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1 U.S. NUCLEAR REGULATORY COMMISSION

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NUCLEAR SAFETY RESEARCH REVIEW COMMITTEE

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Holiday Inn-Crowne Plaza

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1750 Rockville Pike

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Rockville, Maryland

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Friday, November 9, 1990

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The Committee met, pursuant to notice, at 8:07

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a.m., David L. Morrison, Chairman, presiding.

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PARTICIPANTS:

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David L. Morrison

Mark Cunningham

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Frank Coffman

Andrew Murphy

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Brian Sheron

Farouk Eltawila

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1 PARTICIPANTS [continued]:

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3 Larry Shao

Ralph O. Meyer

4 Herbert Isbin

Sol Burstein

5 Edwin E. Kintner

Spencer Bush

6 Eric Beckjord

Richard Vogel

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P R O C E E D I N G S

[8:07 a.m.]

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3 DR. MORRISON: I'd like to call the meeting to
4 order, if we may. We have a fairly busy agenda and as I
5 understand, a lot of people have been busy last night, since
6 I have marked up drafts which, I find very useful in pulling
7 together the final report. The topics that I believe we
8 need to cover today -- and let me go over that and we can
9 add others to the list if you like.

10 When Eric gets back sometime this morning, we'll
11 address the subject of advanced reactors, since he gave us
12 his paper last night and copies of viewgraphs, I think it
13 would be best to wait until he gets here to discuss that
14 topic.

15 The second item I want to deal with is the, some
16 statements of priorities on behalf of the NSRRC here with
17 regard to the important elements in the research program.

18 The third broad topic is to cover what I have in
19 the draft listed as program balance, but it's really sort of
20 other issues or special issues of note with regard to the
21 procedures that are being followed within the research
22 program.

23 A fourth topic is to discuss, at least in a
24 general sense, what our activities for next year should be
25 and maybe set aside some timeframes in a general sense for

1 when we ought to meet again.

2 And fifth, if there's any additional redrafting we
3 want to do today, why we can do that. So, have I covered
4 everything of interest?

5 MR. BURSTEIN: One of the chapters in the material
6 you've prepared had to do with user needs. We did not get a
7 chance to deal with that, as I recall, in great detail
8 yesterday. Is that part of the priorities discussion?

9 DR. MORRISON: Well, that's part of what I'm
10 calling program balance and other issues and procedural
11 aspects to solve, so we will cover that very definitely.

12 While it's fresh in mind, why don't we back up to
13 the subject of priorities. We started yesterday looking a
14 little bit at it. Spence detected that there was a
15 difference between the priorities which I had on page seven
16 and eight and those that he had listed. I think we need to
17 address probably three ways to approach the priorities.
18 One, what I have listed on page seven and eight are what are
19 titled "program elements within the five year plan."

20 What some of Spence's activities are are a mixture
21 of program elements and program activities. Now, we could
22 go down to program activities level, but that would give us
23 a huge number, I think, to deal with in terms of priorities.
24 And I'm not even sure that the program elements that I have
25 which amount to what? Four -- ten -- thirteen plus about

1 two is, fifteen are not already too many to deal with. So,
2 we have a choice of increasing the number of items on that
3 or decreasing the number of items on that. And by
4 decreasing, we needn't follow in particular than the titles
5 of the program elements and the program activities in the
6 plan, or we could stick with the ones that are there. So, I
7 think that's three possibilities to deal with it.

8 MR. MEYER: Could I interrupt. Before you get too
9 far into this, last night, Spence gave me a marked up copy
10 of this priorities section, which I had sent for xeroxing.
11 I'll step out now and call them and see how many minutes
12 it's going to be before it arrives. But, we should have it
13 in our hands if that's going to be useful for this
14 discussion in the next ten or fifteen minutes.

15 DR. BUSH: Probably not. I think the decision you
16 have to make is how few or how many titles you have. I
17 think that's the gut issue, isn't it?

18 DR. MORRISON: Yes, I think that's right, Spence.
19 Maybe, well, you may want to check on that anyway, Ralph,
20 but I think what we should do is just in general talk about
21 what we see as the priorities and then maybe I can map that
22 onto what the five-year plan is or just ignore the titles in
23 the five-year plan.

24 DR. BUSH: Let me ask this question, because I
25 think it will have an impact, which is one reason I want

1 that next cut down. And that is that, within a heading you
2 might have what you would classify as a very high priority
3 and by like token under that you could have what I would
4 classify as a medium to medium-low priority. One way to
5 handle it is, indeed, not to go down any further than the --
6 such as integrity, you wouldn't go below the next
7 subcategory, which would be reactor vessels and piping. But
8 you might show in the priority table something like high- or
9 high/ medium-high/ -- something of that nature. And then
10 the text, per se, would indicate, would make it apparent
11 which ones you meant would be high and which ones you meant
12 medium, if you go that far. I asked a question; I'm not
13 supposing it as a specific position, but more than asking a
14 question.

15 DR. MORRISON: I think that's certainly an
16 appropriate way to go. Or, you can back up and just pull
17 out specific items and if, for example, it's only the
18 reactor vessel you're concerned with, we can ignore the
19 title of "Reactor Vessel and Piping Integrity" and just talk
20 about the reactor vessel as obviously a high priority item.

21 DR. BUSH: Or we could group them under there.
22 For example, if we have, we could talk about high items,
23 high-, medium-, and low-, and put them -- in which case, one
24 would take a, like the reactor vessel piping, one would have
25 "Pressure Vessel Safety/Inspection" and that would be it.

1 It wouldn't, unless you want to --

2 MR. BURSTEIN: I think that's a possibility and I
3 think we want to try to retain as much flexibility, but we
4 also, I think, need to simplify this as much as possible. I
5 think if you have more than a number of broad categories
6 corresponding to the five-year plan, as appears on page
7 seven and the top of eight.

8 Then you start getting into listing a very large
9 number, and you don't distinguish necessarily between the
10 major headings, which I think lies to the advantage of the
11 major grouping. For example, I don't know if somebody were
12 to ride up on a hack and ask, is the concept of reactor
13 integrity more important than human factors. If you break
14 down the programs into their subcategories, you don't get
15 that distinction. All you get is distinctions within each
16 group as such. And I think you lose some of that overall
17 perspective of priority.

18 DR. BUSH: There's one problem -- not a problem,
19 really. Again, they have to face up to it, and that is that
20 we will have what we would call major elements that would be
21 one-tenth the size of sub-elements. And the question is, do
22 you control a major element or are you really controlling it
23 more in dollars because, for example, you've got some there
24 that are \$600,000, versus a sub-element that is \$7 million.

25 MR. BURSTEIN: It seems to me that you need to

1 then amplify in the write-ups how those sub-elements fit
2 within the broad category.

3 DR. BUSH: Yeah, that's the other option. It
4 depends on what you decide, how much you put in that first
5 one, except you run into the anomaly that if you call a
6 major element high and then the text says, well, two out of
7 the three items are high and one item is low, you know, it
8 doesn't show up and it may not have to unless you show it
9 with some kind of a slash or something.

10 MR. BURSTEIN: I think that's the reality of where
11 those groupings are myself. That's just a view.

12 DR. MORRISON: It's my view that I wouldn't be
13 concerned about the dollars that are being spent. I think,
14 obviously, certain things can only accommodate so much
15 money, from a research standpoint, to be done effectively,
16 and others are very expensive to do. So, I think the
17 dollars is sort of a second order of consideration, as long
18 as we can say there's enough money in there for what we
19 would designate as a high-priority item or maybe the other
20 way around. There's too much for something that we think is
21 low-priority item, even though it's an expensive task.

22 Well, certainly another way to look at it is, what
23 are some of the near-term things versus the long-term
24 things. We keep talking about the item of closure and
25 trying to move away some tasks. Is that another way to look

1 at it? What should be the priority items in the near-term
2 versus those in the longer term.

3 DR. BUSH: That's very difficult to tell from the
4 five-year plan. I tried to decide what that is and there's
5 a lot of gobbledeygook in there. And what you'll finally
6 find out is that it's a matter that supposed to be done but
7 since the dollars are going up, you have to wonder if
8 there's a lot of hidden stuff in the agenda that you can't
9 account for.

10 DR. MORRISON: The question is, what does Spence
11 Bush feel is important? Not necessarily what the plant
12 feels.

13 MR. BURSTEIN: There is, perhaps, a need to
14 clarify some understand of what we mean. As I read this NRC
15 approach, near-term is everything related to licensing
16 activity that we know about now and long-term is the so-
17 called anticipatory or non-specific research activity. I
18 guess I, I'm not sure that that is a uniformly accepted
19 equivalent and maybe you ought to define it, Mr. Chairman.

20 DR. MORRISON: I certainly agree, Sol, with your
21 conclusion that that's what the plan defines it as. Where I
22 think the gap is is in areas like advanced reactors, where
23 it's almost a known -- I wouldn't put it in the category of
24 anticipatory; it's not something I'm searching to find out
25 what's --

1 MR. BURSTEIN: I would not, but it's certainly
2 going to take ten or twenty years.

3 DR. MORRISON: That's right. It's going to take a
4 long time to address.

5 MR. BURSTEIN: So, in the conventional idea of the
6 use of the word "long-term" versus "short-term," it's a
7 little different than what Howard maybe used in this plan
8 description.

9 DR. VOGEL: That's terminology that developed in
10 the source term. The word was reorganized and I'm not sure
11 it extends, at that time the thinking extended to the rest
12 of the NRC program. And since then, it may have been so
13 extensive. My own particular concern is that I don't think
14 that the setting of priorities should be made in such a way
15 that it can be used in a mechanical and non-thinking way to
16 adjust budgets at a later budget time.

17 MR. UHRIG: I agree. You have to set budgets on
18 the basis, divide budgets on the basis of how much there is
19 there against the priorities.

20 MR. BURSTEIN: I think we're kidding ourselves,
21 gentlemen, if we believe that priorities do not mean
22 budgets.

23 DR. BUSH: Yeah, so do I.

24 [Laughter.]

25 MR. BURSTEIN: Why are we setting priorities if

1 not to show where the emphasis of resources should be
2 applied? That to me is people and money.

3 DR. VOGEL: Right. And my plea is not to make
4 this so easy that it can be done poorly.

5 DR. MORRISON: See, that's where I disagree, that
6 you could put \$25 million into a reactor vessel program
7 because it's inherently expensive. You may consider human
8 factors or some element of human factors an equally
9 important one, but you couldn't possibly spend \$25 million.

10 DR. VOGEL: That's exactly the concern that I
11 have. That's right.

12 MR. UHRIG: Well, I assume the budget -- I mean,
13 if you have all the money you want, then there's no problem.
14 It's obviously when it begins to bind a bit. And then you
15 have to ask yourself, do I cut this zero and do I cut this
16 one 50 percent or do I cut it completely and defer it for
17 two years. That's the decisions that they usually make. At
18 least, that's been my experience.

19 DR. MORRISON: I think that's within a logical
20 definition of, what does it take to accomplish a particular
21 objective within a program. Can you do it for 90 percent of
22 that number or 80 percent of that number without breaking
23 100.

24 DR. BUSH: Ninety percent is no problem, as you
25 well know. It's when you get down to about 70 percent that

1 really the shoe begins to pinch a bit. Then, you have to
2 decide, should I defer, should I cut, or should I simply x-
3 out -- that's really the decision you're faced with. At
4 least, that's when I watched budget, because I've been doing
5 it in this area at least for 20-odd years.

6 DR. MORRISON: Let's take sort of an ad hoc
7 approach for a moment.

8 DR. BUSH: I sore feelings. I was expressing, you
9 know, an option.

10 DR. MORRISON: Spence, you've looked a number of
11 these things. What do you put at, say, the top two or three
12 items on your list, if one looks across the board of all the
13 research activities that NRC is involved in? On the video,
14 I want to jot some of these on the board up there and you
15 can see them as we -- this is by program element/category.

16 DR. BUSH: The ones I have, I can do fairly
17 easily, and obviously you can subsume -- if you want to get
18 fewer headings. I guess, the way I would look at it
19 somewhat is, what has an impact in the near future on
20 decision.

21 As a result, looking in the opposite, Dave, the
22 waste disposal things, you know, if one had flexibility I
23 would have then a lower priority. But the facts of life are
24 that since the money tends to be set, you don't have an
25 awful lot of choice in that area because, to me, until they

1 make a decision -- and I don't think they've made it yet --
2 on what they're really going to do with regard to handling
3 high-level waste, you're kind of spinning you wheels. Maybe
4 I'm wrong on that one, but that's certainly been my
5 impression about what's not going on.

6 MR. ISBIN: Well, they're doing a lot of
7 background work, which is preparatory to any site, I think,
8 as well as site-specific.

9 DR. BUSH: Seventy percent of the money is going
10 for QA. Isn't that a nice figure.

11 MR. ISBIN: You mean, at the center?

12 DR. BUSH: No. But, the center can only work with
13 the information they get. And most of the money that DOE is
14 getting is going for paper.

15 DR. VOGEL: I can't believe it.

16 DR. BUSH: I couldn't either, but I was told by
17 the people.

18 MR. UHRIG: This think they need, DOE, reactor
19 operations in paper.

20 DR. BUSH: It's strangling it. It's completely --

21 MR. UHRIG: Paper is up and down. All they've got
22 to do is have one little tiny glitch and they're down for
23 three months.

24 DR. BUSH: You know, it may not be 70 percent, but
25 it's absolutely horrendous. It should be about 10 to 15

1 percent. It's incredible. And the thing is, it has an
2 impact on what NRC does, plus the political decisions. You
3 know, do you do this or do you do that type of thing.

4 DR. MORRISON: Well, since that court case, at
5 least, has been settled and said that the state can't
6 prohibit DOE from going outside, at least, the Yucca
7 Mountain, you mean people aren't punching holes and walking
8 the sites and looking at what happens to groundwater flow?

9 DR. BUSH: Oh, they're doing experiments. It's
10 just that basically it's an awful lot of money being dumped
11 into it and you don't see an awful lot coming out the other
12 end in productive information.

13 No, well, that's irrelevant except if you don't
14 have anything to work with, it's kind of hard to move in on
15 it. That's why I would say I would do that. In the major
16 categories in the integrity, you run into the problem --
17 containment, I think, is going to have add to the impact on
18 the advanced reactors. And this is leverage money. My
19 current estimate is on a containment structure at work, for
20 every dollar of NRC money there would be \$10 to \$20 of other
21 money, mostly from Japan. So, that's it's desirable to have
22 it and so forth, so I would give it kind of a medium to high
23 priority because of that.

24 MR. ISBIN: May I ask where are you reading from
25 your revised list here?

1 DR. BUSH: It is on the list. It's on the second
2 page and it would be the item that would be racked with
3 containment structural integrity. I'm just giving
4 rationales as much as anything and I'm trying to stay with
5 big titles, not the small titles. Seismic and Structural
6 is kind of an interesting one because it's split. Let must
7 just talk Seismic and Structural because I do know what's
8 going on in the earth sciences.

9 I would classify this one, even though we -- as a
10 cut below. I would put it as medium, edging a little bit
11 toward high. There are some definite pluses in it, but
12 there are some aspects that we had a lot of answers. The
13 question is Sol's point: how much more icing do you want to
14 put on the cake.

15 Engineering standard support, even though it's a
16 small number, I would put high, because that's your end
17 product. If you don't have that money, you begin to lose
18 out because you don't have an impact on the quotes and
19 standards group -- you don't like the guise of regulations.
20 You've got to have seed money in there and it has to be
21 reasonable.

