrogen and you restore electric power and the operator turns on the containment sprays, condenses out the steam, and now has a lot of hydrogen. What happens? Is this something we should be providing further guidance on?

A lot of this involves doing a lot of analyses and interaction with the human factor people in terms of what you can do. So this is what I consider more of our longer term research program right now. We're sort of feeling our way along in terms of what we should do, what areas we need to focus in on, and the like.

I would point out, too, one bullet on Page 13. I apologize that there is no mention made of an RES assessment activity, because we do have a very active assessment program.

MR. VOGEL: I just wondered where it was because I knew it was going on.

MR. SHERON: If it's not in the five-year plan, I apologize.

MR. VOGEL: I didn't find it, no.

MR. SHERON: It is going on. We've had a number

of meetings with them, I think very successful in terms of us understanding what's in the code and so forth. Herb, I don't know if you want to say anything more about those interactions.

MR. VOGEL: Well, I still have a friend or two at EPRI and I sometimes ask them how things are going on their side, and they seem to be happy.

MR. KINTNER: What's wrong with Dick's suggestion to take the 1150 scenarios and walk through them? It would seem to me it would take a long time with some knowledgeable people to start drawing some conclusions about accident management from that kind of process.

MR. SHERON: I think we're actually doing that. Dr. Shotkin has a program at Sandia. Would Shotkin's program on looking at 1150 insights for accident management --

MR. CUNNINGHAM: Yes. They've been doing that through people that they've contracted with at UCLA.

MR. SHERON: But there is an integrated program with the Sandia people to look at 1150 and try and confer from the scenarios, from the sequences what accident management strategies kind of fall out of what we learn from 1150.

MR. ISBIN: Now, Neil was a little bit concerned on timing of some of the research. Personally, I don't

think we need to go into that detail in commenting at this time.

MR. VOGEL: What timing are you referring to?

MR. ISBIN: I think on hydrogen, on igniters, the middle of the page there. I would propose that we omit that.

MR. VOGEL: Well, that particular problem is one that's been pretty much highlighted and discussed.

MR. ISBIN: It's in the five-year program. Neil's point of view is that it's not timely.

MR. VOGEL: Not fast enough.

MR. ISBIN: Not fast enough, but accident management will be with us for some time and we'll learn more and more as we go along. So I wouldn't be as concerned as the -- having a requirement of --

MR. VOGEL: If I were a utility type of fellow who had a reactor, I guess independent of accident management, that's an answer I'd like as soon as I could get it. There's another reason for getting the answers. That is not the paper exercise, but the real world. You've got your containment full of steam and hydrogen, hey, what do you do, fellow.

MR. SHERON: There is a little bit of philosophical difference. The industry, when they talk accident management, they're principally talking things to

do to prevent the core from melting, being able to make emergency connections and so forth. They have not really focused, I think, or seen any real benefit way down the road after the core is melted and the like. So there is sort of a complimentary approach here.

MR. VOGEL: But you can get a containment with hydrogen in it, can't you, Ed?

MR. KINTNER: They can.

MR. VOGEL: That was a cheap shot, wasn't it?

MR. KINTNER: No, it wasn't. It was a good one. Let me ask you to put this in sort of a broader context, because I think it sets the stage for some of these things that will come later. We've been looking very, very intensively at the question of hydrogen as it relates to containment strength and containment volume and igniters.

What's coming through is that many present plants, if I understand correctly, don't have igniters. Some plants, later plants have new igniters. The intention in the NRC is, if I understand it, that we will all have not just igniters, but advanced igniters and sensors that tell us how much hydrogen is in it and so forth, significantly more complex systems than we have today, so that the next generation is more complex in this regard.

It was one of the things behind my question about is anybody doing anything to be sure we don't. If you

really examine the question of hydrogen as to how much is going to be there and what is detonable versus what's going to be what is combustible, and what is the effect of steam or water in the containment, and what is the effect of geometry in the containment, you get absolute miasma.

I mean, it's not at all certain to me that the very finest hydrogen detonators and so forth is going to answer the question. Nevertheless, we are now in the process of being more and more complex and nothing we have been able to say to the staff up to this point has convinced them in any way at all that there are some alternatives to 100 percent zirconium and 80 percent or 90 percent detonation. That's going to be a very, very expensive problem before we're through with the next generation of light water reactors.

And I'm not so sure that if we do all the things that are presently visualized we're doing what is safe.

MR. VOGEL: The problem is technically very complicated when you get different behaviors to how many obstacles you have.

MR. KINTNER: And the circulation. Pretty soon you have to circulate and when you get detonation in one part of the containment, does it transmit to the other?

MR. VOGEL: When you get a problem like that, what you try and do is find a way of walking around it, not

walking through it.

MR. KINTNER: What we think is that the containment is big enough, if you take some --

MR. BURSTEIN: You still have these differences, these fundamental differences.

MR. KINTNER: I guess the point I'm making is that there is here a great need -- that is to say if you had more information, you'd feel a lot better both from the standpoint of the requirements and from the standpoint of the safety.

That went back to the question I asked earlier about the containment performance issues. If we really understand these well enough, we can design the containment in every respect, all those things associated with containment security, to optimize them.

MR. ELTAWILA: I think we are really going to be addressing in our hydrogen research program most of the questions that you have mentioned here.

MR. KINTNER: But I mention it in connection with this one --

MR. ISBIN: I think it's more a question of timeliness. We agreed that you are addressing the problem, and Neil's point --

MR. VOGEL: Whether it's moving fast enough.

MR. ISBIN: I thought that we ought to stay with

what you have. So this is a dilemma.

MR. VOGEL: One of the problems that I have in the back of my mind is whether after you've given it your best shot and spend all your hard-earned money, whether you really have a definitive answer that you can translate into a plant, just the point of complications that you raise.

MR. KINTNER: To be rather blunt on this, the present requirement just recently agreed to by the Commission, Full Commission on the recommendation of the staff is if something is 100 percent zirconium in the fuel area, it will be burned.

If you listen to that casually, and I'm sure the Commissioners did, and they think, gee, we're really putting this to the extremes. That isn't true at all. There's a lot of zirconium around that can burn, stainless steel can burn. You can make a lot of hydrogen more than that establishes.

MR. BECKJORD: Plus, not to mention concrete.

MR. KINTNER: No mention of concrete.

MR. VOGEL: And carbon monoxide, too. It burns.

MR. ELTAWILA: But the point is that you cannot assume that all of them are going to produce at the same time. So that's the measure that the staff looked at in trying to combine them. This is an upper limit, but to design the containment for it, but we recognize there are

other sources of hydrogen in the containment that hopefully will not occur at the same time.

MR. VOGEL: The complexity of this particular problem reminds me of the complexity of the degradation of cores as to whether you're ever going to --

MR. BUSH: To get what they're talking about, I think we've already invoked the China Syndrome and maybe you don't know where you are, because I don't see how you're going to get to that extent. We looked at it for metal fuel, which is a lot worse than you're talking about, and the conclusions, technical conclusions, not the decision, was that really it was a low probability, a very low probability. But they were told that the solution was very obvious.

What you do, since this was confinement, as you would sweep all the fission products off because that was less than the hydrogen detonator. This was a very peculiar approach, in my estimation. Fortunately, I don't think it applies here, except that I think if you convert this to TNT equivalents, it's an awful lot of TNT before that containment is going to do much, and those are big containments. Some of the small ones, I would get nervous about it.

MR. VOGEL: So back to this point, I guess, here, Neil's point about wanting the work to go faster.

MR. ISBIN: I think we're somewhat divided.