22 MR. UHRIG: It's not big but it's important.

23 DR. BUSH: It's very important.

24 MR. ISBIN: Well, now, you have it still as medium
25 on the list.

1 DR. BUSH: Yes, the reason being that I was trying
2 to be honest about the ones that I thought had, should have
3 the highest priority if many were to be cut. I wouldn't
4 expect that they get cut for a couple of reasons. One, it
5 isn't a big number, but I don't think I'm justified in
6 putting it the top, top category.

7 MR. ASBIN: Okay, so that's why you --

8 DR. BUSH: That's right. It would be the top of
9 the second category, which would be a medium/high. If I
10 stay with the reactor vessel piping components, I'm in the
11 dilemma -- I'd have to give it a high with a parenthetical
12 in there that there are subcomponents that would be picked
13 up in the write-up that are run to a medium/low. So, as a
14 category it gets a very high priority but a subset of it may
15 be a medium/low.

16 DR. MORRISON: This was a reactor vessel one?

17 DR. BUSH: That's the reactor vessel and piping
18 component. See, I'm trying to stay with the big ones.

19 DR. MORRISON: Okay.

20 DR. BUSH: I'm going along with what you say and
21 so I'm faced with that dilemma. I would say high and then a
22 parenthesis, you know, some kind of a thing -- a slash, high
23 to - low type of thing, and then the back-up words would
24 pick up the fact that the piping would probably, would
25 definitely be several cuts below.

1 Now, I don't know, you know, that's weasel
2 wording, I admit. But I don't know how to get the point
3 across that, you know, everything in here is top, top, top,
4 it has to go. I don't think you want to leave that
5 impression but I'm willing to listen. And, of course,
6 aging, as far as I'm concerned, is I think -- it's either
7 the 1'or 2 priority now, isn't it, pretty much?

8 MR. BURSTEIN: Why?

9 DR. BUSH: Aging?

10 MR. BURSTEIN: Why?

11 DR. BUSH: Well, because you aren't going to get -

12 -

13 MR. BURSTEIN: Because of license --

14 DR. BUSH: -- plants off the ground.

15 MR. BURSTEIN: Well, a point is that as a result
16 off a legal situation, and not because there's some
17 technology that's missing.

18 DR. BUSH: Oh, yes, there is some technology
19 missing, too.

20 MR. BURSTEIN: There is?

21 DR. BUSH: Yes. There are quite a few things --
22 the functional --

23 MR. SPEIS: Continuing, you know --

24 MR. BURSTEIN: I understand but it seems to be,
25 you know, here we go again. It seems to me that aging

1 management, as it's now called -- it's another lovely term -
2 - begins on the date of birth.

3 DR. BUSH: Well, I agree.

4 MR. BURSTEIN: And it continues on for whatever
5 period of time you call life.

6 DR. BUSH: How many utilities have ever thought
7 that way though, Sol? You know. Not too many.

8 MR. BURSTEIN: Well I mean, I know a number.

9 DR. BUSH: Yeah, but I know quite a few that
10 haven't, too.

11 MR. BURSTEIN: Well, that's to say that you never
12 do any inspection and you never do any repair and you never
13 do any maintenance and you never do any replacement, or you
14 never do any modification. And that is not happening at any
15 plants that I know of in the country.

16 DR. BUSH: I agree.

17 MR. BURSTEIN: So, when we start talking about
18 aging phenomena, we are really addressing the same things we
19 should be addressing in the initial term.

20 MR. SPEIS: Now --

21 MR. BURSTEIN: Now, if you say no, I'll --

22 MR. SPEIS: I said now. I said now.

23 DR. BUSH: Well, I agree.

24 MR. SPEIS: I said now. We're addressing those
25 things now.

1 MR. BURSTEIN: N-o-w.

2 MR. SPEIS: N-o-w.

3 [Laughter.]

4 MR. BURSTEIN: Very good.

5 MR. SPEIS: I forgot the "w."

6 [Laughter.]

7 MR. BURSTEIN: It makes a difference.

8 DR. BUSH: So, here's a kind of an example. It
9 may not be a very good one, but let's take insulation. If
10 you degrade insulation and you've got all the environments
11 to degrade insulation in there -- you've got the
12 temperature, you've got radiation fields, etc. -- the
13 question is, if you had an accident, do you lose your
14 electrical systems? And I don't think we really know, just
15 as a for-instance.

16 MR. BURSTEIN: I think we know what happens to
17 dielectric strengths of insulation with time. And in the
18 end, in the environment. And there is, you know, we have a
19 whole history of looking at this and in many cases, we
20 gambled that cables would only last 20 years; we knew what
21 we were going to have to replace. But the concept of basic
22 research -- I think we need to define, we need to define
23 maybe better things like fatigue or stress corrosion or
24 erosion or corrosion.

25 But that goes with 5 years, 10 years, 15 years.

1 You don't have to wait until 50 years.

2 DR. BUSH: I don't disagree.

3 MR. BURSTEIN: Pressure vessel integrity. It's
4 the same problem that we have with loss of ductility. It
5 doesn't begin off the edge of a cliff at that point in time.
6 So my question --

7 VOICE: You're not convincing me.

8 MR. BURSTEIN: Forgive me.

9 DR. BUSH: You don't have to convince me.

10 MR. BURSTEIN: I know, because we've been through
11 this before. My question is, is aging require a new set of
12 research programs or is it a continuation of the kinds of
13 activities that we've been doing, and are they only being
14 illuminated at this point to a little greater brightness
15 because of the license renewal environment

16 DR. BUSH: I think it's beyond that. I think, for
17 example, the stuff that came out of shipping port, no one,
18 mostly when this stuff went out we tried to trace some of it
19 down. You know, it gets cut out but a lot of it, nobody
20 does anything with it. They don't really, you know,
21 establish -- we know it failed because of this -- but they
22 don't look at, you know, it would have failed in two years
23 because of that type thing. That's the type of stuff
24 they've been doing at Oak Ridge and at INEL and so forth.

25 MR. BURSTEIN: This comes down to trying to answer

1 the question of priority. I'm not sure whether aging really
2 involves some basically new research endeavors, or whether
3 it's an extrapolation or a continuation of what we've been
4 really been paying attention to all along, or should have
5 been.

6 MR. SPEIS: I think it's a mix of all the things
7 you've talked about. There's more efforts in some areas.
8 Some of the things are continuing. There are a few things
9 that we thought we understood and now we're finding
10 otherwise. And because of the large extent, we want to
11 pursue those few areas, okay. So, it is really a mix, okay,
12 when you scrutinize the program.

13 DR. BUSH: The functional reliability of balance
14 is a classic case. You know, as a function, some of the
15 degradation mechanisms. And when you look at the PRAs at
16 some of them and whether you believe them or not, what
17 surfaces on them is that those are great key ones and if
18 they don't operate when they're supposed to, you've got real
19 problems.

20 MR. UHRIG: Is there room for a new category along
21 here somewhere?

22 DR. MORRISON: Throw it out and let's see.

23 MR. UHRIG: I've got a category called
24 "Maintaining Control of Nuclear Power Plants." It might be
25 called "Intelligent Management," and it includes such things

1 as human factors, reliable instrumentation and control
2 systems, and systems engineering-simplification.

3 MR. ISBIN: Are these items linked to specific
4 research programs?

5 MR. UHRIG: No, they're not. But -- well, there
6 is, yes, there's the human factors programs and there has
7 been, within that category, there has been some work on
8 instrumentation and control, but it's been minimal, advanced
9 instrumentation and control. It's been a very small sub-
10 system of the human factors activities.

11 DR. BUSH: I think there's an intent, as I recall,
12 isn't -- there's a program, I believe, that's proposed to
13 look a little more at IFC.

14 MR. UHRIG: The mechanical.

15 DR. BUSH: The mechanical context. I don't know
16 if it flew off the ground or not, but it has been proposed.

17 MR. UHRIG: Well, I know that specifically
18 Beltrachhi has been sort of a one-man effort in this area.

19 DR. BUSH: Well, as I recall, it was one of the
20 components in that write-up on advanced reactors that is in
21 draft form.

22 MR. SPEIS: Yes. What he's doing now is for
23 future more than anything, second generation.

24 MR. UHRIG: Yes, except that there's a whole issue
25 of replacing instruments.

1 MR. SPEIS: That's a question that there were no -
2 - how to be able to review, that would question why it's a
3 very small effort.

4 MR. UHRIG: Yes. I guess my pitch is that it's,
5 it should be larger. That's a prejudiced viewpoint.

6 DR. MORRISON: Bob, are you really saying that
7 you'd split what is now under the broad heading there
8 "Preventing Damage to Reactor Cores" into kind of two big
9 pieces? The category you mentioned maintaining --

10 MR. UHRIG: Well, it's preventing damage, period.
11 The whole purpose of licensing, if -- one of the main
12 purposes of licensing is to give the public confidence that
13 these plants can be and are operated in a safe way to
14 prevent -- I've forgotten the words -- but, without
15 endangering the health and safety of the public. And, I'm
16 looking at things that are more directed at the operation as
17 opposed to accident things, or aging.

18 Intelligent management, I guess, is -- if you want
19 to put it in a broad category -- because almost every time a
20 plant gets in trouble, whether the initiator was a human
21 error or a failure of some sort, the big trouble usually
22 arises from the interaction of the humans involved with the
23 systems.

24 DR. MORRISON: I would raise the question whether
25 that's an NRC responsibility.

1 MR. UHRIG: Well, get rid of it.

2 [Laughter.]

3 MR. UHRIG: The systems are so complex that they
4 behave almost in a counter-intuitive manner. And,
5 simplification -- maybe that's outside the jurisdiction of
6 the NRC.

7 MR. BURSTEIN: One of the things we have to
8 distinguish -- I don't know if it is, Mr. Chairman, is the
9 application of our priorities here to existing versus future
10 plants. While I might support Bob's philosophy and
11 direction and argue strongly with him for simplification,
12 there is no way in this world that I'm going to go back and
13 retrofit 100 existing nuclear plants --

14 MR. UHRIG: I agree.

15 MR. BURSTEIN: -- with the present environment --
16 staff, funds, process, public acceptance, and so on -- to
17 accomplish what you're suggesting.

18 MR. UHRIG: Even if a piece of present
19 instrumentation or control fails and the manufacturer is no
20 longer existent, I cannot replace it with a new concept
21 without reopening the licensing process. If I want to
22 maintain my current licensing basis, I have to put it back
23 in as close to in-kind, which perpetuates a 50-year role
24 philosophy and design.

25 DR. BUSH: Unless, of course, you have no choice.

1 MR. BURSTEIN: But what choice do I have, sir?

2 DR. BUSH: One other choice is to do exactly what
3 you said, reopen the licensing process. For example, let's
4 say that you had an analog system and wanted to go to a
5 digital, or vice versa, and you couldn't replace it. Then
6 you'd do just what you'd said. For example, you've done the
7 same thing on piping systems and I don't suggest there, but
8 if you have no other choice, if you're going to take out the
9 whole damn research system of a BWR and replace it then
10 you're going to reopen the process. That's just a fact.

11 MR. UHRIG: This is what they have done at
12 Sequoyah.

13 DR. BUSH: I agree with you.

14 MR. UHRIG: Sequoyah just put an Eagle 21 in both
15 units. Their second unit is coming up this week.

16 DR. BUSH: That's a conscious decision that was
17 made by the utility, which has the option, what has in
18 contrast that they're forcing it from above. I agree with
19 Sol.

20 MR. UHRIG: But there has to be an ability within
21 the NRC to judge that system and I don't --

22 DR. BUSH: That's a different aspect of it.

23 MR. UHRIG: And that's one of the purposes of the
24 research is to provide a basis for that judgment.

25 DR. BUSH: Well, I won't disagree with you that I

1 I and C has been under-funded. For example, I feel like Sol
2 does. To put it in context, on the BWR plant, Sol, the
3 plants that are sitting like WNPl, I've said myself I would
4 never let that plant start up until they took that whole I
5 and C system and pitched it out in the river, as far as I'm
6 concerned, and replace it with a system that was more
7 reliable. But I would never under any circumstances require
8 a backfit on the other BNW plants.

9 In other words, here's a plant that is in similar
10 licensing process. You could deal with the thing -- you
11 would have a more reliable system but, by like token, it
12 should be a regulatory requirement to take an operating
13 plant and enforce that action. I agree with you completely
14 that the amount of information we have on those systems
15 within the regulatory framework is not very good.

16 MR. UHRIG: There is the horror story of the
17 Canadian medical radiator, where a glitch in the software
18 wound up killing two people and horribly overexposing a
19 number of others. And that's the kind of thing --

20 DR. BUSH: We get those all the time. That's one
21 of the -- we kill more people in the medical field with
22 radiation than in the nuclear business. In fact, I don't
23 know if you saw the last one or not; if that wasn't a
24 tragedy of errors, if ever I've seen that. The one guy who
25 put it on his neck, did you see that one? The thing was

1 withdrawn from the thing you put it on; I think he got 4,000
2 rads.

3 MR. ISBIN: Mr. Chairman, I think the discussions
4 have been interesting -- perhaps useful, but I wonder in
5 addressing strategy and content, you need to, you really
6 need to single out these priorities because we're going to
7 have a difficult time trying to explain what we mean by the
8 priorities.

9 DR. VOGEL: Or agreeing on them.

10 MR. ISBIN: And in the substance of discussions of
11 each of these major sections, we do address priorities,
12 strategy, and content. Maybe that would be the best
13 solution.

14 DR. MORRISON: Are you suggesting, Herb, to do it
15 by individual section, rather than --

16 MR. ISBIN: Individual section rather than trying
17 to single it out as initially proposed. Yes.

18 DR. MORRISON: Well, that certainly can be done.
19 I would feel a little bit remiss that we didn't go back and
20 maybe address in the context of what we did yesterday on the
21 broad mission statements, which we talked a little bit
22 about -- where should advanced reactors, for example, fit
23 yesterday? Where should waste fit?

24 MR. ISBIN: Yes.

25 DR. MORRISON: These would be the, I guess, the

1 implication that is providing the technical basis to deal
2 with the margins really are talking about mainly existing
3 plants, although it does go through into the advanced
4 plants, as well. And I thought that was coming out of the
5 discussion just a minute or two ago here on, you know where
6 do we put for example plant life extension, regardless of
7 what the motivator is there, against advanced reactors. I
8 thing in all cases we start with some concept that we don't
9 want an accident to begin with.

10 And then in the NRC program hierarchy, they say,
11 well, we want to make sure that the reactor primary system
12 has some sort of integrity. If it doesn't, what do we do to
13 prevent damage to the core and if that fails, what does we
14 do to make sure containment is all right.

15 So, there's sort of a hierarchy here within the
16 program plan anyway in terms of priorities.

17 DR. VOGEL: Perhaps another way of going after
18 this priority thing is that in the five year plan we see, by
19 implication, the NRC's priorities. We've got fundamentals
20 and so on. Maybe one approach would be to comment that this
21 program shouldn't be a low priority and the other one should
22 be decreased or whatever, you know, critique the status quo,
23 rather than to take the approach of getting priority listing
24 for the future.

25 In other words, why don't you guys put more money

1 in whatever and less money in something else. That takes
2 off the horn of the dilemma, try to --

3 MR. BURSTEIN: I think that's what we're doing is
4 evading a responsibility, if you'll forgive me.

5 DR. VOGEL: Yes.

6 MR. ISBIN: But the responsibility is very grave
7 in that we recognize the implications and yet we're trying
8 to do it in a very over-simplified manner. That's the
9 dilemma.