MR. BUSH: Your point is very valid. You can spend a lot of money and when you finish up, you're going to have something with a very wide uncertainty band and you can say, well, on one hand, it might happen, and on the other hand, it might not. So that's what you're going to end up with.

MR. SHERON: You need to remember one thing, too. Right now we don't even have any user needs for doing beyond short-term work in this area. NRR, really, they look upon this as something that is our research, not something that they're saying they have to know.

So in terms of saying what are the testing needs, the only ones I think we really assessed right now that we need is this adding water to a degraded core. Unfortunately, as you know, this is not an easy test to run. As a matter of fact, the only place we've really found that we could do it is the Faro facility. We've got an agreement with them. I think it's very favorable for the NRC.

We're only paying, what, 15 percent.

MR. VOGEL: I was over there in June and inspected the Faro facilities.

MR. SHERON: We're paying a very small fraction of the total cost of the test. So I get a little hesitant to go over there and tell them now you've got to speed it up,

too. But if there is anything that does come up where we think that we can get the answers faster, certainly we'll try and avail ourselves of it.

MR. BUSH: Of course, one would argue that if you've established a position, why should you spend the research money on it, because you may not have -- I can't visualize one that's much worse.

MR. KINTNER: One way to do that is to look at it. I'm not arguing a case, I'm just observing. That I suspect that over the period of time in which these igniters and other requirements are applied, there will be billions of dollars associated with them, if, in fact, there's another generation of reactors in this country. So it's another case in which if you really knew what you'd like to know, you might be able to make nuclear power far more efficient.

MR. BECKJORD: Just one point here on the hydrogen. If the Japanese proposal develops as they are now suggesting it, some of that work may be accelerated.

MR. ELTAWILA: As a matter of fact, that would be -- for example, on the hydrogen issue, we always assess hydrogen as a low temperature phenomenon we studied for a long period of time. Now in severe accidents, hydrogen will be coming at high temperature and there is a potential that you'll have an ignition of the hydrogen as it's produced. This is one of the phenomena, although it by itself is not a

threatening phenomena, but would change our perception of the hydrogen.

We can study that issue and see if the hydrogen would be burned as produced. Then if you have an event that can effect on the ultimate -- containment study and we don't have to concentrate so hard on detonation and can think about other measures of hydrogen being burned. So we are pursuing issues that will go that one more step to change our perception.

MR. ISBIN: Perhaps, Mr. Chairman, we could add a statement, the thrust of Neil's comment, but retain the importance of his comment and we'll try to formulate something.

MR. MORRISON: I would agree with that.

MR. VOGEL: We have illuminated all of the aspects of this problem.

MR. SHERON: The other thing here which I guess is a little troublesome here, of course, on the closure section, I'll just pass this on for the Committee's consideration. He says that the draft five-year plan does not state and define a closure goal. Accident management is an appropriate area for the NRC to raise as a test case for pushing the closure issue with RES to a conclusion. We should request that the five-year plan be rewritten to specifically define a closure goal and date.

I've always thought of accident management for at least the longer term as exploratory type research. This is an area that we're still kind of getting our feet wet in in the sense of trying to look at what is it that can be done by operators to mitigate accidents, to prevent them.

I guess I don't feel comfortable in being able to say I could articulate what a goal is. I could say I'll look at five scenarios and analyze them.

MR. BECKJORD: No. We've stated the goal. The goal is to prevent, once it starts to terminate, if it continues to bring it under control, and, finally, to preserve the containment as long as possible.

MR. SHERON: I've asked my contractors, for example, I said put on your thinking caps, be creative and think of ways that operators could, in fact, do things. I don't care if it's make sure you've got a spare car to run up to the Sears and buy a pump that you can bring back and hook up.

I see closure on the issue of accident management research when I've analyzed the scenarios and the strategies that have been identified and I stop running out of people thinking of better scenarios or better strategies that might work. When I start rehashing the old stuff is when I think to turn it off.

MR. BURSTEIN: Of the possibility of a strategy or

scenario. You can contemplate an infinite number of variations, but if they become, on their face, incredible or worse, I'm not sure the word even incredible is suitable, then I think you have to use some judgment in allocating resources to deal with such phenomena.

There is a time when it may be appropriate to dismiss a scenario simply because it is inappropriate, totally inappropriate to be considered.

MR. BUSH: I think that Neil has somewhat of a point, and I don't think this is a necessarily good example, because I could visualize accident management as one of these things that there are so many facets to it that you keep going. But several other programs, if you read the words in the five-year plan, one would assess that the completion of 90 percent of it would occur in about two-and-a-half years and you have to say the funds are going up.

Now, that's -- either things are -- you're getting into the very complex and very expensive parts which aren't very obvious in the words, or there's something where it's rather obvious that some of those -- because I just finished looking at some of them -- that you would expect a downturn in the funds that, indeed, isn't mirrored in the five-year plan, compared to the words.

Not according to yours because I was looking at some other sets of programs. But my suspicion is that you

could probably come up with that assumption fairly well across the board.

MR. SHERON: I'm certainly not trying to argue with it. We don't want to close out programs or resolve them -- I guess I would suggest that there's possibly other programs that could serve as a good test bed for a closure process besides this one, that's all.

MR. BUSH: I'm just saying that that's a more basic problem. If you're going to ask about it, then there are some programs you'd have to say what's the logic of the funding going up when the level of effort is going down. It doesn't seem to make much sense.

MR. MORRISON: From our report's standpoint, it seems to me to pick up -- the goal that's stated in there, as Eric said it, is not accept Neil's comment as written, but articulate the goal and say what we really need to do is for the staff to continue to look at what accomplishment of that goal or what would taken as indications of accomplishment of that goal.

So we know what we're looking for, not just starting from the standpoint of I'll know it when I see it. Maybe we can define some criteria here that will help to at least focus attention on what results would be meaningful in terms of closure.

But I have no problem not stating a date because

the program is too new.

MR. BECKJORD: Let's work on it and give them something for their consideration in their report. We'll get it to you and make copies of it.

MR. MORRISON: Yes. It doesn't need to be particularly long, but if there's at least a direction indicated or here's the goal, I know I'm going east, not west. We aren't asking to rewrite the five-year plan. I don't think that's an appropriate part of our activities here.

MR. VOGEL: Okay. Severe accidents, content and closure. Is that where we are?

MR. ISBIN: right.

MR. ELTAWILA: Question No. 5 on recent reaction and it's in the five-year plan Section IV at Page 1-37. The concern that Neil has is activities Nos. 2 and 4 could be a duplication of each other and I agree with him after reading that. They are the same, so we are going to eliminate one of them in the next revision.

MR. ISBIN: These two activities are, again, what?

MR. ELTAWILA: They're a duplication of each other. They are related to the transient aspect of melt spreading and it's actually almost word-for-word the same. So we're going to change that, correct that.

MR. VOGEL: That sounds like an editorial --

MR. ELTAWILA: It's just editorial.

MR. ISBIN: So we don't need to include anything.

MR. ELTAWILA: Question No. 6 on hydrogen transport and combustion, that's in IV, Page 1-40, the concern is there is no relationship between the activities of HDR in Germany and what the Sandia National Laboratory will be doing on hydrogen, high temperature hydrogen. There is one word missing in Item 3. Actually, HDR does not have any hydrogen combustion and high temperature. HDR is a hydrogen transport and there would be some combustion, but very low temperature. Only in high temperature hydrogen combustion would be conducted at Sandia. The word missing on Page IV at 1-40 is on the third line from the bottom, it should be common and -- which is saying if we are going to assist our board to see if we need to do any notification based on the hydrogen distribution work at HDR and at high temperature hydrogen at Sandia, and so on. Another editorial change that was causing that confusion.

MR. VOGEL: That's in the five-year plan.

MR. ELTAWILA: Five-year plan. Item No. 7, Neil's question about integration and application and he's referencing IV 1-41. It stated that the only part that NRC will be supporting is the MELCOR code and he's questioning why does Activity 3 not have as its focal point identification of the mechanistic deterministic code which

RES will maintain. In that I can agree with saying that we are going to review our severe accident research to see which codes need to be assessed further or developed further, and his comment is a good comment, we should state in that Item 3 that the two codes that will be assessed in that regard are the SCDAP/RELAP code and the MELCOR code for system analysis codes.

So just adding the list of the codes to that activity will make it clear, and I agree with his comment on that. Finally, he asked about what are the lessons learned from the severe accident scaling methodology -- help formulating the research program better, and I think this activity definitely helps in developing containment heating. We now have a program that once we conduct these tests, which will be starting very soon, we feel that the data will be applicable to current generation nuclear power plants and we'll be able to validate using that approach, and definitely now we feel more confident with the test program than we felt before.

MR. KINTNER: Where are the tests, at Sandia?

MR. ELTAWILA: Sandia. We have tests at Sandia and Argonne National Laboratories. The Sandia is one-tenth of scale of Argonne one-thirtieth of scale. We have this program right now ongoing at Sandia. It's just if you put different construction to the floor, what's the effect of

that on the time of flight and things like that.

So this program is ongoing. We plan to have a test at Sandia November 15. They are planning to run a cavity test, most probably without water and maybe a month later would have a test with water.

But the full integral test will around sometime in April of next year. But all these are scoping tests right now to see that the facility is performing right and we don't have any bugs in the system.

MR. KINTNER: You will be using corium?

MR. ELTAWILA: They are going to be using thermite. I think that's the advantage of this scaling methodology. By using the scaling methodology, we'll be able to identify the similarity criteria between thermite and, for example, corium. Every parameter has been adjusted so it can get from experiment to --

MR. SHERON: One of the big things the scaling analysis showed us was that previous tests running with 50 percent more melt mass than would be appropriate for a scaled facility. So they actually cut the melt mass by about half. In other words, they were putting way too much energy in the system.

MR. KINTNER: In the end, there's a final test where they use a molten uranium dioxide or something closer to core debris?

MR. ELTAWILA: Sandia does not have the capability. They can eventually if we see the need at the need to do a U02 test, we can do it either at Argonne because they have the experience of melting U02. They have done that work for EPRI in the past. But at this time we feel that the scaling rationale is developed and we don't need to go that way.

But if, as a final confirmatory test, we see the need for such a test, I think we can run it at the Argonne facilities.

MR. VOGEL: Scaling analysis is fine, but if there are some unidentified chemical reaction that you're unaware of --

MR. ELTAWILA: Neil is asking for a presentation, but one of the things that's why he says it's taking a long time, that they went over every possible chemical reaction that can take place and tried to find a time in which that chemical reaction can compare and compare it to the rest of the dominant phenomena and account for it in the scaling rationale and hopefully that will be simulated in the experiment.

MR. VOGEL: There are such things -- I never thought of boron carbide and stainless steel being low melting. I consider myself a very bright fellow, in all honesty.

MR. ISBIN: Now, do I understand correctly, Farouk, that with the proposed tests at Sandia and Argonne that the DCH program is now or will be well defined and that you will be able to resolve DCH as planned? Is that the --

MR. ELTAWILA: No, that's not the complete program.

MR. ISBIN: That's what I was wondering.

MR. ELTAWILA: I just mentioned that there is existing work right now, but definitely we need to do some separate effects tests to identify some of the important phenomena --

MR. ISBIN: That's what I wanted to get at.

MR. ELTAWILA: That program right now, we have not established such a program because we still have a request for proposal outside. So we have not decided where this program is going to be performed, and that's why there is no mention of it.

MR. ISBIN: And this is mainly of the area of entrainment.

MR. ELTAWILA: Entrainment, deentrainment, particle site distribution, effect of water in cavity on this phenomena, too. So definitely we feel that the salesmen rely so heavily on certain assumptions about the model that can be used for entrainment, for example. And until we validate that such a model is going to be operative

in a separate effects test, all the scaling rationale can fall apart.

So we definitely will need the separate effects tests to validate that.

MR. SHERON: If I could gain a couple brownie points from the Committee. One of your comments way back that we should consider putting contracts, more contracts in the universities where it's appropriate -- these experiments, these separate effects experiments, indeed, appear to be the kind of work that could be done on a university scale. In other words, they don't call it very high temperature, dangerous, and that's one of the reasons we went out with a request for proposals rather than just handing it to a laboratory.

We are expecting in this process a little bit of a delay, but I think ultimately we'll probably get a better product because we'll have independent thinking on it. So this is an area where we're hoping that we'll get some good proposals in from universities.

MR. VOGEL: It really takes staff time to put the university in the proper technical framework as to what you're trying to do. Then you get some very highly sophisticated and senior professor who doesn't know beans about reactor safety. You have to educate him.

MR. SHERON: Also, just to answer Herb's question

a little more on does this solve DCH. No. What this does is it solves -- basically, it will provide the experimental basis for completing the containment loading capability.

In other words, this will tell us given a core, a high pressure core melt ejection of a give mass, composition and temperature of melt, it will give us confidence on how well we can calculate the resulting containment load. The other pieces to the puzzle are the natural circulation induced failures. As the reactor would start to degrade the core and melt down, the boil-over process at high pressure -- there's a lot of mechanisms which would tend to depressurize the primary system.

1150 was used extensively to help us analyze this. One was the pump seal failure, one is the PORV failure, both of which were depressurized at system. The other one is as you uncover the core, you start to circulate -- you get very high temperature gas and steam and hydrogen which will, basically through density differences, migrate to the cooler surfaces, which would be the hot leg surge line and the steam generator.

We have calculations right now which show that if you do, indeed, get these natural circulation patterns established, these hot gases can eat up the piping components to the point where under 2500 pounds pressure and you get a rupture failure. For the most part, we see the

surge line as the weak link and that's what will go first, in our calculations.

But one of the things that's depending upon is how well we've calculated these natural circulation patterns. So we have tests going on right now and analyses to try and confirm our codes and, in fact, give us a good reasonable estimate of these circulation patterns.

What we need to do once we get all this information is try and link it together, perhaps in a method similar to Theofanous used in Mark I, integrating it together with causal relationships and the like and try and come up with an overall assessment of the likelihood that given a high pressure core melt that will ultimately result in a containment failure.

That's the whole puzzle on how you get it.

MR. MORRISON: At the risk of terminating some very useful discussion, I'd like to see if we can wrap up this severe accident one in about five or ten minutes so we can spend perhaps 45 minutes on the human factors and finish then all of this section by our quitting time today.

MR. ISBIN: Actually, we are covering grounds on later paragraphs.

MR. MORRISON: I think we are, yes.

MR. VOGEL: What do you think, Brian, about the material on Page 14 under overall strategy?

MR. SHERON: Well, I guess I'd almost have to ask one question. The thing that caught my eye obviously was the talk about shifting funding for work on reactor containment structural integrity.

I would point out, number one, if you do a bounding calculation or in trying to do a bounding calculation that you could get the scientific community to agree that you'll very likely have a very horrendous load on a containment.

Number two, I'm not convinced that doing more work on structural integrity is going to show that the containments are any stronger. I mean, the containments are as strong as what they are.