10 MR. BURSTEIN: I couldn't agree with you more.
11 Very good summary.

12 DR. VOGEL: Well, oversimplifying has its hazards.

13 DR. MORRISON: If that is the -- it seems like an
14 approach, and I think one could go back to the plan. Let me
15 see what page it's on.

16 Yes, page 419 of the plan, which basically shows
17 the major program elements and the budgets over a five-year
18 period. Taking your point of departure, you were saying,
19 All right, let's use dollars as kind of a surrogate in terms
20 of the importance of the program, and is this the way we
21 would stack it up? Would we change it?

22 MR. BURSTEIN: I don't see that dollars is a
23 measure of priority.

24 MR. VOGEL: Not by itself.

25 MR. BURSTEIN: If, for example, it cost \$10

1 million to test a scale model of some containment, and it
2 cost \$1 million to dig a hole and verify a seismic criteria,
3 I'm not sure that you can just automatically say that
4 containment integrity is ten times more important.

5 MR. MORRISON: I think you just reversed fields on
6 me.

7 MR. UHRIG: You know, you almost have a
8 logarithmic scale here. If you have a \$10 million item, say
9 at the reference seven, a \$1 million index of six, if you
10 have to cut, you go down to 6.9 and 5.9, the cut on the \$10
11 million is a lot more than the million-dollar one, from a
12 dollar standpoint. That's sort of what we tend to do, I
13 think, in our minds, is to look at that on sort of a
14 logarithmic scale. Sometimes little programs are very
15 important.

16 MR. BURSTEIN: Bush said I could cut ten percent
17 out of that reactor containment study and fund the seismic
18 hole in the ground.

19 MR. UHRIG: Well, that's exactly my point.

20 MR. ISBIN: I thought that the NRC had developed
21 priorities by looking at Gramm-Rudman and seeing what they
22 would need to cut out in order to survive. That table, I
23 don't have.

24 MR. BUSH: He had the different options, of
25 course, there, but I don't know if he necessarily wants to

1 release it. I wouldn't if I were in his shoes.

2 MR. MORRISON: No, I believe that we did have it
3 at the last meeting. It was one of Eric's --

4 MR. BUSH: It was a break down, that is about four
5 pages?

6 MR. MORRISON: Yes, and it's in a very summary
7 sense.

8 MR. BUSH: I think the point at which we seem to
9 be breaking up is the degree of how far we go down. We seem
10 to vibrate back and forth.

11 MR. BURSTFIN: The Commission has issued a high
12 and medium ranking of priority items, and I think there is a
13 NUREG 0933 which deals with generic safety issues and their
14 prioritization as the Commission sees it. Is this a
15 starting point for us to say we agree or disagree?

16 MR. MORRISON: Do we want to go back to that level
17 of detail, or can we accept that the staff has appropriately
18 wrapped that into the program. I don't know whether that's
19 a valid assumption or not.

20 MR. SPEIS: This is a little bit different. We
21 have two documents. One of them is the one that Saul is
22 talking about, 0933, and in that one, every time some issue
23 comes out relating to plant operations or from other
24 sources, we prioritize it in terms of its importance. So
25 that is a catalogue of everything that has come up the last

1 ten or 20 years.

2 The other thing that we have also, we have a
3 document which we prepared a few years ago where we
4 attempted to use risk criteria to prioritize our research
5 program. In fact, the research program we do have in place
6 is based from that.

7 MR. BURSTEIN: Didn't you send us something on
8 priorities from the chairman?

9 MR. MORRISON: Let me interrupt for a moment. I'd
10 like the record to show that Eric Beckjord just rejoined us,
11 and that Eric would like to make an introductory remark.

12 MR. BECKJORD: I wanted to introduce Dr. Geoffrey
13 Ballard, who is here visiting the US this week, and he is
14 head of the Safety and Reliability Directorate in the UK.
15 So he has considerable interest in the matters that happen
16 to be under discussion.

17 I met with him early this morning, and I told him
18 about this meeting and asked him if he'd like to sit in and
19 here it for a bit, and he said he would very much like to.
20 So I wanted you to be aware of his presence.

21 MR. MORRISON: We very much welcome you to the
22 meeting, Mr. Ballard. Please feel free to comment, if you
23 would like, on any of these issues.

24 MR. BECKJORD: Let's see. I did make copies of
25 the Todreas letter, which I will pass around.

1 MR. MORRISON: Which letter is --

2 MR. BECKJORD: That was the one that was under
3 discussion yesterday, and we didn't have copies of it.

4 MR. MORRISON: This was the one on the questions
5 that the subcommittee had raised and that Brian's group were
6 addressing.

7 MR. BECKJORD: Right.

8 MR. MORRISON: Good. Thank you. So I think we
9 interrupted your train of thought.

10 MR. BURSTEIN: I was just inquiring, sir, as to
11 whether or not, at again Dr. Todreas' request, we didn't get
12 from our staff counsel a copy of Chairman Carr's priority
13 list with the recent mailing.

14 MR. MORRISON: I got it. Well, we got his
15 activities. Are you talking about the same document?
16 Commission activities?

17 MR. SPEIS: It's a two-page memo.

18 MR. BURSTEIN: That wasn't very relevant.

19 MR. BUSH: In fact, I brought it with me and
20 looked at it, and decided finally it's not really relevant
21 to what we're discussing today in most cases.

22 MR. BURSTEIN: It identifies the items that the
23 chairman at least, if not the Commission, feel are of
24 relative priority to them.

25 MR. SPEIS: It's more than the chairman's. They

1 update it every six months, and the Commission concurs with
2 it.

3 MR. BUSH: Most of the items on there I couldn't
4 tie to what we're talking about here.

5 MR. MORRISON: It's certainly not done to the
6 level of detail we have here. We have to read between the
7 lines.

8 MR. BUSH: Really read between the lines. I tried
9 to, but I wasn't successful.

10 MR. SPEIS: Well, advanced reactors are there,
11 waste, license renewal.

12 MR. BURSTEIN: Under research, the identified
13 items are not too far different from what we have, the
14 license renewal, severe accident, waste issues.

15 MR. MORRISON: Conspicuous by its absence was your
16 mention of advanced reactors, which I think we put on the
17 list as a priority.

18 MR. BURSTEIN: It is not included under research.
19 It is in other areas.

20 MR. MORRISON: Other areas.

21 MR. BURSTEIN: Yes.

22 MR. MORRISON: Okay. Herb, let's come back to the
23 train of thought that you were talking about of approaching
24 this whole subject of priorities. I had the sense you felt
25 we were off in the wrong direction.

1 MR. ISBIN: Yes. I felt that the task is not
2 achievable under these circumstances to briefly list
3 priorities; that we could be much more effective in carrying
4 out Taylor's request on commenting on strategy and content
5 by including such remarks in the text which we developed,
6 and that we would omit the priority list, as you have
7 indicated.

8 MR. MORRISON: I think probably we get -- we may
9 have a difference of opinion on what we mean by strategy. I
10 think the farther down we get into the list in trying to set
11 priorities, the more it becomes a non-strategic issue and
12 very much one of a day-to-day tactical kind of dispersement
13 of funds.

14 MR. ISBIN: One point in the text is to comment on
15 areas where you think perhaps priorities should be increased
16 or decreased. That would give you that opportunity. But in
17 general, the Committee apparently concurs on the major
18 directions.

19 MR. VOGEL: I think that what we're thinking
20 really about is fine-tuning the priorities, a major
21 evolution.

22 MR. MORRISON: I understand what both of you are
23 trying to say, and language that makes sense to me is that
24 if were to go back to the major missionaries that we agreed
25 upon yesterday in roughly some order -- and not going so far

1 to say that that order is priority, but at least it was an
2 order in which we felt they should be addressed, that in
3 general the current program addresses those in about the
4 right degree of priority, and maybe even to the right
5 distribution of funds across those major areas for program
6 elements that are used in the plant -- than each of the
7 individual sections ought to deal within that, given that
8 the integrity of the reactor components is so many millions
9 of dollars, take what Spence is saying, is these are the
10 right priorities within that.

11 MR. ISBIN: Yes.

12 MR. MORRISON: And do the same thing in the other
13 major categories.

14 MR. ISBIN: Yes.

15 MR. MORRISON: But don't bring those numbers up
16 into some broad simplified table list.

17 MR. ISBIN: Yes.

18 MR. MORRISON: Does anybody have discomfort with
19 that?

20 MR. VOGEL: I have more comfort with it.

21 MR. MORRISON: Less discomfort.

22 MR. BURSTEIN: I think we're all comfortable with
23 that, Mr. Chairman, but I wonder if it's responsive to the
24 charge of this committee. If the NRC would be comfortable
25 with that, or if they would find that it presented them with

1 a problem, it may have a bearing on how the committee is
2 asked to respond.

3 Basically, I think the committee is free to make
4 its own judgment, obviously, as to how it wishes to handle
5 that matter, but I don't think any -- at least I am not
6 uncomfortable with that approach. My only concern is, does
7 it fulfill the committee's obligation? If everybody feels
8 that it does, I certainly would not argue contrary wise.

9 MR. MORRISON: Well, I would attempt to fulfill
10 the committee's obligation by writing a couple more
11 paragraphs behind our list of items in the requirements
12 section and trying to put that in context, and, at least in
13 general words, tie together what we think our priorities are
14 without trying to put --

15 MR. BURSTEIN: That would satisfy me even more.

16 MR. MORRISON: Okay. Let me try that in the next
17 draft. The next draft is going to look quite different from
18 the current one.

19 MR. ISBIN: I think that's a very good suggestion.

20 MR. MORRISON: Well, then, let's look at the
21 program areas, then, or the program elements. I think,
22 Spence, we have all of yours now in that marked up draft?

23 MR. BUSH: Mine are down. As I say, I've got them
24 down as a subcategory, and you can look them up, if you want
25 to. Everything is in there that I looked at.

1 MR. MORRISON: Okay. So your marked up one, it
2 breaks out piping integrity as a --

3 MR. BUSH: Yes.

4 MR. MORRISON: I think that's probably a good way
5 to go because there is such a disparity in your thinking
6 between the vessel and the piping integrity.

7 MR. BURSTEIN: It seems to me, Mr. Chairman, that
8 yesterday we also dealt with a couple of the others. Are
9 you going to get to each of those in turn?

10 MR. MORRISON: Oh, yes.

11 MR. BURSTEIN: Fine.

12 MR. MORRISON: We're satisfied with integrity of
13 reactor components, and just using this 7 and 8 as simply a
14 table to follow. I'd like to see what we're doing in the
15 preventing of damage to the reactor cores since that cuts
16 across two of the subcommittees -- actually, three of the
17 subcommittees, I believe.

18 MR. VOGEL: I'm not sure on the engineering
19 standard support whether medium is crossed out and high is
20 written above it, or whether that high applies to inspection
21 procedures.

22 MR. BUSH: That's inspection procedures.

23 MR. VOGEL: All right. Then the medium --

24 MR. BUSH: It still stays with that one. That's
25 the highest of that category. One reason for doing some of

1 this, I think, is that I feel strongly on some of these
2 issues that we should achieve closure in a reasonable period
3 of time, and a reasonable period is three or four years.

4 You remember the chairman commenting that he felt
5 one of his major functions was that he had finally after,
6 what, six -- no, it was more than that -- since the Civil
7 War, that one program that he had finally been able to deep
8 six. It's very nice to say that something is done -- your
9 point -- and say we will continue --

10 MR. BURSTEIN: I have been trying to declare a
11 victory and go home for a long time.

12 MR. VOGEL: All that's very fine, but to get
13 something done, it takes money at the end, so it cannot be a
14 low priority when you're trying to complete it.

15 MR. BUSH: I agree.

16 MR. VOGEL: Yes.

17 MR. BURSTEIN: Let me take the piping. We have
18 come a long way from the business on supports. We have
19 decided. We have a GDC that says, you know, it's a leak
20 before break, in contrast to the other one. Quite a few of
21 the things we're doing now are frosting on the cake. It's
22 nice to know that it's maybe not that critical?

23 MR. MORRISON: Why don't you, Spence, when you
24 mark up your draft, put that statement in there, or
25 something to that effect that does indicate those items that

1 you believe need to be brought to closure, need and can be
2 brought to closure, in a period of a few years, as specific
3 as you feel comfortable in being.

4 I think it would be useful. Even the sense that
5 it should be closed in a few years is going to be very
6 helpful, I think, to the reader of the report. Well, I
7 believe that represents the sense of what we've been saying
8 around the table.

9 MR. BUSH: I think so.

10 MR. VOGEL: Elaborating on this closure business,
11 one of the things that happens is people ask for closure on
12 a given item, and they say, Well, the way we're going to get
13 closure is to get the money. Then you leave the problem
14 incompletely solved. That's no way to get a closure, to
15 walk away from an unsolved problem.

16 So my thought is that the funding should not be
17 brought down to a very low level to get closure; you should
18 get closure for technical reasons.

19 MR. BUSH: Well, I agree, but, you know,
20 confirmation a week before break -- this is kind of a
21 peculiar thing to do, and we already have on the books the
22 GDC-4. If you really felt that concerned, you should have
23 done it before you ever modified GDC-4. As far as I'm
24 concerned, that issue is pretty well closed.

25 MR. VOGEL: Technically closed, but not

1 financially closed.

2 MR. ISBIN: Do you think that, in your statement
3 on closure, you might reflect some of this, as well as some
4 specific items which Spence and others may enumerate?

5 MR. MORRISON: I believe that it should be, and
6 that's one of the reasons we're putting that topic on the
7 list. We talk about closure. Obviously, there are two or
8 three ways to look at it, one just what Dick is talking
9 about, from the technical aspect. I think the second one is
10 the procedural aspect, such as how do you really declare
11 victory within the NRC on that, looking that there may be
12 user needs that come in from outside of research, and maybe
13 within research, you agree that the technical victory is
14 there, but somebody says, No, I don't feel that it is. So
15 how do you resolve that?

16 It's not clear to me what the mechanism is. Maybe
17 there should be a mechanism. Otherwise, you continue
18 forever, and you don't have control over your research
19 program if you continue forever on that.

20 So it's a combination of both the user needs and
21 the closure section there, and that may have to be scrambled
22 or rewritten to get the idea across correctly.

23 Well, Herb and Dick, I guess, what about this area
24 on your subcommittee. There are three major elements in the
25 draft in that area. Is that sufficient to discuss the

1 priorities?

2 MR. ISBIN: We have revised it very extensively,
3 and you would need to see the draft copies in order to
4 comment. I think, Dick, that we do have items there in
5 which we're talking about priorities, changes, cautions. I
6 think it may be sufficient, but Dick and I will review it
7 again just to be sure.

8 MR. MORRISON: That's a good idea.

9 MR. BURSTEIN: We did, as I recall, in our earlier
10 discussion relating to page eleven and twelve, perhaps not
11 specifically renumber those items 1, 2, 3 --

12 MR. ISBIN: We ordered them.

13 MR. BURSTEIN: That's right. As I recall, the
14 order was --

15 MR. ISBIN: Integral system groups first, but not
16 as a 1, but as a bullet.

17 MR. BURSTEIN: That's right. But in that
18 sequence, we had, I guess, 2, 3, 1 is the way we ended up.

19 MR. ISBIN: Correct. Yes.

20 MR. BURSTEIN: So that, in effect, you did give
21 some prioritization to those.

22 MR. ISBIN: Oh, yes. Oh, yes. And we changed the
23 content as well.

24 MR. VOGEL: What you're suggesting is that for
25 this particular section, perhaps we add a paragraph, a

1 general comments/summary paragraph on priorities within this
2 section which we call "Systems and Severe Accidents."