MR. VOGEL: Well, I wrote this. You will note that I said bounding calculations of a reasonable nature. I know just what your problem is. The guys get unreasonable and blow things sky high.

MR. KINTNER: But containments can be made stronger and they can be made bigger.

MR. VOGEL: Yes.

MR. BECKJORD: I was talking existing.

MR. ISBIN: So what would you feel comfortable with us doing with this paragraph without doing violence to our integrity as a Committee?

MR. ELTAWILA: If you mean by switching funding to

do something such as integrity tests, I think that's going to be extremely difficult because that means that we have to run tests for each life of nuclear power plants in this country. I'll give you an example.

For example, Sequoia. There are two sister plants. One of them has, based on the analysis, an ultimate capability of 60 and the other one has the ultimate capability of 120. So it means that not because they are steel containment or because they are concrete containment they are going to be -- and the materials to use and so on has an effect on how these containments are going to perform.

The best way is to have analytical, a validated analytical tool to use to assess these containments rather than running tests on the different containment types.

MR. VOGEL: I guess leaving aside the question of shifting funding to containment integrity, I do feel a little bit discouraged about having definitive answers on the mechanisms of core collapse. It seems to me that a core can collapse so many different ways in a severe accident. It's a real rough thing to get an answer that everybody agrees to.

MR. SHERON: What you might want to do in this area of overall strategy would be to -- and I would have no difficulty with it -- would be to endorse approaching

resolution of the issue similar to what was done on, say, the Mark I, where you take the pieces and you assign probability distribution functions to the various uncertainty areas, including, for example, the way the core melts, the amount of mass and so forth, establish the causal relationships between the various parameters and carry through the probablistic fact of assessment.

That way you're not -- this gets you away from having to come up with a definitive mechanistic model. You kind of treat it more as a probablistic approach.

MR. BUSH: Well, that has problems, too.

MR. SHERON: Not nearly as many.

MR. BUSH: I had a question in that respect. That's a purely analytic approach versus getting a benchmark, how much to benchmark. The reason why I've been -- I've had to follow them in the liquid metal area which is a totally different animal, but I also know that the theoretically-based computer codes had to be modified substantially as they got data, and they got a fair amount of data and every year they looked different.

I just have a question.

MR. BECKJORD: What would you benchmark?

MR. BUSH: Well, there are some experiments -- some of these experiments that they're talking about could conceivably provide information.

MR. ELTAWILA: We really feel that we have the program right now -- for example, the lower head examination program that is going to give us an idea about what are the conditions that would be necessary to fail the lower head. And we try to face this with the core melt progression and see if these conditions will be resultant in a failure of the lower head.

This program by itself can help us know the problems through different certain failure modes of the lower head and will be far different compositions that can lead into that failure and based on the early core melt progression -- and some of the information we have from TMI might be able to get a bound on the problem and see if the condition that's needed to fail the lower head can be progressed or come from the data that we have -- from the early core melt progression.

From that, I think we can use that for the probablistic approach and we have an idea about how, for example, DCH is going to -- the containment integrity and how, for example, melt spreading can effect shell issue and so on.

So by using the probablistic approach that Brian was talking about and some of the information that's coming from the different elements of the program right now, we might be approaching the problem in a reasonable bounding

approach that you're talking about.

MR. KINTNER: The analyses of TMI-2, core bores and so forth, dealing with a lot of information on this question that Dick raises, how the core fails.

MR. VOGEL: How it failed once.

MR. BECKJORD: Let me comment on this one. It's one thing to say it might be prudent to have a stronger fall-back position. I guess what I would suggest for your consideration is the following. I think that we're very close now to a resolution of the DCH containment loading question. The scaling method is almost done.

Assuming that we are satisfied with that, we're going to be able to move forward with those tests. That's the first piece of the -- that's the first half of that problem. The other half is the more difficult one which is determining how the core would go about failing the vessel, to determine the mode of failure and when it would occur and how large the failure might be. That's the second piece. It's more difficult. We're not as far ahead on that.

It seems to me that our strategy should be to concentrate on those things now. I think we're going to know about DCH pretty soon, certainly by the time that you would have your next review on severe accidents.

MR. KINTNER: What do you mean we're going to know about DCH, Eric? You mean you're going know whether it is a

significant loading problem?

MR. BECKJORD: Whether the approach that we're taking is going to work out. Whether we are confident of the answers that we are going to be getting from the experiments.

MR. KINTNER: It's sort of black and white.

MR. BECKJORD: I think -- well, I think that that will give us the information which will enable us to state what the loading on the containments is likely to be. If that works out, then we can concentrate on the second piece of the puzzle. I guess personally I would rather, since I think we're pretty close to that, rather to keep our full attention on that, to developing another approach at this point, because if you suggest developing a backup approach, why, you know, everyone says, okay, when are you going to have your backup approach.

So we're going to go off and work on that rather than get the first answer. I think if we can get to the first answer on the direct containment heating, then we're going to know a lot better whether we need a backup approach or not. I don't think the delay, since it's within two to four months now, is going to be all that significant.

MR. SHERON: The real question is whether or not -- the real fix to this problem, the only fix to this problem that we can tell is practical is do you or don't you require

operators to depressurize and when they depressurize in order to avoid this. The industry is totally confused. For the advanced reactors, they are saying we will depressurize. It's in their procedures.

In the operating plants, it's always the same. We don't want to depressurize.

MR. BURSTEIN: Well, I don't know about that. I know one who wanted to do that a long time ago. They did a survey, and don't quote me exactly, but the Europeans seem to be backfitting a number of plants with pressurizer vent valves.

MR. SHERON: The Germans blow their vessel through the top of the containment if they get a high pressure melt injection. They don't have -- they have a sealed cavity. When they pressurize the cavity, it just blows the vessel straight up.

MR. ELTAWILA: The German strategy about depressurization is equivalent to feed and bleed in ours. It's not really a depressurization system that we're talking about in this case here.

MR. BURSTEIN: It also depends on whether you're talking low pressure or high pressure. My question is are there any experiences or analyses or experiments being run there in connection with that that are useful here? I don't see any mention of this anywhere.

MR. BECKJORD: They've never discussed anything that bears on this when I've been present.

MR. SHERON: The Germans are pushing it for UPT of TRAM.

MR. BECKJORD: But that doesn't really deal with this.

MR. SHERON: They're only talking a 300 pound system that they're going to depressurize.

MR. ISBIN: Didn't Zipper point out that the German approach was different from ours and that, first of all, their main objective is to prevent the accidents.

MR. BURSTEIN: Which is ours, I hope.

MR. ISBIN: -- to do the research almost exclusively in that area.

MR. BECKJORD: Yes, clearly. I think this is strictly -- this is a mitigation question. The Commission, at least in the situations that I'm aware of, has always put about two or three times as much attention on prevention as on mitigation, but it doesn't want to ignore mitigation, and this is in mitigation.

MR. BURSTEIN: Well, so is a depressurization.

MR. BECKJORD: Yes.

MR. ISBIN: Well, I'm not very much in favor of a backup position, but, on the other hand, Eric, I hope that you're right, but I think you're far too optimistic on the

DCH program with reference to the four or so months. That seems an uncomfortably short time in order to know if you're on the right track, from what you were just telling me.

MR. ELTAWILA: No. I think what Eric is -- we are going to run the first test in April on that. At that time, we are going to be able to determine if DCH, for the test that we have run, is the animal that we've been told to believe that it's going to fail every containment or it is -- it can be manageable, we can assess the containment against it and we can develop our codes against it. So that's what we're going to learn in the next four months. And two years after that, we'll be able to --

MR. ISBIN: Those tests are that definitive? I thought that you had to do some exploratory research and this is what you had to research, get proposals out for entrainment and deentrainment, and that this was all part of the picture to determine some of the dominant phenomena. Did I misunderstand? I mean, I don't know.

MR. ELTAWILA: You're not misunderstanding. We still need to do it to completely be able to say that we have the resolved the problem completely, we have to go through the process that you have indicated. But at the same time, once we run the first test, we'll have some feeling -- in the past, every test we ran, the materials, worked out of the cavity and pressurized the containment.

Now based on the scaling analysis and based on some of the work that Argonne has done, we feel that the material will be trapped in the cavity, we feel that the conversion to hydrogen is not as the code is projecting and probably that is going to be validated by the first experiment.

We cannot convert all the components to hydrogen. The containment will not be threatened. And don't forget that most of the DCH load is coming from hydrogen burn, over 50 percent of it, and that's assuming that we have very fine particle generation in the cavity that's producing a lot of hydrogen and that hydrogen detonated at the same time that the thermal -- containment and the debris reached thermal equilibrium.

The addition of these two loads together resulted in that title. Our guess right now, I'm going to call it a guess, is that that's not going to -- we're not going to get that efficiency in the hydrogen production.

MR. ISBIN: This is all correct and you achieved quite a bit in defining the tests, getting ready to run them.

MR. KINTNER: How can you determine hydrogen production with thermite?

MR. ELTAWILA: They are adding chromium to the thermite to stimulate. It's aluminum, iron and has some

chromium in it which will simulate the zirconium and steel in the core geometry and that produces as much hydrogen as zirconium. So there is a chromium additive.

MR. BUSH: That's highly dependent. The one of tying it is highly dependent on the form of the metallic you're talking about, because it's an area or surface problem.

MR. ELTAWILA: Sandia has done analysis, and I'm not a chemist, but they indicated that the chromium is definitely going to be representative of the zirconium.

MR. BUSH: How do you know? How does anybody know whether --

MR. VOGEL: That's uncomfortable.

MR. BUSH: If you assume a comminution of the zirc, then obviously you have a system that --

MR. BECKJORD: Who recommended this? Levy and -- there were about three or four people who looked into this and made this recommendation on the constituents of that.

MR. ELTAWILA: Fred Moody and Levy and Sandia --

MR. VOGEL: Fred Moody is a thermal hydrologist. Levy is not a chemist. Where's the chemist?

MR. ELTAWILA: The chemists are all coming from Sandia. Sandia has very good chemists.

MR. KINTNER: If I understood you correctly, here we are with an experiment which is going to perhaps show

that containments in this instance fail badly. That seems to me to be a pretty fundamental question to be dependent upon an experiment which is not more closely associated with reality. I'm not saying it isn't true. I'm just saying that the circumstances in a molten core, still water in the vessel presumably, some of it's hardened on the bottom of the vessel, it did in TMI, too, all the questions, what pressure is it at, how much water is down there and what steam is in the containment when this thing blows.

This is really reaching for an answer, it seems to me.

MR. VOGEL: Chromium is not zirconium. The kinetics will be different.

MR. SHERON: We have a scaling report coming in very soon. The scaling report, I assume, is accommodating not only the thermal hydraulic scaling parameters, but also the chemical scaling. Let us look at it. We hear your concern and we will get back to you and let you know.

MR. MORRISON: I would suggest that you have an expert -- there's a great deal of concern here, and Dr. Vogel. It seems to me if you go back far enough in your history, take a look at the charge in the engineering group there at Argonne that did so much pioneering work on the zirc-water reaction.

MR. VOGEL: You remember that?

MR. MORRISON: I remember that.

MR. VOGEL: I'll be damned.

MR. MORRISON: And you tried to find out what the difference between that and aluminum was, and I don't think anybody ever did find out why the hell aluminum was different from zirconium, but it's probably kinetics.

MR. VOGEL: Or zirconium and zirconium alloys.

MR. MORRISON: Right.

MR. KINTNER: It's got a lot of the fuel cooling interaction sensitivities of the liquid metal.

MR. VOGEL: How did you know about that work? That's 25 years ago.

MR. BECKJORD: Baker and I go back a long time together. We still remember that work.

MR. VOGEL: I am amazed.

MR. ELTAWILA: I don't want you to be left with the impression that we have not looked at the similarities between the chromium and zirconium.

MR. MORRISON: Let me, as the Chairman, suggest a strategy here that perhaps Herb and you and Dick can think over this overnight on this overall question here on severe accidents and see if there's any additional information we're going to need from the staff tomorrow, and we can come back and address those questions.

On the other hand, after some reflection, you may

feel you're comfortable enough with redrafting the material you're thinking of in the sense of the discussion.

I think, in part, it does have some of Neil's concerns in it on whether it's a matter of timing.

MR. VOGEL: I'm not sure where Neil falls on this backup thing, because I find that this paragraph is essentially verbatim what I gave him. So he completely agreed with it. Maybe he didn't.

MR. MORRISON: Otherwise, he would have changed it.

MR. VOGEL: I suppose he would have.

MR. MORRISON: But let's shift gears for the last half hour here and try to pick up the sense of the human factors area. Group, we thank you for your input here.

[Brief recess.]

MR. MORRISON: Let's reconvene. The human factors starts on Page 18 of the report. As I mentioned earlier today, what I have done is extracted the information that was sent to me by Dave Woods. What Dave did is go back to the document that we have referred to a couple times here today, let's revitalize the nuclear safety research, and wrote several paragraphs or pages on each of the items in that particular report.

That's not the way in which the Subcommittee approached its review of what was presented to it by the

staff. I didn't try to map the two, but what I did is extract simply paragraphs that I thought were particularly important from what Dave had written.

So the first paragraph really reiterates his view and I think it's also the National Research Council's view that there needs to be a commitment to human factors research, and certainly we're seeing that within the NRC program so far. It perhaps could be reduced to a paragraph or maybe a phrase in the final write-up here.

Secondly, he's talking about a systems approach that one can do on an individual issue basis. I don't think one can argue with that, although I don't believe that Dave made any greater comments as to what really a systems approach is as it relates to human factors.

MR. BURSTEIN: As this thing emerges, as this technology emerges and there's a lot of development going on, how do you know whether an individual issue treatment is part of a broader application or whether it's an extraneous issue till you pursue it? I think that's one of the risks. And maybe we have to exercise a little judgment at the beginning.

But that hinges on the next paragraph to a great degree, and that's the business of related research information, it seems to me.

MR. MORRISON: I think there are several

paragraphs -- in fact, I gave Frank my copy of this, so I'm not sure that I'm totally right, but I believe on this tracking related developments, Dave Woods made a number of comments of work that was going on in other fields, whether it's aircraft safety or other activities.

MR. BURSTEIN: I think that's very important.

MR. MORRISON: At the same time, he was recommending also kind of a multi-disciplined look at the problem which I think went throughout his entire series of questions to the staff, do you have the right mix of experts looking at this kind of problem. Perhaps the feeling was that maybe the nuclear field is behind others in taking that kind of an approach.

MR. BURSTEIN: Well, we have some philosophies --

MR. MORRISON: Jump in if you think I'm misstating.

MR. BURSTEIN: Well, we have some philosophies that didn't permit us to do some of those things that are still there. We had, for example, independent and redundant means of measuring and independence of instrumentation from control, and other philosophies which really meant, in many cases, separate individual hard-wired logic systems that we couldn't take advantage of some of the technology.