3 MR. ISBIN: Only if we think it adds to the
4 strategy that's not already implied.

5 MR. MORRISON: Yes. If I can get it out of the
6 text, it would be all right. My problem was on page twelve,
7 for example, where you had called out a specific heading of
8 "Priorities," and said "No further comments."

9 MR. ISBIN: We crossed all that out.

10 MR. MORRISON: Yes. And I kept trying to read
11 back into that, and I couldn't get any sense of priorities
12 from what preceded it.

13 MR. ISBIN: No. We have reworded the contents.

14 MR. VOGEL: Now we've got a new deal on this
15 section.

16 MR. ISBIN: Yes. It's almost entirely rewritten.

17 MR. MORRISON: A general question, since you two
18 have looked at this in more detail overnight, are those
19 three major categories sufficient? Does that encompass your
20 thoughts and enhance the committee's thoughts on what should
21 be under this broad heading of "Systems and Severe
22 Accidents"?

23 MR. ISBIN: It certainly doesn't include all of
24 the topics that one would find in the five-year budget.

25 MR. VOGEL: My own feeling was I didn't think we

1 were obligated to comment on everything.

2 MR. ISBIN: Right.

3 MR. MORRISON: I agree, but maybe we need a
4 sentence in the very beginning saying why these three, and
5 not ten others.

6 MR. MEYER: Yes. I think that's -- I've been
7 sitting here looking at Spence's part as well, where Spence
8 started with categories that were the same as those in the
9 five-year plan, and then you split a few of them up, added a
10 few, and changed them around. I started thinking how
11 difficult it's going to be to deal with this on the
12 receiving end when the report is providing comments that
13 aren't in register with the plan that we're working with.

14 In cases where I think you have an important point
15 to make about the plan that we're not working with is in
16 some way inadequate, like the piping and the program vessel
17 program should be split into two programs for the following
18 reason, that that could be helpful. But now you get into
19 the Preventing Damage to Reactor Cores Program, and the
20 comments are even more selective. I begin to wonder, Well,
21 what about the other large portions of the program, and what
22 is the committee's advise in that regard?

23 MR. VOGEL: I think probably -- it's maybe not a
24 completely safe assumption, but you can assume that if
25 there's no comment that we're not all that unhappy.

1 MR. ISBIN: But I think we're being asked to make
2 some statement in that regard so that items are not omitted
3 as such. Okay. I think we have in the instruction.

4 MR. MORRISON: I'm not asking for a lot, because
5 it's my impression that the charge given to us by the EDO
6 was to look strategically. We could follow a path of
7 saying, Well, we've looked at the plan, and here's the
8 response on item by item, but I don't think that's what we
9 have to do. I think we should come back and say, It's the
10 committee's viewpoint that here are the big items that need
11 to be addressed, and that's what we're focusing on
12 strategically. By definition, don't read anything into that
13 on the other items pro or con, but these are the most
14 important ones that we felt were worthy of --

15 MR. MEYER: As long as it's clear, I think that
16 will work. However, if your advice begins to look like a
17 detailed list which is out of register with our plan, then
18 it could be confusing unless you make it clear at the
19 outset.

20 MR. BUSH: Well, in recognition of what you said,
21 and I think for very good reasons Dave dropped it, but my
22 letter to you actually started with a tabulation that shows
23 the items, bing, bing, bing, just as they are, maybe not --
24 they're in the budget plan if you dig it out, but they're
25 effectively this one. By having that at the beginning, you

1 can immediately see when they move from the rank order in
2 here to the other rank ordering.

3 I don't think it's necessary, incidentally, but
4 for my purposes, it tied to it, it made it easier for me to
5 write the letter. What it does then effectively, by its
6 absence, you see some of the things in here. I think it's
7 harder in your area, quite a bit harder than I had.

8 MR. VOGEL: Yes.

9 MR. MORRISON: Well, the other two items, then,
10 that we had information on yesterday were the human factors
11 and the earth sciences area.

12 MR. BUSH: Well, we also had it on the waste
13 indirectly. It wasn't included, but we had it in the
14 letter. Remember, it didn't get in the report, but he had
15 written a couple of pages on high-level waste.

16 MR. MORRISON: Oh, there were a couple of pages on
17 high-level waste, yes. Well, to start with that, since you
18 have it on the table, the basic comment there was to make
19 sure that the low-level and the high-level waste programs
20 were at least integrated with one another and in common
21 elements. In a sense, that's motherhood, but on the other
22 hand, given a tight budget, it makes infinite sense to do
23 that, and the technology or technical base isn't all that
24 different.

25 MR. BUSH: That is a confusing factor, and it

1 makes it a little more difficult in the sense that that
2 money -- the one pocket comes out of -- by one path and the
3 other one comes by another path. I don't think that is
4 anything we need to worry about, or that would be my
5 feeling.

6 MR. MORRISON: Unless we feel that the color of
7 the money constrains the program.

8 MR. BUSH: Then it would be critical. That's
9 right. I agree.

10 MR. BURSTEIN: There is one part of that earth
11 sciences or waste program relationship that affects
12 production plants, and that's the seismic issues and the
13 seismic design criteria for nuclear power plants and other
14 facilities in general.

15 There are a number of questions and priorities
16 within that area that have across-the-board application, and
17 I think the resolution, for example, of the differences
18 between a Lawrence Livermore and EPRI issue that we debated
19 at length yesterday is, to me, a higher priority than five
20 years, because what it now says is that we've got two
21 methods, both approved by the Commission, and the Commission
22 staff's answer is we take the one that gives us the worst
23 result or the best result, depending upon their point of
24 view, which is a very awkward and certainly not helpful
25 situation in either existing plant designs or modifications

1 and certainly on new plants.

2 So there are priorities within that particular
3 grouping, sir, that, while it may appear low in relation to
4 that grouping as we discussed at the onset, I think the
5 seismic issue, for example, surfaces high on the overall
6 across-the-board application.

7 MR. BUSH: That's a subset, and there's an anomaly
8 in that in the sense that that was looked at by the group
9 that was looking at waste. Quite frankly, it's much more
10 pertinent at this stage to the reactors rather than it is to
11 the waste program.

12 MR. BURSTEIN: It illustrates the problems you
13 enumerated at the beginning.

14 MR. MORRISON: It also illustrates that that's a
15 program that is roughly a million dollars, and it's not a
16 big-ticket item because you can't spend that much money in
17 there, and it's a very important item to pursue. I will
18 reflect that in the draft, then, on that rewrite.

19 One that I think we need to come up with some
20 guidance on is the human factors, where it fits in terms of
21 priorities. We'll worry about getting the words to fit that
22 one.

23 Bob, did you have a chance to read the write-up
24 that I had in the draft report I sent around?

25 MR. UHRIG: That was delivered last night when I

1 got here?

2 MR. MORRISON: Yes.

3 MR. UHRIG: Yes. I went through it, maybe a
4 little hurriedly, but I did go through it.

5 MR. MORRISON: Knowing that you've been working in
6 that area, I wonder whether you have any comments or
7 feelings about it. Saul has marked it up considerably
8 overnight.

9 MR. UHRIG: I didn't mark it up. I just went
10 through the whole thing, very hurriedly. But let me come
11 back to human factors. It's an area that I think we have
12 been made very sensitive to as a result of Three Mile
13 Island, and it continues to be an area where it's
14 importance, I think, is demonstrated over and over again.

15 I don't know quite where it fits in this program.
16 It's not containment, it's not -- it's really operationally
17 oriented, and that's why I was throwing it in the category
18 of maintaining control or intelligent management, something
19 of this sort.

20 But the question that's fundamental here is, is
21 this an area that the NRC should be doing the research in,
22 or should the utilities and the vendors be doing it?

23 MR. BURSTEIN: Are there safety implications to --

24 MR. UHRIG: Oh, absolutely.

25 MR. BURSTEIN: That justifies NRC's participation

1 to whatever degree you recommend, but clearly if there is a
2 safety connection to human behavior or performance, and
3 clearly it impacts now the jurisdictional --

4 MR. UHRIG: Such issues as the allocation of
5 function between man and machine. Within the basic design
6 of the system, again, I have the same problem Sol has here
7 -- you can't go back and retrofit 106 reactors, or whatever
8 the number is. You can't drastically change them. But
9 there may be places where some intelligent changes could be
10 made.

11 MR. MORRISON: You were saying that you look at
12 the program through some risk criteria. How does the human
13 factor shape up in that in terms of setting priorities? Can
14 you enlighten us any on that?

15 MR. SPEIS: Well, you know, it's not that easy to
16 quantify human errors, you know, and people have been trying
17 the last ten years. But we have to continue because every
18 time we go out and evaluate an event, especially an event of
19 some importance severity, when you read those reports, you
20 find out that, you know, quite a few of the things that went
21 wrong were due to human errors or some interaction between
22 the machine and the human himself.

23 MR. UHRIG: Has there been an attempt to separate
24 those things that are purely human and those that are due to
25 the interaction with the machine?

1 MR. SPEIS: Yes. We're trying, and, you know,
2 there are the early attempt -- Sandia put out some handbook
3 on trying to assign quantitative values to human errors, but
4 they were kind of rough. That information, of course, came
5 not only from the nuclear industry, but from other places.
6 But we're trying now to, based on what has happened the la
7 ten year, to assign, to try to do that separation that
8 you're talking about, to be more quantitative. But it's
9 always going to be a question mark, you know.

10 MR. UHRIG: It's hard to separate the nuclear
11 field from the other fields. There is the classical curve
12 of error rate versus information transfer rate, where it's
13 high on the low end because of boredom and high on the other
14 end because of information overload.

15 MR. BURSTEIN: I knew we'd get to that bell-shaped
16 curve sooner or later.

17 MR. UHRIG: It's an inverted bell.

18 MR. BURSTEIN: May I ask a question of Robert,
19 whose knowledge in this area far exceeds mine, certainly.

20 MR. VOGEL: You're being set up, Bob.

21 [Laughter.]

22 MR. BURSTFIN: One of the matters in this write-up
23 had to do with the idea of human performance prediction or
24 behavior prediction, which I feel is a rather awkward, to
25 say the least, thing to be pursuing at this stage in our

1 knowledge of human factors science.

2 MR. UHRIG: You do this every time you license an
3 operator.

4 MR. BURSTEIN: Yes, to some degree, but is that
5 what we need --

6 MR. UHRIG: You're predicting whether he's going
7 to be able to handle the problems that are going to come up.

8 MR. BURSTEIN: That's an implicit situation. What
9 I'm doing is testing his experience and training by giving
10 him an examination, and I do that with a physician or a
11 doctor or something else, or an operator, or any other
12 licensed thing. But that gives me a probability that,
13 because he knows so much now and he's of good stable
14 personality, that maybe he will perform better than an
15 average off-the-street person.

16 But the question of spending a lot of money and
17 trying to get to human performance prediction at this stage
18 of the state of the science is one that I wondered if you
19 had an opinion about.

20 MR. UHRIG: Well, the answer is no. I am not a
21 human factors person. I come at this from the
22 instrumentation and control side. Most of my work has been
23 in conjunction with human factors people in this field, and
24 I sort of represented the technical side and they
25 represented the human factors side.

1 So the answer is no, I don't have a good feel for
2 this except that I am increasingly sensitive to how
3 important it is, to again come back to the allocation of
4 function, to the responsibility that the operator has here.
5 What is his role? Should he be a button flipper, or should
6 he be a manager? I think we're in that transition.

7 We've done that in the space program. NASA was
8 launching they're using 800 and 900 people to launch a
9 mission back in the moon days. They backed up, automated
10 the systems, and now they're routinely launching missions
11 with, oh, 80, 90, 100 people. It's a different philosophy.
12 That transition has not been made in the nuclear business.

13 MR. VOGEL: The problem is the difficulty of
14 communication between the soft scientists and hard
15 scientists. We continually stumble over trying to
16 understand what the human factors people are talking about.

17 MR. UHRIG: An awful lot of handwriting.

18 MR. VOGEL: Yes.

19 MR. SPEIS: There are so many elements that are
20 interconnected, you know. For example, you talk about the
21 operator, how well he understands his role, how clear are
22 the instructions, when does he improvise or he follow
23 blindly the procedures, training. There are so many things.
24 So once we start looking at the human error rate, then we
25 have to bring all these elements that bear on that subject.

1 MR. BURSTEIN: We heard yesterday that the amount
2 of procedure violations by operators was one or two percent,
3 and there was no significant consequences as a result of
4 those procedure violations.

5 Now, if we broaden the human factors concern as to
6 say, When this pump fails because of a design flaw, is that
7 a human factors clause or is it an equipment failure?

8 MR. SPEIS: I guess I don't know what you were
9 talking about yesterday. Maybe you were talking about
10 willful violations versus --

11 MR. BURSTEIN: No. We talked about all of them.

12 MR. UHRIG: Well, I would challenge that number.

13 MR. BECKJORD: I thought we were talking about the
14 willful violations.

15 MR. BURSTEIN: There were ten deliberate
16 violations, 40 we couldn't --

17 MR. BUSH: Which had no measured consequence,
18 apparent consequence.

19 MR. BURSTEIN: Right. And 40 we couldn't
20 distinguish, and the balance were all --

21 MR. UHRIG: I thought I had seen 40 human error
22 type explanations on licensee event reports from Sequoyah
23 alone in the last four months.

24 MR. BURSTEIN: The bulk of them were inadvertent,
25 were not deliberate.

1 MR. UHRIG: Oh, yes. They were violations of
2 procedures. They just said, To hell with it. I'm here in a
3 high radiation field. I'm going to get the job done and get
4 the hell out. You know, that kind of thing.

5 MR. BURSTEIN: That's a deliberate.

6 MR. UHRIG: Yes, that's a deliberate, and that
7 happens.

8 MR. BURSTEIN: I don't blame them.

9 [Laughter.]

10 MR. BUSH: Well, the other thing we have to
11 recognize on the reported violations is the reported
12 violations are just that, and the number of violations on
13 human factors, there are a lot of them that aren't reported.
14 I think we all recognize that.

15 MR. UHRIG: Well, violations of the procedures are
16 reportable.

17 MR. BUSH: If they're detected. There are a lot
18 of them that aren't detected and aren't reported.

19 MR. UHRIG: I can't argue with that.

20 MR. BUSH: That's the only point I was making.

21 MR. BURSTEIN: Now, I don't know how many.

22 MR. BUSH: Well, all I know is there are quite a
23 few than are reported.

24 MR. UHRIG: They are reportable.

25 MR. BUSH: Oh, yes. I don't disagree with you.

1 MR. BURSTEIN: One of the things that some of us
2 had hoped the human factors program would develop is some
3 early demonstration of achievement, of accomplishment. Are
4 we just spending money to entertain this new discipline, or
5 are there some real opportunities for us to achieve some
6 results?

7 We talked about the opportunity for perhaps human
8 factors applications to instrumentation and control which
9 the computer display operator interface and the application
10 of computers to perhaps safety control features, which imply
11 a whole host of issues that we have already addressed and
12 have pretty well set in concrete for the last several
13 decades -- whether they should be rethought, whether we need
14 to talk about dependence on unique digital systems or not is
15 an issue.

16 Some people have hoped that when it came to things
17 like training, shift rotation, size of plant staffs and
18 function, and other relatively simple and what would look to
19 an outside as a soluble problem, would be addressed and
20 resolved first to give the community confidence in this
21 human factors concept and approach.

22 But if we try to apply it to the ultimate
23 intelligent management function all the way through, we're
24 going to, first of all, not get results for 20 years, and
25 secondly, we're going to turn off a hell of a lot of folks

1 in the interval who are going to say we've been pouring
2 money into this thing and we don't show any progress.