The next paragraph dealing with computer display systems brings up a lot of implications to me. It means

that we may, if we're going to rely on some of these as our primary window and control function, we've got to go back and redo some of the regulatory requirements that we have lived with for the last 25 or 30 years.

If we do, indeed, proceed with a greater opportunity to rely on advanced computer display and control systems, then we have to recognize that in doing so we're going to perhaps cancel out or supercede some of the principles used in regulation for the last 25 or 30 years. I don't think that's bad, but it makes for a major change and it requires certain degrees of reliability that we haven't achieved in some applications up to now, or a reduction in the kind of reliability that we demand of some of these systems for nuclear applications.

We haven't talked about networks or artificial intelligences or other things yet, but clearly, it seems to me, the reliability of those systems is going to be a key to their utilization. I think these are suitable areas for research, absolutely.

MR. MORRISON: Let me toss a question to Frank because it's really embedded in all of that Page 19. I think the feeling is that computer displays are much more a hands-off involvement in advanced reactors is going to be proposed and go forward, and apparently EDF is doing some things. How closely tied are we to the EDF programs?

What's coming out of that that's of value to us, Frank?

MR. COFFMAN: We're trying to monitor the EDF progress and several of the staff have been over to see the work their doing on their N-4 reactors. They have a simulator. It is all digital technology. There are two points I need to make about it.

One is that their regulatory agency, CEA, has said that there will be an analogue, electro-mechanical backup to the digital controls in the control room in case they lose one of the computers -- in case they lose all the computers that support the digital interface. That's given that the likelihood of losing all those computers, and I'm not confident on this, I think it is three computers, for more than eight hours -- I am confident about the rest of it -- for more than eight hours is once every eight years, and that was too frequent for the French regulatory agency.

For a duration of eight hours, one every eight years.

MR. BURSTEIN: Once in eight years.

MR. COFFMAN: Once in eight years. And that was too frequent. So they required this analogue backup. So that's a key lesson that we've already learned from monitoring the French efforts.

The other thing is that Westinghouse has been instrumental and interactive with the French in developing

their system, and Westinghouse has learned some lessons from that activity and they are trying to build on those lessons as they're designing the AP-600 in some of their other control rooms.

So not only us, but the utilities are taking advantage of that Westinghouse -- I'm sorry -- that French experience. And there is other international experience that we're trying to gain from the Japanese and from the Norwegians.

MR. BURSTEIN: This philosophy of having this backup is not very much different from our present utilization of digital systems in control rooms in U.S. nuclear plants where we encourage their use for diagnostics, for data gathering, but not for primary indication and control functions.

MR. COFFMAN: For safety systems.

MR. BURSTEIN: That's right. For safety systems. If indeed, that prevails, it appears the worldwide experience that -- I'm just wondering how much of an advantage there is in pursuing some of these applications for computer information and control systems.

MR. COFFMAN: The Canadians, because of the complexity of the startup in the Candu, the Canadians have gone to digital technology in their controls. And based upon some experience that they have had over -- and it was

more than one year, and I don't want to guess at the years, I'd have to go check my notes -- but over more than a one year period where they had both analogue and digital systems operating, that they had no failures in the digital system that had safety implications, where they did have some failures in the analogue systems that had similar application.

MR. BECKJORD: Frank, I thought the failure that occurred in January in their refueling sequencing was a digital failure.

MR. COFFMAN: Yes. That --

MR. BECKJORD: That led to a loss of coolant.

MR. COFFMAN: That was at the Bruce plant. I was speaking to the Point Lapro plant, and the reason I was -- let me address them both, but first the Point Lapro. There they had a parallel experience with digital and analogue and they found that none of the failures in the digital systems had potential adverse safety implications because digital systems give you an added advantage. That technology gives you an added advantage of being able to self-survey, to monitor itself, and to detect a defective channel, and to remove that channel from the processing and the interface, from the software treatment of the information coming from that channel.

So there is a real technology difference in the

digital systems. It gives you the advantage of on-line continuous self-surveillance. So that's a motivation. I think the technology -- I'm trying to answer the question is it any different, and I think it is. It gives you some added capabilities that have safety implications.

I can address the Bruce experience, but maybe I should first stop here and see if I've answered the question.

MR. BURSTEIN: I think you answered my question.

MR. COFFMAN: The Bruce experience was that they had a digital system controlling refueling. It's on-line refueling in the Candu reactor. In the software, even though the software had been verified and validated and gone through their reliability requirements, there was in the software a sequence of steps that the program took, but because of an interruption in the process, in the way the operators were moving through the process, the software went back and reentered the sequence, bypassing one of the checks, and the check was do you have the machine locked in place, do you have it locked in before moving the machine.

It was a very critical step. So they ended up moving the refueling machine while on-line without having it framed against the vessel. What that led to was a small leak. So, yes, it was a safety-significant issue caused by software unreliability. So those are real questions.

I may have gotten us off the main point discussing this experience.

MR. BURSTEIN: I think that's useful.

MR. MORRISON: Moving to Page 20, then, the whole question of digital control systems obviously leads you into greater software problems. This was identified as an area where NRC is paying some attention to that and it seemed to be worthy of mention.

The next couple paragraphs deal with the subject of personnel subsystems and shift scheduling which was talked about this morning. There is no recognition in here that even though new rules were developed, there's still the operational issues and the management issues within individual plants and utilities that relates to the employees involved.

MR. BURSTEIN: I have a problem with -- in the middle of that paragraph it says because current practices are so poor in this area. You'll forgive me, but I would like to suggest some different wording.

MR. MORRISON: I will note that, Sol, because there will be considerable different wording in the whole thing to get it down to several --

MR. BURSTEIN: I'm sure. I guess there will be more.

MR. MORRISON: There has to be more. There's too

many pages and they don't seem to focus in the way in which they really should.

MR. BURSTEIN: Right.

MR. BUSH: Could I ask Frank a question that is somewhat irrelevant, but I think it still pertains to this thing.

MR. MORRISON: Go ahead.

MR. BUSH: There's an area -- I don't think -- I went through this and tried to find it and it doesn't get mentioned at all that the NRC was asked to participate in, and decided not to, which is obviously their privilege, that essentially is a one to two year program to look at -- in the [illegible] area -- on the reliability of the operator as a function of such variables as heat, which obviously an NDE person has two sets of SWP clothes, noise, of which you have lots, fatigue in the sense of operating double shifts and things of that nature, which I would think would be relevant to some of the things here because this one will be -- they're going to use what they call an envigilator so everything is under -- is observed, every single operation is observed and noted. A one-way window type thing.

The operator cannot see the envigilator, but the envigilator sees everything.

MR. BURSTEIN: I think we won't be able to keep operators on the plant and we'll have 64 union grievances

filed immediately.

MR. BUSH: No, no, no. I say there is a program that's there that is actual y underway now in the United Kingdom and in Italy, and I'm just saying it would seem to me it would be something that they should have been participating in. That's the only point I'm making.

No. You can't do it in a plant for a variety of reasons, and you wouldn't want to do it in a plant.

MR. BURSTEIN: But we do have -- we have done some of that work in this country in specific plants. I don't know that it's as formally undertaken as a program --

MR. BUSH: This is highly formalized.

MR. COFFMAN: I think I know a little bit of it. Let me, if I could, organize a comment here, and I think it will still answer the question. The way it reads here is as if it's addressing the regulatory policy. We are doing research to support maybe an improvement in the regulatory policy, and certainly I would agree we're not making any judgments about current practices in our work. It really doesn't relate to our work.