3 So hopefully, the NRC human factors research
4 effort could be directed towards some early successful
5 demonstrations to build confidence into this discipline.

6 MR. UHRIG: The problem here is that it's an art,
7 not a science yet. There are, however, certain things that
8 are very logical, very reasonable to expect to come out of
9 this.

10 A lot of this has been done on the human factors
11 evaluation of the control room panels, such things as
12 simpleminded as four channels here instead of one, two,
13 four, three. So every time the operator looks at it, he has
14 to invert the three and the four from his logical thinking
15 pattern because somebody put them in backwards.

16 Another thing in the human factors area we run
17 into in TMI. We made a recommendation to a committee that I
18 chaired about ten years ago that on the rotational shift,
19 they rotate them like once a month instead of every week.
20 Once in six weeks would have been better because of the
21 ability of the human body to adopt to this shift.

22 The operators just rebelled against it. They
23 said, Our wives will kill us. They would not go along with
24 it at all, in spite of the fact that there was clear
25 evidence that ,from the ability to be alert, the ability to

1 maintain and operate that plant safely, it was better to
2 rotate shifts every six weeks instead of every week.

3 There are other factors that come in here.

4 MR. VOGEL: Sometimes, I think that there is an
5 element in the human factors work that's institutionalizing
6 common sense.

7 MR. UHRIG: Well, if you just did that, you would
8 be successful.

9 [Laughter.]

10 MR. BURSTEIN: I hope that you're not indicting
11 this technology by saying we deliberately don't. There have
12 been glitches, of course, but I think the idiot who doesn't
13 put one, two, three, four in his switches or fixes it when
14 it's wrong should get fired, and if he were working for me,
15 he wouldn't be very long.

16 MR. UHRIG: You should have seen some of those
17 review and what was there.

18 MR. BURSTEIN: And I agree. I think it's stupid
19 to put the indicator over here and the control switch for it
20 over there. But those are -- I think, again, the common
21 sense approach to that gives us hopefully a basis on which
22 we've been mostly successful up until now.

23 I am intrigued by the statement that this is an
24 art still, and not a science yet, in which case it makes it
25 that much more difficult for us to deal with.

1 MR. BECKJORD: Well, you could conclude from Bob's
2 statement that the focus on the study on shift rotation was
3 too narrow, that it should have included the wives' desires
4 in this.

5 MR. BURSTEIN: We said this, you know, we talked
6 about predicting the behavior based on the fellow's previous
7 shift history, his position, maybe the state of the plant.
8 Nobody has ever taken into account whether he had a good
9 night's sleep, whether he was off two days before, whether
10 his children were sick or his wife was having some health
11 problem --

12 MR. UHRIG: Or his mother-in-law came.

13 [Laughter.]

14 MR. BURSTEIN: Yes. What his personal situation
15 is that may have had a much greater impact on his demeanor
16 and his attention and his focus during that particular
17 shift.

18 Nobody has interviewed, and I asked this question
19 when we had our meeting, nobody has interviewed the labor
20 unions to see whether they would participate in some of
21 these programs, because I think without them, the imposition
22 of shift schedules, as you pointed out, is almost an
23 impossibility.

24 MR. MORRISON: Well, the question in my mind is do
25 you continue to study those issues and try to get a better

1 definition of it, or are we smart enough now to conclude
2 that we're not going to fix the human side of the problem.
3 What can we do from technology that will eliminate any
4 issues that might occur? You aren't going to have a meter
5 that the operator walks through in the morning, and, as he
6 goes through, just like in the airport, you're okay or
7 you're not okay.

8 MR. BURSTEIN: Sure we do. It's called fitness
9 for duty.

10 MR. MORRISON: I don't know how you do that.

11 MR. BURSTEIN: We have a requirement. These guys
12 imposed it on us for operators.

13 MR. UHRIG: There was some work done a few years
14 ago on voice analyzers in terms of trying to determine the
15 state of a person's well-being, and it was very interesting.
16 It was not infallible, and at the time we looked at it, we
17 talked to the NRC about it and got a very negative response.
18 I guess we were trying to substitute it for some other
19 things, but --

20 MR. BURSTEIN: Lie detectors are illegal in a lot
21 of places.

22 MR. UHRIG: This is not a lie detector.

23 MR. BURSTEIN: The emphasis ought to be on the
24 technology side. What can I do to that control panel or
25 what can I do on a digital control system that doesn't

1 really matter what that status of the operator's voice is,
2 because I don't think I can change all the operators. I
3 think that number of variables is much higher than we can
4 deal with.

5 MR. UHRIG: We're sitting here in an age of
6 computers where you can intelligently manage systems, and
7 literally second-guess the operators and everything they do,
8 and it's --

9 MR. BUSH: Some things.

10 MR. UHRIG: Some things. Okay. But the
11 Taiwanese, with EPRI's financial backing, have put in an
12 emergency operating procedures expert system, and they swear
13 by it. They have positive evidence that the average
14 operators can significantly improve their performance
15 through the use of this system, and it's as good as or
16 better than the best operators, and for the beginners, it's
17 fantastic in terms of the improvement.

18 So here's a technology that is in place, at least
19 one place in the world -- it could be put in place elsewhere
20 -- that has, at least on the basis of tests, shown that it
21 improves the ability of the operators to deal with
22 emergencies, and that's the name of the game.

23 MR. BUSH: There's one thing about human factors
24 that doesn't get factored in. At least I haven't seen it,
25 and that worries me. That is that, as indicated in the

1 discussions yesterday, most of these events tend to be
2 inconsequential. The problem is it does not consider the
3 fact that that may be a precursor event, and there may be a
4 follow-on event that does it.

5 The classic example I think about that still gives
6 me cold chills is one at Trojan, where the NRC -- I guess it
7 was the AEC in those days -- made a decision which I said
8 was stupid, and I was bias, and that is that to make sure
9 that the thing would work, once you set a valve, you pulled
10 -- do you remember when they did that there, so that there
11 could be no electrical impulse, and you had to reactivate?
12 These are the safety valves, and they had to be in a certain
13 position.

14 I said, I'll bet you any amount of money that
15 somebody is going to do it wrong, and sure enough, at
16 Trojan, they had valves for nine months that were
17 misaligned, and, of course, if you had an accident, they
18 wouldn't have worked. Somebody would have had to go to
19 another panel someplace off in the distance here and close
20 that circuit breaker in order to operate the valve.

21 That's the thing that really scares the hell out
22 of me because it's not the first event, it's if you have
23 another event that goes with it that you get into trouble.

24 MR. UHRIG: Well, I've never been involved in an
25 incident that there wasn't multiple causes.

1 MR. BUSH: What if there wasn't multiple causes?

2 MR. UHRIG: There always is. There always is.

3 MR. BUSH: I'm not sure that some of the programs
4 cover that type of thing because it isn't the first one that
5 worries me. Ask the question: Well, if this happens
6 tomorrow, after having this happen today, what is my
7 situation?

8 MR. UHRIG: I had a fuel-handling accident about
9 25 years ago at the University of Florida that still -- you
10 look at it, and you say the whole thing was insane. Nobody
11 got hurt, but --

12 MR. VOGEL: I had a hydrogen explosion in a
13 plutonium glove box. Three things went wrong
14 simultaneously, and of course it was a quarter of five on a
15 Friday.

16 MR. UHRIG: Or four o'clock in the morning.

17 MR. MORRISON: We all have those horror stories.

18 MR. BURSTEIN: Mr. Chairman, it seems to me that
19 in connection with the human factors issues, you will be
20 circulating some revised text, but I would again like to
21 emphasize that when it comes to matters of importance or
22 priority or emphasis, I should urge consideration of those
23 programs that show a potential for success at an early time.

24 I'm repeating myself I realize, but I think we
25 need to achieve some going on with this, and that it

1 probably, in my view, is certainly a high-priority item, but
2 not as high as reactor vessel integrity or containment
3 integrity if we were to compare these things on a broad
4 issue.

5 I think those items that have potential
6 significant payoffs but require very long-term scientific or
7 artful development are of lower priority -- predictive
8 behavior, for example, or even total substitution of the
9 human element in plants. While desirable in some cases, if
10 indeed we have confidence that all these systems are better
11 than any human we can apply, let's get rid of the operator,
12 as is done in some safety operational features in other
13 countries.

14 MR. UHRIG: The example that I cited here, the
15 Taiwanese, they do not have emergency procedures in the
16 control room at all. They are all within the computers.

17 MR. BURSTEIN: Well, again, that's great for the
18 Taiwanese, but the U.S. Nuclear Regulatory Commission would
19 not permit that, and I don't know how long it's going to
20 take for them to get around to considering it. But that, to
21 me, is a longer term lower priority issue compared to some
22 of the others we've mentioned.

23 MR. VOGEL: Bob, I'm reminded of the incident that
24 was described to us yesterday on the candor reactor, where
25 there was a software glitch which led to an accident. Was

1 Bruce?

2 MR. BECKJORD: I think it was Bruce. I thought it
3 was Bruce, but I could be wrong. The machine was moved by a
4 software instruction that was -- there should have been a
5 hold put on it, as he explained.

6 MR. BUSH: I understood that the reactor
7 effectively -- what happened is that the computer went down
8 or something, and so it didn't go back to Step 1, you know,
9 it kind of caught in between and skipped a step.

10 MR. BECKJORD: It moved the machine and it caused
11 a loss of coolant.

12 MR. UHRIG: Here again is a verification and
13 validation issue, that this is a big issue that --

14 MR. BUSH: There was a debate whether they had
15 done beta testing on the software or not.

16 MR. VOGEL: Can Taiwan ever really be sure it's
17 gotten all those glitches out?

18 MR. BUSH: Well, it depends on how many lines of
19 information you have.

20 MR. SPEIS: Mr. Chairman?

21 MR. MORRISON: Yes.

22 MR. SPEIS: I would say that 80 percent of the
23 problems in this area are defined for us or ask from the
24 other offices, especially NRR and NMSS. It is true that
25 part of our problem is exploratory, okay, because of the

1 word that was used here, "art," and what we're doing in that
2 case is trying to correlate, you know, go back and look at
3 safety indicators vis a vis human errors, or maybe
4 organization structure, and so on and so forth.

5 So in that area, it's possible that we might not
6 come up with anything, but we feel it's important enough to
7 go through this exploration and then sit back and see, even
8 after we come up with correlations, do those correlations
9 make sense, okay, and then see if something worthwhile comes
10 out of it. So I would say that's probably 25, 25 percent.
11 But in most of other areas, you know, it's kind of well-
12 defined problems.

13 MR. MORRISON: Sol, you had a comment on that?

14 MR. BURSTEIN: Yes. I was just going to remark
15 that, again, Bob raised this question early on that we
16 should address, and that is who should do some of this
17 research? Should it be within the NRC, particularly the
18 exploratory and developmental areas, or should it be in
19 other institutions?

20 Obviously, I think, if it's done outside the
21 Commission's staff endeavor and budget, there must be
22 somehow a follow-up or an awareness of participation and
23 information gathering of what is occurring in the rest of
24 the world and in other complex system applications.

25 MR. UHRIG: The thing that came out of our study

1 on the advanced instrumentation was the need for criteria,
2 acceptance criteria. There is a lot of interest, both in
3 the utilities and the vendors, in dealing with advanced
4 systems, but none of them seem to be willing to put much
5 money or effort into it until they at least have some
6 assurance that there is some criteria as to what would be
7 acceptable and what would not be acceptable. That's maybe
8 the area where the research is needed.

9 MR. MORRISON: I think maybe we've spent about
10 enough time on this, but I did want to get back to a comment
11 you made earlier about the Commission meeting yesterday and
12 some questions or concerns on the human factors program.

13 MR. BECKJORD: Oh. One thing you ought to be
14 aware of, by the way, the Chairman spoke at the end of the
15 meeting, and Dr. Speis was there with Tom Ryan, who gave the
16 presentation. I think he said that he particularly wanted
17 the staff to follow the recommendations of this committee on
18 human factors. I just thought you ought to know that.

19 MR. SPEIS: He had read the previous comments and
20 the questions and concerns, and he said that his thinking is
21 consistent with those comments and views, and he wants us to
22 look carefully at that. So he was referring to some
23 previous letters that you people had sent us about this
24 program.

25 MR. BECKJORD: Presumably, it was the last letter.

1 MR. SPEIS: He was referring mostly to the
2 organizational part of the research program, which is really
3 exploratory because, as all of us know, a well managed and
4 operated plant gets into less difficulties than otherwise,
5 and Sol is a classic example. You know, he used to run good
6 plants that never got into any trouble.

7 The question is, you know, how do you put your
8 hands to correlate? What does it mean, what are the
9 subelements, you know, the training, the people, the
10 interaction between all of the elements of your
11 organization. That's where we're trying to see if we can
12 gather some correlations.

13 MR. VOGEL: It's sort of interesting, the Florida
14 Power & Light as an example of a reactor that has run very
15 smoothly, and one in which there has been some bumpy --

16 [Laughter.]

17 MR. VOGEL: Operates smoothly sometimes is a
18 better way of putting it.

19 MR. BECKJORD: There was one other point I wanted
20 to comment on, wanted to make relative to Sol's comments.
21 Sol had talked about, you know, gathering the information
22 and making sure that we were aware of the work that was
23 going on in other fields.

24 The research program that we proposed and that the
25 Commission accepted was based largely on the human factors

1 research study done by the National Research Council, and
2 they collected a large group of people, of the experts who
3 had the knowledge in this area, and the question that they
4 put to them was, What should be done in human factors
5 research relating to nuclear power plants?

6 The committee worked for two years and came forth
7 with about 40 main suggestions on the program of research
8 that should be pursued. We took that report. We were
9 working with the people while it was underway, so we had
10 some knowledge of what it was going to say. That is really
11 the basis for our program. We accepted just about all --
12 not everything in the report, but most of the major items.
13 Those are in the program, and they urge very strongly that
14 we study the organizational and management aspects.

15 They said on this point of, you know, who should
16 do it, they said NRC should do it because NRC is in the best
17 position to undertake the exploratory work. My thought has
18 been always that the best possible outcome would be that the
19 utility industry would pick up on this and pick the ball and
20 run with it. I don't think we're at that point yet.

21 I think there's interest in what we're doing, but
22 --

23 MR. UHRIG: Is this an INPO function? Could it
24 be? It could be but --

25 MR. BECKJORD: Except INP says they don't do

1 research.

2 MR. BURSTEIN: There is a great deal of internal
3 dissension as to whether that is an industry desire or not.
4 We had this discussion before, and I agree with you that
5 organization management has an important role to play. I
6 deplore, however, what some of the human factors fraternity
7 consider to be organization and management.

8 If you recall, we had somebody who was undertaking
9 a review concerning human performance or plant performance
10 versus rate of return on common equity. I can cite a number
11 of other similar corporate factors that you could make all
12 kinds of interesting comparisons which would prove
13 absolutely nothing.

14 We talked again and again around this table about
15 perhaps size of staff and complexities of management and
16 tables of organization and the flow of information between
17 various levels. There was a recommendation from INPO that
18 we rotate people out of senior positions every five years
19 because they otherwise get burned up. I asked them where I
20 was going to get the 20 years experience they wanted me to
21 have in the shift superintendent? How do I compromise these
22 various forces that are coming at us?

23 It seems to me that if we got a few nuclear
24 engineers in with those human factors nuts or idiots, that
25 maybe we'd get something out of this thing that would be

1 useful. But unfortunately, we keep talking past each other
2 because we're not familiar enough with each other's
3 disciplines. That's why, you know, Bob, who's been through
4 this, understands this very clearly, and there are a few
5 others, but they are rare birds.

6 If NRC can somehow direct its program to get some
7 nuclear technology operational and organizational
8 understanding into the human factors fraternity, it'll
9 probably do more for the program than anything else we can
10 think of.

11 MR. MORRISON: Let me bring the human factors
12 discussion to a close with a couple of comments. First,
13 I'll work with Dave Woods to see what we can do about the
14 draft that you already marked up, Sol. I think that is
15 perhaps an important task, given just Eric Beckjord's
16 comments here on how the program was structured around the
17 National Research Council's report.

18 MR. BURSTEIN: And our last report on this
19 subject.

20 MR. MORRISON: Yes. We need to go back to that,
21 but Dave Woods' draft took about, oh, there must have been
22 twelve major categories, recommendations out of that report,
23 and addressed the paragraphs that I selected out of there to
24 those categories. I didn't put the categories in this. So
25 it's somewhat being responsive to what the general program

1 guidelines were.

2 I talked briefly with Frank Coffman yesterday and
3 got about the same story that you were saying, Eric, that,
4 indeed, the program had been structured based upon the
5 recommendations of the National Academy, and he felt that,
6 almost without exception, now everything that was
7 recommended has been addressed one way or another. So I
8 have to reconcile that with some of the feelings around the
9 table here.

10 I have deep concern with the Chairman's comments
11 yesterday, if he's saying that you guys in research have to
12 follow what we recommend. I don't want to be too premature
13 in recommending something in this report, so it may be a
14 somewhat strange part of our report.

15 Along those lines, it sounds to me like the
16 committee needs to spend a significant portion of some
17 future meeting dealing with human factors with both the
18 staff and with Dave Woods, our expert on human factors on
19 the committee, or other experts -- excuse me, Bob -- or
20 other experts on human factors.

21 MR. UHRIG: No, I'm not an expert in human
22 factors. Not at all. I'm a novice.

23 MR. MORRISON: So, with that, let me see what I
24 can come up with on the revised draft for your review.

25 MR. BALLARD: Mr. Chairman, you kindly said that

1 if I had something useful to say, I might care to
2 contribute.

3 MR. MORRISON: Please do.

4 MR. BALLARD: Just really rounding off that point,
5 you know, perhaps, in the UK, we've had four or five major
6 non-nuclear accidents over the last two or three years which
7 have been the subject of very lengthy public inquiries. In
8 every one of those cases, they have concluded that the major
9 causes of the accident were to do with the actual management
10 and organization of the safety in those companies, and a
11 failure to address properly how to make their systems more
12 tolerant against human error. Every one of those reports
13 essentially makes that as a major category.

14 Partly as a result of that, but partly as a result
15 of earlier accidents as well, with in the UK there has been
16 a fairly major program of work on human factors research
17 which has been very much aimed toward two points, I think:
18 One, the management and organization of safety in companies;
19 but secondly, perhaps the point that Eric Beckjord made, how
20 do we make our systems increasingly fault tolerant of human
21 error?

22 We cannot screen people in perhaps the way one of
23 the gentlemen was suggesting. We can actually recognize
24 what they might do and try and make our systems fault
25 tolerant against that.

1 There are a number of areas where those things
2 have come out of our research. For example, I heard the
3 discussion on breaches of tech specs. On our plant, we have
4 what are called IOIs, identified operating instructions,
5 which are the same things.

6 A specific result of part of our research was that
7 there is now a computerized advisory system being tested on
8 some of our plant called Essential Systems Status Monitor
9 which actually helps the operator to understand what the
10 sense of the IOIs are, and tells him when he is likely to be
11 in breach of them, because they were actually getting rather
12 complicated and difficult to understand. The result of the
13 research was that he actually needed help in doing that.

14 That was just an example, I think, of perhaps
15 where the research actually produced a very tangible result,
16 because I agree with you, it does actually have to do that.
17 It really just illustrates that we're actually going down
18 quite similar lines to I think what is being proposed in the
19 NRC's program.

20 MR. UHRIG: It sounds like you're well ahead of us
21 in that area.

22 MR. BALLARD: I'm not sure we're ahead of you, but
23 I think we're actually, you know, we are in parallel, and
24 maybe in a sense I'm offering some comment which will
25 support the NRC's current program in that area.

1 MR. MORRISON: Well, thank you for your very
2 enlightening comment. That's quite useful.

3 Let's take a ten-minute break and come back and
4 deal with advanced reactors, if we're ready to leave that
5 area.

6 MR. BECKJORD: Yes.

7 MR. MORRISON: Good.

8 [Recess.]

9 MR. MORRISON: Why don't we reconvene.

10 Now I'd like to address the subject of advanced
11 reactors. Eric Beckjord had given us a copy of a speech
12 that he presented and some viewgraphs associated with it,
13 and offered to give us an overview on what he sees and
14 perhaps the Research Office sees with regard to advanced
15 reactors. Let's use that as a place to start.

16 Eric, why don't you lead off?

17 MR. BECKJORD: Thank you. Let me summarize the
18 points in that talk, and also refer to a couple of other
19 matters that are of current action and interest right now
20 that are related.

21 First of all, the advanced reactors, the research
22 on advanced reactors is based on the assumption that the
23 advanced reactors in that list are the evolutionary light
24 water reactors -- that is to say the ABWR, the ABWR designs,
25 the combustion CE 80 Plus.

1 Tom Murley's organization is reviewing the ABWR
2 now which Tokyo Electric Power is building in Japan, and
3 that was part of the agreement that was reached at the time
4 between the Japanese and General Electric and the
5 Commission, that the ABWR would get a safety review.

6 Now, I think it 's -- let me speak a little later
7 about the requirements, the safety requirements for the
8 evolutionary light water reactors. There has been reference
9 to them in several Commission papers, but I want to come
10 back to that when I've outlined what the other reactors are
11 that are in this category.

12 So first, it's the evolutionary reactors.
13 Generally, these are in the size range of 900 to 1300
14 megawatts. In other words, they are comparable in size to
15 the plants in operation today.

16 Another category is the advanced reactors that are
17 not water, namely, the MHTGR, modular high-temperature gas-
18 cooled reactor, and the sodium liquid metal reactor.

19 For over two years now, the Office of Research ha
20 been reviewing these reactors in accordance with an
21 agreement with the Department of Energy, which is funding
22 the development of them, and we have two draft SERs, one for
23 each of these types.

24 The process of review came to a temporary halt two
25 years ago on the issue of containment for the MHTGR, and as

1 result of that, well, there was a letter written at that
2 time to the Department of Energy asking for some more
3 information on what their intentions were with regard to
4 containment and the fact that the NPR, the new production
5 reactor, in the gas-cooled version had decided and publicly
6 announced that it would have a containment. So the question
7 was, how do you account for the NPR having a containment and
8 the commercial version not having a containment?

9 The Department of Energy reviewed that, did a
10 study, came back, gave us the results of it, and last mid
11 summer, they advised me that they were not ready to proceed
12 because they had gone back to take another look at the basic
13 parameter of the output, the electric output of that plant,
14 and they have since concluded that the original 350 megawatt
15 design was not going to be economic, and they are looking at
16 a larger version. My understanding is that the reference
17 design now is a 550 megawatts, give or take a few.

18 MR. BURSTEIN: Single reactor?

19 MR. BECKJORD: Yes.

20 MR. UHRIG: Single cavity?

21 MR. BECKJORD: I don't know. All I've heard is
22 the size of the reactor from them and that it will take them
23 about two years to work out the concept in enough detail.
24 So I think that, as things stand now, that we'll probably
25 get information from time to time, but it will probably be

1 two years before they have a revised proposal.

2 In the meantime, the Commission has decided to
3 transfer the review of these advanced reactors, the non-
4 water, to Tom Murley's organization, and there will be a
5 letter coming forth some time -- it could be a day, it could
6 be a week -- that will announce the transfer of that
7 responsibility to Murley. He has formed a new division in
8 his organization, and the responsibilities of that division
9 will be the review and certification of all of the advanced
10 reactors.

11 MR. VOGEL: All advanced reactors?

12 MR. BECKJORD: Yes, all advanced reactors. See,
13 in effect, in the reorganization of 1987, the NRC went out
14 of the business of license reviews since there were no new
15 licenses. There were still a few in process so to be
16 completed, but there were no new ones. The decision was
17 made at the time that the Commission would concentrate on
18 the operation of the existing reactors today. That's what
19 Tom Murley's organization has done.

20 When this is announced, it will signal what has,
21 in fact, been underway now for the better part of the year
22 up until now, which is the consideration of licensing and
23 certification of future reactors based on the Part 52 rule
24 on standardization which the Commission passed last year,
25 approved last year.

1 So, Tom Murley's office is just positioning itself
2 to get ready to go into the licensing review again. It will
3 mean that we will transfer two people from the Research
4 Office to Murley, the two who have been working on the
5 review of those two reactors.

6 To make a long story short, I think the
7 relationship between the two offices will become -- on
8 advanced reactors, will be now analogous to what it is on
9 the operating reactors. That is to say we will continue to
10 do the research and develop information, but the review will
11 be carried out by the Nuclear Reactor Regulation Office. So
12 that's an administrative change.

13 This plan that I have referred to several times on
14 the advanced reactor research has two parts. We've been
15 working on it, and Murley's office has been developing their
16 view of user needs. I would say between now and the end of
17 the year, we will be working together on that to reconcile
18 these two drafts to come up with a plan for both the
19 certification review and for the research on these advanced
20 reactors.

21 Now let me turn to -- I've talked about two types,
22 the evolution light water reactors and the non-water
23 reactors. The other type that will be under review are the
24 advanced light water reactors, and the ones that are on the
25 table right now are about five: the Westinghouse AP 600

1 pressurized water; the GE small boiling water reactor, which
2 is of about the same size. These are roughly 600 megawatts
3 in electrical capacity. There's the SIR, the integral
4 reactor that has been developed. Combustion is involved in
5 this, and there's been work on it in the UK.

6 There are two others: the ADP-PIUS design and the
7 CANDU-3 400 mega-watt heavy water reactor which the
8 Canadians propose to build somewhere in Canada. There are,
9 I think, three possible sites now and localities which are
10 considering that.

11 These reactors present a different problem than
12 the evolutionary light water reactors. I think, if I could
13 characterize the evolutionary types in a word, they are
14 concepts which are based on incorporating the experience of
15 20 years plus operation of the two light water types into
16 evolutionary improvements in the design.

17 The safety systems have been improved, emergency
18 power. There has been some improvement in materials.
19 Probably one of the most important things would be the new
20 instrumentation and control in the computers, and computer
21 software will be introduced into those, and you've had some
22 discussion on that.

23 As far as research is concerned on the
24 evolutionary types, my feeling, our feeling is that with the
25 exception of the instrumentation and control and computer

1 use, that the other research that we're doing in systems and
2 in vessels and in severe accidents largely applies to the
3 evolutionary types. That is to say there are no new
4 questions that these reactors raise that we are not now
5 addressing.

6 The work on instrumentation and control and
7 computer use is, as we have said, primarily now the matter
8 of defining what should be done by way of verification and
9 validation, and a definition of what is needed for
10 acceptance of these in a licensing proceeding. But that's
11 nonetheless a big job because we do not have a lot of
12 experience in these advanced control and instrumentation
13 technologies. We are attempting to catch up on that now.

14 With regard to the research required for the gas
15 and the liquid metal reactor -- yes?

16 MR. BURSTEIN: Excuse me. I thought you were
17 going to describe your needs for the CANDU, did you say?

18 MR. BECKJORD: Well, I'll come back to that.

19 MR. BURSTEIN: Oh, you'll come back to it.

20 MR. BECKJORD: Yes. This isn't perfectly
21 organized. I'm trying to go over the changes in
22 organization and then the considerations of where research
23 might be done on these advanced reactors.

24 The two draft safety evaluation reports on the gas
25 and on the liquid metal reactor deal extensively with

1 research and the research that is required on these, and the
2 question of whether, you know, prototypes are needed.
3 Generally, the DOE concept is based on the supposition that
4 the first plant in each category would be built as a
5 prototype and that it would perform certain safety
6 evolutions to demonstrate that it had, in fact, achieved its
7 goals.

8 Now, in both cases, the designs on paper looked
9 very good from a prevention point of view. They have very
10 low core damage frequencies. From everything we can see in
11 that regard, they appear to offer some very important safety
12 improvements.

13 I think in the case of the gas-cooled reactor, it
14 was on that basis that the sponsors felt that they would go
15 ahead without a containment. That issue will come up before
16 the Commission, and I think that, when all is said and done,
17 my own view is that it is very likely that there will be a
18 containment requirement for that gas reactor, albeit not the
19 conventional kind of containment that we think of for the
20 water reactors. That is to say it will not be a high
21 pressure design necessarily, but a design adequate to the
22 dominant sequences that could occur in that plant and to
23 define some defense in depth.

24 Now, the research in both cases had to do with --
25 the required research had to do, in the case of gas-cooled

1 reactors, with the fuel and the fuel cycle. That is to say,
2 this gas reactor has the coating on the particle fuel, and
3 one of the important problems is to explore what that means
4 in terms of the entire fuel cycle because the reactor would
5 be licensed now, but some other fuel for that reactor might
6 be manufactured 50 years from now. So how do you assure
7 that the necessary quality requirements are preserved
8 throughout this time.

9 There are some other questions relating to the
10 fuel performance. It draws in some respects on the Fort St.
11 Vrain experience, but there are significant differences, and
12 these also have to be explored.

13 In the case of the liquid metal reactor, I'd say
14 that there are several areas of questions, some in the
15 control and instrumentation area because of the way that the
16 plants would be controlled, probably several plants under
17 one dominant control system, and there is a question there
18 about the roles that would be played by the central as
19 opposed to the unit controls.

20 But there are, I think, some other very important
21 questions on reactivity control. The metallic fuel that is
22 proposed for this reactor has demonstrated favorable
23 performance characteristics in the EBWR, but the core for
24 this reactor would, of course, be much larger, and the
25 question is, does the same bowing effect that would occur in

1 the case of any loss of flow accident insert the same
2 negative reactivity? There are still some questions about
3 sodium void coefficients, and that type of thing.

4 These research follow-ups are pretty well detailed
5 in the two safety evaluation reports.

6 MR. BURSTEIN: Have those been issued?

7 MR. BECKJORD: Yes, they're available. They're
8 drafts. If you're interested, we can certainly -- EPRI has
9 had -- people have reviewed these from several -- in fact,
10 you were on the MHTGR.

11 MR. BURSTEIN: I didn't know whether they had been
12 issued as a final.

13 MR. BECKJORD: No, not final.

14 MR. BURSTEIN: Okay.

15 MR. BUSH: I have back-up documentation on the
16 thing. I have six feet of documents that are about --

17 MR. BURSTEIN: Are you kidding?

18 MR. BUSH: No, just effectively on the back-up
19 information for the metal, liquid metal.

20 MR. BECKJORD: Let me speak briefly, then, about
21 the advanced water reactors, the AP600, the GE SBWR, and the
22 PIUS and CANDU. There is also the EPRI requirements
23 document, which I haven't mentioned, which pertains -- it's
24 nearing completion, is the requirements document for the
25 evolutionary reactors, and then EPRI also has underway a

1 requirements document for the smaller passive reactors.
2 That's probably a year or two away from completion.

3 These reactor, I would say, are a significant
4 step. They differ substantially from the evolutionary
5 types, not only in their size, but in the safety concept.
6 In the case of the AP 600, Westinghouse has gone back to
7 canned rotor pumps to eliminate the seals.