But in our work we are looking at operator vigilance in the control rooms. We're doing some detailed work, eight-hour shift, 12-hour shift. We're doing some work to determine the ranges of performance given heat, vibration, noise levels and stuff like that. But we are not

doing anything other than reading material that's coming out of the U.K. work on NDE. I think they're doing it on tubing. They were doing ultrasonic testing on tubing and that was the NDE operation, and they were -- that's old background, maybe.

But their process that they follow, which the U.K. calls Sherpa, I think, is very much akin to how we would go in and evaluate the human factors of a process. But all we're doing is just -- we're aware of it. Why we never participated I think was before I got involved.

MR. BUSH: Well, I think the money would have had to have come out of the NDE program because it wasn't in human factors. The reason I asked the point is that this going to -- this will be something that the NRC will probably ask the codes to take action on in the next three or four years.

MR. COFFMAN: It is good work that they're doing. We do have a joint effort with a U.K. firm, UKAEA has a division called Safety Reliability --

MR. BURSTEIN: This is under the SRB.

MR. COFFMAN: One of their chiefs there, we are working with Peter Humphries. So it's through that channel that we get the information, but we're not directly participating.

MR. BUSH: This one fits logically in that

paragraph we looked at. We talked about knowledge of the foreign work and things of that nature. It's one of the few programs I know that has, over about a four-year period, developed all of that matrix.

MR. COFFMAN: There are several reports. There is one point I would like to address in this.

MR. MORRISON: Go ahead.

MR. COFFMAN: It's the very last paragraph.

MR. BURSTEIN: On Page?

MR. COFFMAN: It begins on Page 21 and goes over to 22. I wish Dave Woods was here so that we could talk about it because I think it needs to be cleared up. In the paragraph before that, he talks about doing work that is combining modeling and empirical work. It starts out here with in that light, it's hard to understand why we're not looking more in the procedure violations.

We had a significant effort on procedure violations and we're coming to the close of that. What we were asked to provide was a copy of the contractor's report to Dave Woods. We did that and it doesn't reflect the NRC position, which is, at this time, to not proceed with more work in procedure violations because of the work that we have done.

I'd like to just characterize what we have done and why that led us to the conclusion. The agency has

programs in place to upgrade emergency operating procedures and also to ensure that those upgrades have taken place by inspections. So those programs have been going on for a couple of years.

We also have a generic issue that is looking at whether or not there is -- whether it's cost-effective in a safety sense, value impact effective, to upgrade procedures other than EOPs. That's been going on and it appears that -- well, please take this as a speculation on the outcome, I'm speculating that we will probably say yes, there are some upgrades to procedures other than EOPs that would be safety effective.

So we got those two efforts and then, in addition, we already have guidance documents in place on how to upgrade procedures, what constitutes upgrades in procedures. Then we went into this project which was a followup to Chernobyl that we were trying to characterize what are the procedure violations that take place in the U.S. utilities.

There are some conclusions that came out of that study on the frequency and the nature and the consequences of those procedure violations that are occurring in U.S. plants. On the frequency, there were some 800 cases looked at, 800-plus cases looked at and 13 of those cases could be characterized as willful violations of procedures where the operator intended to violate the procedure. He did it

knowledgeably and willfully.

MR. ISBIN: And correctly?

MR. COFFMAN: In some cases, he did it safety correct, even though procedurally incorrect. But we're not taking -- I don't want to take credit for that.

MR. BURSTEIN: The motive is not defined, is that what you're saying?

MR. COFFMAN: That's right. The motive is not defined, but in some cases what he did was in the safer direction. But not taking credit for that, I'm just saying he violated the procedure. If you treat the procedures -- he just violated the procedure. There were 13 cases out of the over 800 that we looked at.

There were some 40 that were indeterminate. So there's an uncertainty in there of about 40, if I'm remembering my numbers right. But the vast majority of the procedure violations were due to inadvertant violation of procedures. In those cases, it was primarily because they weren't well written procedures, they hadn't been validated, they had missing warning steps, and things like that.

The point is out of that study the frequency of procedure violations was less than two percent. As far as the consequences go, there were some consequences, health physics violations, there were some doses that workers received because they violated these procedures. I'm doing

this from memory, so don't quote me exactly on the numbers, but I think there were one or two cases where there were some inadvertant releases to atmosphere, radioactive gases or something, but they were not beyond the limits, I think it's the Part 20 limits.

So that the consequences -- the frequency is low, the consequences are not major. In determining the causes, trying to determine the causes, the contractor's report went through a rather elaborate chapter; in fact, the longest chapter in the report was the contractor's speculation -- not speculation -- it was his characterization of how procedures might be violated, what might influence or motivate plant personnel to violate procedures.

Then they tried to determine in their study, they tried to fill in with empirical data what, in fact, is happening, how are these procedures being violated, and they were unable to characterize the causes very clearly in, like I said, about 40 cases. In 30 of the cases they were able to, but there's this difficulty in trying to characterize what's motivating plant personnel to violate procedures.

Let me see if I can't just state it in a quick sentence. I think the point is that it takes a lot of effort to look at each case and try and determine what the cause is. It's just very resource-intensive to determine the causes.

So given all this and the other research we have to do, and I guess I could take the blame for this because I think it's the right thing to do, and that is that it just does not appear cost-effective to proceed in looking further and putting a lot of money in determining the causes of procedure violations given that the consequences are small and that the measured frequency is small.

There are some other arguments which are a little weaker that --

MR. BURSTEIN: Are you going to recommend to the regulators that the fines be small, too? It seems procedure violations are the things that generate more disciplinary responses from the regulators than almost anything else. It's interesting that you should come to that conclusion. I hope that gets translated into regulatory practice. I think that's very important and it indicates areas where perhaps it is not appropriate to spend a lot of time.

But then it begs the question, then, how serious really are human factors or human errors and how significantly do they impact plant safety, because we're spending a lot of money and the PRAs are telling us, at least according to some, that human errors are really a major source of risk.

We don't seem to validate that by an analysis of these procedure violations. Is some of the data that we're

putting in the PRAs then wrong, our assumptions need clarification?

MR. COFFMAN: If you look at the failure rates that are put in the PRAs, they are pretty low. They're down at the one percent or less. There are some that are higher, but we in the human factors research program are trying to take an approach that addresses both aspects.

One is how important are human errors to plant risk, and we're trying to develop methods to systematically quantify that and get some real hard numbers for it. But simultaneously we're saying regardless of how important they are, are there some things that are cost-effective to do to reduce the likelihood of human errors.

One of the things that was done in this case that we're talking about is to develop this guidance document on how to write procedures properly.

MR. ISBIN: Is this program related at all to what INPO has been doing for the past few years, a big emphasis on procedures, upgrading of procedures, guidance for writing procedures? It seems to be somewhat in parallel with what you're doing. I assume that you're well aware of their accomplishments on plant-to-plant.

MR. COFFMAN: Not plant-to-plant, because the EOPs is being done by the regulatory office.

MR. ISBIN: But you talked about other procedures

and I'm just talking about operating procedures.

MR. COFFMAN: I'm not aware on a plant-by-plant basis what INPO is doing in upgrading --

MR. BECKJORD: They won't discuss that with us.

MR. BURSTEIN: I was going to say it seems to me that material is not available for the individual plants.

MR. ISBIN: The guidance on how to write procedures is certainly available.

MR. BURSTEIN: Yes. I think INPO has become very prescriptive about some matters, again trying to reflect a standardized approach which has some, maybe, origins. Whether that has accomplished anything more than what we've had before is something we can't really debate. We've had claims that the NRC's -- NRR that is responsible for the improvement in plant performance and we have Zach Pate's argument that it's his INPO. And nobody fortunately can prove the other wrong. So I guess we're justified in doing both.

MR. MORRISON: Having reviewed, at least superficially, this write-up in here, I'd appreciate any guidance the other members of the Committee can give me as to what you think we ought to have as the main items --

MR. BURSTEIN: I think we've got to take out a number of things, Mr. Chairman. I'm concerned about statements like at the bottom of Page 20 in that last

paragraph that says the behavioral science community is upset because the industry hasn't adopted some of their recommendations.

MR. ISBIN: Did we first finish the end of 21 and you had this preamble in which you were trying to explain your position. Wasn't that the purpose? And then you wanted to comment -- you sort of disagreed with the paragraph.

MR. COFFMAN: Yes. I disagree with the paragraph and I think that the -- I concluded that it's not cost-effective to do further research. So that's in direct opposition to his recommendation or his comment here that he doesn't understand why we're not, that we need to have a good model that can predict where and why procedure violations will occur. I'm saying it's not even cost-effective to try and determine the causes of why they occurred after the fact.

Certainly when it comes to prediction -- and I realize I'm giving just an opinion here, I'm not representing an office position or anything, but I don't think that even our use of other reliability methods an intent of predicting anything. It's more in determining where to allocate resources and where to explore further.

But to predict where procedures will be violated is more ambitious than I think --

MR. BURSTEIN: This, if I may pursue. Can I ask what the staff's view is in regard to the previous paragraph on Page 21, the ability to measure and predict human performance, to carry on an extension of what you were just saying. Is really this the staff's view or do you share this view that's printed here on this page?

MR. COFFMAN: I would think the majority of the staff involved in human factors research would delete the word predict. I don't think we're -- we don't predict.

MR. BURSTEIN: There are some on the Committee who would, too, but I wanted to get the staff's viewpoint of what's in this paragraph.

MR. COFFMAN: At the risk of talking too much, our objectives are to model or characterize human performance, to try and measure it, and monitor, and to develop the methods to do that. But we are not trying to predict.

MR. BURSTEIN: To your knowledge, does the state of human factors research in general auger an ability to get predictive models successfully?

MR. COFFMAN: Auger is a word I don't use daily.

MR. BURSTEIN: That's why I picked it.

MR. COFFMAN: You mean to support?

MR. BURSTEIN: Yes.

MR. COFFMAN: Yes. To varying degrees, though; to those things that are more observable, like environmental

conditions, how people perform at different temperatures or under different vibrating floors, those measurable things. It does it better than in other areas, like trying to measure stress levels or operator vigilance or things like that.

MR. BURSTEIN: It does not. Thank you, Mr. Chairman. I think I got the answer. I have difficulty with that one paragraph on prediction myself.

MR. ISBIN: Was there anything in the Kouts report that you're responding to on the NUREG --

MR. COFFMAN: No. We're aware of that. We, in fact, participated in some of the debriefings to inform the Kouts Committee, but we are not directly responding to it. But we coordinate closely with the other brancnes and divisions.

MR. BECKJORD: He was really endorsing that we continue to work on it.

MR. MORRISON: Sol, could I ask you to do a very simple thing and look at those pages and tell me are there several of the ones that you'd like to have out or several of the ones you'd like to have in. Let me see what I can do with it then in a second draft. I think you're probably closely to the human --

MR. BURSTEIN: I'm not sure I am, but I'll try.

MR. MORRISON: To give us some insight, because I

think we have to back it up as a Committee and see what position we take with regard to human factors research. Obviously, there was a suggestion here that the Kouts report says there ought to be continued.

I don't think we're recommending that it should be continued, although Dave Woods may be pushing it farther than the state really allows it to be done. I think that's the sense I get from looking at predict versus being able to measure.

MR. ISBIN: With the understanding that we received just a while ago the last paragraph on Page 21 and the top of Page 22, what is your intention?

MR. MORRISON: My intention, I think, is to revamp the whole section and circulate it and see what Dave Woods' comments are on this. I get the sense from Frank that there is good reason for discontinuing that activity, and I'm not sure that everybody's in agreement or maybe even an understanding of why it was being discontinued on the part of Dave Woods. I don't think that was discussed in any detail at the Subcommittee meeting.

I think there's a valid reason given in the report that was cited when the evidence was cited.

MR. ISBIN: Okay. That's fine.

MR. MORRISON: All right. Well, on that high note, maybe we should adjourn for the day. Eric, you had

mentioned -- I guess Spence was mentioning that there was an issue we wanted to discuss with Brian or with Farouk.

MR. BECKJORD: Or Mark.

MR. MORRISON: Or Mark.

MR. BECKJORD: I thought if we could take up the point that Spence raised with me out of the --

MR. BUSH: You mean the probability?

MR. BECKJORD: Yes.

MR. MORRISON: Is that something we can do in a short period of time or is that better --

MR. BUSH: Brian seemed to be very confident that you could take a sequence of probabilistic analyses, combine them or integrate them and come up with an answer which adds considerable confidence. The other point I made is that I've worked on these with -- particularly in the failure probabilities of piping which were done at Livermore, and at least in the case of the stress corrosion, I can recall that I had no problem with the model, the inputs are the critical thing, and by reexamining the inputs, we were able to shift the end number by something like four or five orders of magnitude, which then would check the statistics.

So I had reservations on making it a blanket statement that an integrated probablistic approach will give you the answer. That was my concern.

MR. BURSTEIN: I guess, sir, speaking to the

sensitivity of the answer to --

MR. BUSH: Yes. I'm talking about one that you say has a shape like that and it may have a shape like that. So there are big changes tremendously over a few decades. That was the only point I had. He seemed to be so confident you could do it, and I just wasn't that confident.

MR. CUNNINGHAM: I think our experience in general has been like yours, that what drives it is not so much the probablistic model. People tend to agree with the use of probablistic models where we run into problems and disagreement on what you include in the analysis and what you don't and the kind of data.

MR. BURSTEIN: You certainly have had that in the seismic discussions.

MR. BUSH: There are quite a few examples. I was trying to see what the basis was for such a high degree of confidence. I didn't quite agree with that assumption of that level of confidence. That was the only point I was making.

MR. BURSTEIN: That's between the statistician and the engineer.

MR. BUSH: I'm a statistician part-time and I do probabilities part-time, too, but I also know the limitations in the things. So that's the only point I was making.

MR. ISBIN: When you add the term integrated approach, do you have something else in mind?

MR. BUSH: An integrated approach means that I did a series of sequences and then I added them all up. The thing is that the errors accumulate. So if you have input errors in Item 1, it impacts on 2, which may in turn impact on 3, and so forth, and the end number can have a very, very marked change. That's the only point I had. It's a statistical study as contrasted to a probablistic study. We're looking at a few million operating years of experience.

MR. CUNNINGHAM: You've got the integral model to go back and examine -- the results will change.

MR. BUSH: You can get a rate and you can look at sensitivity, each stat, and you can establish from there. But to argue that that is the answer, that's the only thing I have a problem with.

MR. MORRISON: I think you're point is well made, Spence. Let's adjourn with that well made point, then. We shall reconvene at 8:00 tomorrow morning.

[Whereupon, at 5:21 p.m., the meeting was recessed, to reconvene the following day, November 9, 1990, at 8:00 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: Nuclear Safety Research Review

DOCKET NUMBER:

PLACE OF PROCEEDING: Rockville, Maryland

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.

E. Greenberg

Official Reporter
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