8 This is a 600-megawatt plant, it's got two steam
9 generators and two pumps per steam generator. So there are
10 two cold legs, and then one large hot leg. The elimination
11 of the pump seal is an important safety feature.

12 They have incorporated passive emergency core
13 cooling systems for high pressure, intermediate pressure,
14 and low pressure, and they have a containment which will be
15 cooled by essentially passive means, where they've got a
16 water reservoir over it, and a water film will be running
17 down the side of a steel sphere.

18 Then there's a natural draft arrangement. There's
19 a tower which is built around the spherical containment, and
20 that in effect creates a natural draft cooling tower. So
21 the containment will cool by transfer of heat from inside of
22 the containment through the steel shell to a paint coating
23 which was developed many, many years ago and which
24 Westinghouse has tested, but it provides a surface which
25 gives water tension, gives surface tension to the water, and

1 it controls the rate of the water falling down, and at the
2 same time it has very good heat transfer characteristics.
3 So the idea is that the coating will help to hold the water
4 in place while it's being evaporated.

5 MR. BURSTEIN: Give the containment a bubble bath.

6 MR. BECKJORD: Yes, a bubble bath. Exactly.

7 That's a very good way to put it.

8 Now, these passive systems, I think, have some
9 very -- there are some very good ideas and there are some
10 very positive feature there. The same is true of the GE
11 small boiling water reactor. They've gone back to the
12 isolation condenser concept, and they've got gravity-driven
13 core cooling systems. They can use the refueling water for
14 core cooling.

15 They have a separate core cooling water reservoir,
16 and the system -- in the event of an accident, the opening
17 of the valves which would make the gravity-driven water
18 available to the core is by an explosive valve. So it
19 doesn't require power to do this.

20 Then there's a final system on the GE reactor
21 which, in the event of a complete failure, in a failure of
22 the vessel and molten core on the floor, the two reservoir
23 tanks, the two large reservoirs of water, could dump onto
24 the floor under the reactor. There is a piping system which
25 comes down, and it has plugs which isolate it, and the heat

1 from a severe reactor accident would melt the plugs and the
2 water would drain out onto the floor, and it would quench
3 there.

4 So, there are many passive features that have been
5 incorporated in this. At the same time, the designers have
6 reduced the redundancy on the theory that, with operating
7 reactors, you have emergency systems that are active and
8 require large amounts, significant amounts of emergency
9 power, and you overcome the failure, the unreliability of
10 these systems, by redundancy for obvious reasons.

11 In the case of the passive designs, the idea is
12 passive and more reliable systems, but less redundancy. So
13 the question that comes up, a very important question in the
14 review of these passive types, will be, What is the
15 reliability of and what will be the reliability of these
16 passive systems? What is required in the way of design to
17 assure that they produce it, and then how do you inspect and
18 maintain them? They will have much higher reliabilities
19 required, so how do you demonstrate that, in fact, you will
20 have that reliability? So I think that's a major issue to
21 be resolved.

22 There are specific features of these plants that
23 require some follow-up research. Westinghouse is doing
24 this. In the case of the containment, they have set it up
25 on a, you know, kind of a small scale separate effects test

1 to test the films.

2 They've built a scale model of it, and they will
3 have completed this fall a larger scale model of it to test
4 it. I don't recall, but it's probably a -- I don't know.
5 It's a small scale model, but it's still pretty big. It's
6 going to be 20 feet in diameter, or something like that, 18,
7 20 feet.

8 MR. BUSH: I thought it was 13.

9 MR. BURSTEIN: Eleven. It says so in your paper
10 somewhere.

11 MR. BECKJORD: I have it somewhere here. The
12 paper ought to be right on that point.

13 Both the Westinghouse and GE designs I think are
14 based on the assumption that a prototype will not be
15 required, and the EPRI requirements document, I think, will
16 make clear in both cases that they have made their choice.

17 MR. BURSTEIN: One-ninth.

18 MR. BECKJORD: What was it?

19 MR. BURSTEIN: One-ninth.

20 MR. BECKJORD: One-ninth. Yes.

21 MR. BURSTEIN: It's on page seven of your page.

22 MR. BECKJORD: So it is. It's somewhere in the
23 15, 18 foot range.

24 MR. BURSTEIN: But that doesn't preclude these
25 tests on certain components?

1 MR. BECKJORD: No. No,no. No. I know
2 Westinghouse has told us that they feel they can do
3 everything they need to do with component testing and
4 with --

5 MR. BURSTEIN: With the analysis.

6 MR. BECKJORD: Yes, and with scale models, and
7 they believed they did not need an integral systems test for
8 the reactor safety systems. This might also be a scale
9 model, but it would be an integral test to test the
10 operation of this gravity-driven system to make sure that
11 the water goes where it's supposed to go.

12 I think that's still an open issue, and that's
13 something that -- well, Neil Todreas has talked about this
14 in some of his correspondence. He's given you his views on
15 it. We have felt that that may well be an area where some
16 model testing ought to be done at a university, and Herb has
17 commented on that aspect at some length.

18 With regard to the ADP PIUS, I think that, as I
19 see it, and the Commission hasn't made any decision, but I
20 think that's a likely candidate for a prototype because it
21 is so different in concept. Whether it's the containment,
22 or the reactors systems, or the emergence of that in a large
23 reservoir of water, I think the developers have probably
24 gone a long way to establishing their reactivity control
25 system, the dam system which maintains a thermal gradient

1 which separates boron from unboronated water.

2 But the fact that it has no control rods, some
3 significant parts of the primary system are immersed in
4 water, and I think, when you take all of these things
5 together, I see a prototype indicated there.

6 Now, with regard to the CANDU-3, under the treaty
7 between Canada and the U.S., the Canadian industry is
8 treated in a new and very different fashion. That applies,
9 of course, to the consideration of supplying nuclear power
10 plants.

11 AECL of Canada has set up an office nearby in
12 Rockville, and they have a long-term program, as they have
13 said in their words, to develop the CANDU-3 and introduce it
14 into the U.S. market in a competitive way. They are looking
15 for manufacturers and utilities to become interested in
16 this.

17 I think that system -- it appears to me that that
18 is also likely to be a prototype because of the differences
19 from their operating reactors, but they have indicated --

20 MR. BURSTEIN: Excuse me. Is it that much of a
21 deviation from the existing reactor operations scattered
22 around the world?

23 MR. BECKJORD: Well, there are some significant
24 design differences. Refueling is from one side. I'm not
25 really prepared to go into a lot of detail.

1 MR. UHRIG: Would the prototype have to be in the
2 U.S.?

3 MR. BECKJORD: No. AECL has indicated their
4 intent to build this in Canada first, and that would be the
5 prototype. So if that's the way it turns out, then the
6 licensing, the consideration of that for certification would
7 be done by following the Canadian design as it evolves in
8 Canada, and they have indicated a test program for --

9 MR. UHRIG: Are the standards in Canada
10 essentially the same as the U.S. IEEE standards, ASME
11 standards?

12 MR. BECKJORD: No.

13 MR. UHRIG: They are not?

14 MR. BUSH: They have the same ones.

15 MR. UHRIG: They do?

16 MR. BUSH: They basically operate under the same
17 criteria of ASME codes and standards, as far as I know.

18 MR. BECKJORD: I don't think that would be a
19 problem, but they certainly -- well, Spence answered yes and
20 I answered no. I was thinking of some important exceptions.
21 I don't think there are any comparable code cases for the
22 details of the construction, design and construction of
23 their primary system in the ASME code.

24 MR. BUSH: No, because they haven't asked for
25 them. If they wanted them, they could bring them over.

1 MR. BECKJORD: And thinking of that, I answered
2 no. So there would be a lot of --

3 MR. UHRIG: The point could be made with them.

4 MR. BECKJORD: Yes. Well, I think we've already
5 told them that. In particular, the pressure tubes and the
6 headers. So that's something which -- and the welding
7 procedures. I mean, there's a lot of information that the
8 NRC, I think, would have to look at.

9 MR. VOGEL: Is it particularly vulnerable to
10 earthquake problems, seismic problems?

11 MR. BECKJORD: That particular design?

12 MR. VOGEL: Yes. On-line refueling and so on?

13 MR. BECKJORD: Yes, it could be. I don't know
14 that we've looked at that aspect of it. I certainly haven't
15 looked into it.

16 MR. BUSH: Effectively, NPR was -- of course,
17 obviously it's different and it wasn't a heavy water
18 reactor, but it's, you know, a tube design, and that was
19 reviewed seismically. I think there is a first
20 approximation, and they come out the same. There are
21 problems, but nobody seems to think they were
22 insurmountable.

23 MR. BECKJORD: Well, I'm taking longer than I
24 should, but just maybe two other things in five minutes. As
25 far as safety requirements, the Commission has not

1 articulated specific safety requirements for these advanced
2 reactors, but they have made some statements on policy. You
3 know, roughly paraphrased and summarized, they are that
4 whether they are evolutionary -- evolutionary reactors will
5 be safer than the current generation, and advanced reactors
6 will be safer yet.

7 With regard to the water reactors, the
8 requirements will include -- each plant will have a plant
9 specific PRA done as part of the submittal, and the
10 unresolved safety issues will be addressed in the design,
11 and a number of important severe accident issues will be
12 considered. This includes a number of the generic issues
13 that you've heard about.

14 Some specific examples. The ATWS, the anticipated
15 trip without scram, station black-out, mid-loop operations
16 for the PWRs, consideration of fire protection,
17 consideration of the interconnected system,
18 overpressurization of the low-pressure system and failure
19 and loss of coolant there. Let's see. The core debris
20 consideration of how core debris would be cooled, high-
21 pressure melt injection, and let's see. There's one here
22 that I noted down. I'll have to refer to my notes again; I
23 can't read my own note on that.

24 But there is a list of about 15 of these issues
25 that have come up, and what I think the Commission has

1 concluded from that is that these issues should be addressed
2 in the design.

3 They haven't finally approved this, but the severe
4 accident issues, the dominant sequences will be -- those
5 will presumably come out of the PFA study, and that the
6 reactor, including the containment system, will be capable
7 of dealing with severe accidents on a best-estimate basis.

8 The severe accidents are now -- the Commission has
9 gone beyond the design basis theory for plant safety
10 requirements, but the best estimate does not make severe
11 accidents in the same class as the design loss of coolant
12 accident, for example, which is done on the basis of a lot
13 of margin. It'll be on a best-estimate basis.

14 With regard to containment, the Commission has
15 asked both the ACRS and the staff to get together to develop
16 a containment performance criteria, which you had some
17 discussion on.

18 I have mentioned the prototype consideration. The
19 only other thing I would mention is our plan looks at the
20 questions that come up in the conventional categories of the
21 research program, the primary system, the primary component
22 and integrity, the system's operation, including
23 consideration of core damage frequencies, human factors,
24 severe accident research, instrumentation and the use of new
25 materials. I mean, we know, for example, that there will be

1 new materials in the steam generator tubes, and there may be
2 some work to do there.

3 At this point, I don't see any new severe accident
4 considerations that we haven't already dealt with, and that
5 probably requires some further work to establish that. So I
6 think the research is going to wind up concentrating on the
7 new design features and performance components.

8 There are a couple of them mentioned in the paper.
9 The decay heat removal heat exchanger for emergency purposes
10 in the PWR is one. It's quite a unique heat exchanger. I
11 think that will require some developmental testing. I think
12 Westinghouse is proposing to do that.

13 MR. BURSTEIN: How about the low velocity core
14 performance, core cooling performance?

15 MR. BECKJORD: Well, that's one of the things
16 which is on the agenda, to review the capability of the
17 thermal hydraulics codes for describing natural circulation
18 adequately including the accident conditions. There may be
19 some more work on codes indicated in order to make them
20 describe thermal hydraulic performance in the important
21 modes.

22 I've mentioned and I just reemphasized the matter
23 of passive system reliability. I think that is going to be
24 a very important element of this. In some ways, it's
25 straightforward, and I think the difficulty in that area is

1 showing that the reliability is -- the reliability of these
2 systems is going to be substantially higher than the active
3 systems, but how do you prove it, and how do you prove that
4 something fails no more than once in 100,000 years? When
5 you think about it, that's a rather difficult task.

6 Probably I've said enough on that, but I'd be glad
7 to respond to any questions. I think I've covered the main
8 points.

9 MR. UHRIG: Do you propose to create special
10 programs to address the various problems that arise here or
11 to simply expand the existing programs? Low velocity heat
12 transfer -- would that be a modification to some of the
13 existing work, or would this be part of a separate program?

14 MR. BECKJORD: I think the best way to develop the
15 program and get the support for it and convince yourselves
16 and the ACRS is to have a program which is called the
17 Advanced Light Water Reactor Safety Research Program. If
18 there are any elements which are clearly identifiable with
19 work currently underway, we would do it that way, but the
20 new work, I think, we would do under this program so as to
21 keep it clearly identified, and have a, you know, management
22 structure which can organize it.

23 MR. UHRIG: You're taking on three new media here:
24 gas, liquid sodium and heavy water.

25 MR. BECKJORD: Okay. What I have said is

1 addressing the water reactors in the last part.

2 MR. UHRIG: Okay.

3 MR. BECKJORD: And that's because it seems to me
4 that the water reactors are likely to be next in line. As
5 the constituency comes in, then we would have to do
6 something about the gas or the liquid metal. I really think
7 the liquid metal is out beyond the gas as a practical
8 matter.

9 MR. BUSH: I could comment just briefly, a little
10 background that might help the committee. Currently, the AP
11 600 and the SBWR are being looked at, will be looked at for
12 the next six to ten months.

13 They were being looked at against the current
14 criteria more to see if there's a feeling that the
15 procedures, such as the thermal hydraulic codes, are
16 adequate. That doesn't say that the systems aren't adequate
17 to do it, but that perhaps the thermal hydraulic codes in
18 these very low velocity flow regimes simply won't handle it,
19 so it would require a modification.

20 MR. ISBIN: Who is doing that?

21 MR. BUSH: PNL is. And what they're basically
22 doing is --

23 MR. BECKJORD: Is that for the Department of
24 Energy?

25 MR. BUSH: No. This is funded by NRR. I thought

1 it would be good background because out of it, perhaps, will
2 be a focus on where some of the problems would be. They've
3 been looking at it for about two months now, and I think
4 they really have gotten off the ground.

5 There is going to be a -- I guess I'd call it a
6 steering committee for want of a better term, and probably
7 Larry Barondo will chair it, is my suspicion. They'll also
8 have a human factors person on it, a materials person, which
9 I guess I'll be, and two other areas that will be looking at
10 this.

11 Effectively, it isn't intended that this will come
12 up with what I would call answers. It will effectively come
13 up with, "We don't believe the information or the procedures
14 are adequate to handle A, or B, or C, or D." But it will
15 look at the systems, and they do have what's available for
16 both of these two at this time.

17 Out of that, I think, will probably be the basis
18 for you to get requests, say, from NRR that you're going to
19 have -- It looks like these areas are more open than others,
20 because I'm assuming it'll still flow to you.

21 On the thermal hydraulics, if there are major
22 questions or -- I don't know how to answer reliability
23 questions, quite frankly, but on the thermal hydraulics, if
24 they say, "Well, the codes don't cover these regimes very
25 well," that says more work, I think, by somebody. I just

1 mention that as background.

2 MR. VOGEL: There's overlap with the production
3 reactor problems.

4 MR. BUSH: Yes. That's true.

5 MR. BECKJORD: Well, I could offer a gratuitous
6 comment about the natural circulation boiling water reactor,
7 which is that I worked on this 30 years ago. I've been
8 aware of the GE design for five years now, I guess, and I've
9 heard their presentations on it, which are very convincing.
10 I've asked them several times about the stability of it, and
11 they've said, Oh, yeah. We've gone over that. It's stable.
12 No problems.

13 Then I was asked to give a talk about a month ago
14 at a workshop at Brookhaven on the LaSalle event. It was at
15 the time when all of that work was completed. So I decided
16 what I'd do is I'll go talk today's boiling water reactor
17 experts about what we knew about stability 30 years ago. I
18 would make no attempt to instruct them on what they know,
19 but I would tell them what we knew then.

20 In going back over this, I have to tell you that I
21 have a lot of questions now about that tall chimney BWR
22 natural circulation design. I'm not saying they can't do
23 it, but I think that they're going to wind up with a lot of
24 design constraints before they're done, and I think they
25 still will have to deal with situations.

1 If they lose feedwater heating, for example, I
2 think they're going to have to shut the reactor down,
3 because you lose your feedwater heating, the subcooling goes
4 up, and it's subcooling which makes boiling systems
5 unstable.

6 Adding a tall chimney doesn't help because the way
7 that the main line of boiling water reactors were stabilized
8 was by forced circulation and putting the pressure drop in
9 the single-phase region. When you build a tall chimney,
10 it's true that you get more driving head, but you also
11 distribute pressure drops in the chimney. So there's no way
12 out of that.

13 MR. UHRIG: Are you getting involved with the new
14 production reactor in any way?

15 MR. BECKJORD: On the water or the gas?

16 MR. UHRIG: Really the heavy water is what I'm
17 talking about.

18 MR. BECKJORD: No.

19 MR. UHRIG: The intent of Congress, as I recall,
20 was that this was to be built to the same standard, that it
21 could be licensed but would not be.

22 MR. BUSH: DOE has agreed to that.

23 MR. UHRIG: And who is going to monitor that that
24 is done? DOE?

25 MR. BECKJORD: DOE, yes.

1 MR. UHRIG: DOE will do it.

2 MR. BECKJORD: Yes.

3 MR. UHRIG: All right.

4 MR. BECKJORD: They're setting up their own
5 mechanism to do this.

6 MR. UHRIG: Yes, I know they are, but I didn't
7 know whether in that particular case --

8 MR. BECKJORD: There aren't a lot of NRC people to
9 do that.

10 MR. UHRIG: I see.

11 MR. BUSH: They've also broken off pieces or
12 chunks. I've been chairing the committee looking at piping,
13 as a for instance. There are other committees that are
14 looking at different parts of the beast, with the idea of
15 seeing what could be done or should be done about it from a
16 design point of view. So presumably, all the pieces come
17 together. I think the ultimate review would probably be
18 under the auspices of what I would call the Alherne
19 Committee. But I'm not sure whether he still chairs that
20 one.

21 MR. BURSTEIN: Yes, I think he does. Do we have a
22 number for how much is in the five-year plan for these
23 advanced reactor research activities?

24 MR. BECKJORD: No. The last five-year plan had an
25 introductory paragraph which said that we were going to work

1 on this in the coming year, and we would develop some
2 estimates. I've said this before, that the research project
3 has had a slow downtrend, and we've introduced the new areas
4 and the redefined programs, and we've done that at the
5 expense of the thermal hydraulics efforts and several
6 others, but primarily thermal hydraulics, by scaling that
7 back.

8 I don't think it's possible to complete the agenda
9 that you've been reviewing and to fund completely the
10 advanced reactors research on the present budget. I think
11 advanced reactors is going to take some new money.

12 The Chairman spoke to this in his testimony before
13 Congress in this year's budget cycle. When he spoke about
14 research, he said that he felt that he could easily justify
15 a research program at a level of about \$125 million
16 annually, and that would certainly accommodate the existing
17 program plus the new work on the advanced reactors if that
18 is forthcoming in two years' time.

19 MR. UHRIG: The current budget is about 90?

20 MR. BECKJORD: It's 94. It'll be reduced by --
21 you missed that; we talked about that yesterday -- \$4
22 million to \$7 million, so somewhere from 87 to 90.

23 MR. BUSH: There is one slight ray of sunshine in
24 the thing. The advanced reactors tend to be kind of second-
25 order things, and almost all of the actions that are being

1 taken help the situation that are designed into it with
2 regard to the selection of materials.

3 MR. BECKJORD: Yes.

4 MR. BUSH: So you would effectively minimize or
5 eliminate many of the -- the INCONEL-690 which you talked
6 about, there probably has to be some work done on it, but
7 there already has been a lot of work done on 690. So it
8 isn't as if you're going to have to suddenly pump in \$5
9 million or \$10 million in that area, which is going to help
10 because it means that the money can go into other areas
11 which are a lot more unknown, I think.

12 MR. MORRISON: Well, given this very good status
13 report on what is currently happening and at least Eric's
14 view of some of the things that need to be done in the
15 future, what do we want to say in this particular response
16 in response to the EEO request? We certainly have put
17 advanced reactors as a part of the mission.

18 MR. UHRIG: Do we want to in any way attempt to
19 prioritize the different technologies, or was this just
20 going to be a matter of which one comes in first, and ask
21 for a certification, and then we start working on the
22 issues?

23 MR. MORRISON: It seems to me trying to put any
24 priorities on the individual types of reactors in here will
25 be premature.

1 MR. UHRIG: I guess I was thinking of the light
2 water systems first, the evolutionary systems.

3 MR. BURSTEIN: And the small passive next, and --
4 before you get to the non-water designs. Is that the order
5 you had in mind?

6 MR. UHRIG: Yes.

7 MR. BUSH: The evolutionary ones are making what I
8 call an incremental change, but not what I'd call -- I
9 wouldn't call it a quantum jump by any stretch of the
10 imagination.

11 MR. BURSTEIN: Is it fair, then, if that's true,
12 Eric, to look at the evolutionary light water reactor plants
13 for which applications or certifications are already in
14 house, that you don't really need to clobber your budget to
15 address any of those issues?

16 MR. BECKJORD: I think the current research
17 program responds to everything that I know of. There's no
18 new issue that comes up in the evolutionary reactors.

19 MR. BURSTEIN: The new issue would be the passive
20 and the liquid metal and gas, if there was one.

21 MR. BECKJORD: Yes. And if the CANDU comes in,
22 that, of course, is a very complex situation. The one thing
23 I didn't say about that is we don't really -- we don't have
24 people who understand heavy water reactors very well. What
25 the Canadians proposed is that they could come in and they

1 can provide that information, and they can do testing, and
2 if we want testing done, they would fund it. I mean, that's
3 an offer.

4 It hasn't been negotiated as to how that would
5 turn out, but if that were the case, there's a legal
6 question of whether, you know, that's legal under the law.
7 I think the general counsel is looking into that now and I
8 don't know the answer to that question.

9 MR. UHRIG: Is that any different than what is
10 currently being done in other areas? EPRI does a lot of
11 research that provides information to NRC.

12 MR. BECKJORD: Yes. I think the difference is it
13 really comes down to this. The system that we don't
14 understand, and we and the regulators would have to develop
15 an understanding of that system --

16 MR. UHRIG: Expertise in house are available to
17 you.

18 MR. BECKJORD: Yes.

19 MR. BUSH: The problem is going to be, I think,
20 peer review. You have two reservoirs, neither of them
21 correctly applicable, but certainly Savannah River has a lot
22 of experience with heavy water -- now, I'm not saying
23 reactor, but heavy water. Hanford has a lot of experience
24 with tube reactors that are somewhat of an analogue, except
25 that that reservoir is being depleted extremely rapidly, and

1 my guess is that by the time you get around to looking at
2 CANDU's, you'll find very few of the people around that you
3 could use unless you jerk them out of other jobs or
4 something. That's just a fact of life.

5 MR. BURSTEIN: There are none of us left.

6 MR. BUSH: We're getting to be old fogies, like
7 some of us around the table.

8 MR. BECKJORD: So I think there are several
9 elements to this as to how this would be worked out, and it
10 has to do with gaining the experience, it has to do with how
11 some particular research elements would be carried out. It
12 has to do, I think, also with what we discussed earlier, the
13 translation of Canadian standards into things that can be
14 acceptable here.

15 Then also, there's this matter of the information
16 on the experience on these reactors, which the Canadians
17 have said they will make available, but I'm thinking of
18 things like, you know, the Pickering Unit 4 in July of 1977
19 had a very serious event which came out fine, no problem,
20 but the details of that are not generally available.

21 MR. BUSH: To a degree they are. I have
22 documentation. You're talking about the tube problem. Is
23 that the one you're talking about?

24 MR. BECKJORD: No.

25 MR. BUSH: You're talking about the other one?

1 MR. BECKJORD: No. I'm talking about the
2 auxiliary feedwater.

3 MR. BUSH: Okay. I'm talking about the tube
4 problem, which was a very severe one. That was made
5 available.

6 MR. BECKJORD: Yes.

7 MR. MORRISON: Well, is this whole subject of peer
8 review and experience base a high enough priority one that
9 we ought to be recommending some funding now to reestablish
10 or maintain that base?

11 MR. BURSTEIN: It seems, as we said earlier, that
12 there is some regulatory review going on for the
13 evolutionary light water reactors which doesn't require any
14 further funding. To my knowledge, there are no real
15 regulatory reviews except as minimally being requested by
16 DOE in connection with the other advanced reactors for which
17 there is no money.

18 If the rumors that the Commission will require a
19 great deal of detailed engineering for these prototype
20 plants is realized, then I think NRC has lots of time in
21 which to do the required research, and perhaps it could
22 extend beyond this current planning horizon.

23 If, on the other hand, there is going to be some
24 interest in getting an application from a PIUS or a CANDU or
25 one of these other advanced plants in Washington earlier,

1 then it seems to me that there is going to be a need for
2 substantial funds within the five-year plan that now doesn't
3 exist.

4 MR. UHRIG: Do you have the timetable on the
5 CANDU? I have the impression that that's fairly short.

6 MR. BUSH: Short priority, I had thought.

7 MR. BECKJORD: Well, only what the Canadians --
8 they came and made a presentation in October, early October,
9 and what they said was that their plan for the introduction
10 of CANDU-3 into the US was a long-range plan, that they were
11 looking to, maybe in five years, they might have
12 certification.

13 MR. UHRIG: But their introduction to it in Canada
14 is a fairly -- what, '97, '96?

15 MR. BECKJORD: They want to get started, I think,
16 in '92, '93, something like that.

17 MR. BURSTEIN: If certification is required in
18 five years, you have a hell of a lot of work to do before
19 that.

20 MR. UHRIG: That's just in Canada, though.

21 MR. UHRIG: They're talking about putting one into
22 operation in I think '97, if I remember correctly.

23 MR. BECKJORD: Yes, and they would aim to get it
24 certified in the U.S. on about the same schedule.

25 MR. BURSTEIN: Well, that's what I thought you

1 were saying. I'm sorry, I misunderstood. But if a five-
2 year certification process --

3 MR. BECKJORD: That may be a little -- you know,
4 five to seven, say five to seven.

5 MR. BURSTEIN: Then I would think you would have
6 to have some work done within the current five-year plan to
7 address that application.

8 MR. BECKJORD: That's right.

9 MR. BUSH: Eric, my reading on the priorities,
10 from NRR at least, tends to put the SBWR and the AP-600 as
11 the top priorities. They have walked away from SIR, so far
12 as I can tell.

13 MR. BURSTEIN: Walked away from what?

14 MR. BUSH: SIR. PIUS, I think if they get pushed,
15 they'll do something on, but, again, I think that's a lower
16 priority. My reading currently is that CANDU is the same
17 thing. If they get pushed, they'll do it, but they're not
18 going to be revving up to do it.

19 MR. BECKJORD: Well, the AECL is pushing.

20 MR. BUSH: Oh, they're pushing. I'm talking about
21 the Commission -- in other words, NRR -- their willingness,
22 because they've got to put up the money, and they've got to
23 provide the people, and so forth. The other ones, as I see
24 it, are going to be a function of whether DOE really gets
25 very serious about MHTGR and PRISM.

1 MR. BECKJORD: Right.

2 MR. BUSH: Quite frankly -- of course, I've been
3 working on the liquid metal one for a long time -- I don't
4 see them making that next step very fast. So I think they
5 have quite a bit of time still on that one.

6 MR. UHRIG: There has been some concern about the
7 current design.

8 MR. BUSH: You mean the PRISM. The PRISM is safer
9 because what they've done is they've taken features from
10 both and stuck them together. I think what they're going to
11 do is be happy to fund the IFR program, you know, and get
12 more information. Their big problem, I think, is getting
13 meaningful fuel data in the links that are appropriate for
14 that reactor.

15 MR. BECKJORD: Well, if they're really serious
16 about it, I don't understand why they don't do the testing
17 in the FFTF. I mean, because they were going to shut it
18 down.

19 MR. BUSH: They have. The problem is that the
20 admiral has very strong opinions, and I suspect he will
21 control because it seemed to me that that's the very logical
22 thing. In fact, we wrote a letter which went to the admiral
23 eventually that made a very strong pitch that they should
24 indeed test for link elements in FFTF, and made the comment
25 that if they chose to shut down FFTF that they better start

1 looking for other test beds, such as in Japan.

2 MR. BURSTEIN: They have scheduled to shut down,
3 although they're now thinking about how much it'll cost to
4 effect that shutdown. But theoretically, that decision has
5 been made.

6 However, a great deal of the schedule for the
7 liquid metal, which some people think should be done earlier
8 and others later, will depend on how much they can sell it
9 to DOE, and the sales pitch is going to be on the basis of
10 burning actinides, which is right now, I think, a
11 charlatan's approach to things. But that may be an impetus.

12 MR. BUSH: There's something to be said for
13 burning actinides. If you go back and revisit the whole
14 thing in --

15 MR. BURSTEIN: Well, that requires a whole
16 business of processing in the US and everything else. I
17 just try to get a feel for whether, if we eliminate the
18 liquid metal and assume the high temperature gas is going to
19 be done by DOE as part of a production reactor, whether
20 we're talking about \$10 million or \$50 million a year for
21 NRC research when you get into that program.

22 MR. BUSH: If it's a production reactor, NRC
23 doesn't have to get into the thing.

24 MR. BURSTEIN: I understand, but I say we can
25 exclude that for the moment.

1 MR. BUSH: I think so.

2 MR. UHRIG: The thing that bugs me the most about
3 the liquid metal is at the last review, they changed the
4 expansion data on the core rather drastically from the
5 previous review. The end result was they had a \$5 swing
6 over the lifetime of the core instead of the less than \$1
7 swing they had had at the last review. It just totally
8 wiped out a lot of the advantages.

9 They put the GEMs in it, the gas expansion models
10 and some other things that they stuck in there. They blamed
11 part of it on reprocessing the source of the fuel, but there
12 was still about \$3 of that associated with a change in data
13 coming from INEL, which, at this point, that should have
14 been rock-firm.

15 MR. BECKJORD: I don't think they had a very
16 robust engineering approach on that whole thing.

17 MR. UHRIG: Maybe the new numbers are rock-solid.
18 It sure doesn't give one very much confidence that that's on
19 solid ground.

20 MR. BURSTEIN: At this point, I think it's still
21 conceptual pretty much.

22 MR. BUSH: I've been on the committee reviewing,
23 you know, the IRF concept, and I'm not optimistic --

24 MR. UHRIG: That's lagging, too.

25 MR. BUSH: No, that's moving along quite well.

1 MR. UHRIG: No, but the research on the actual
2 separation.

3 MR. BUSH: No, that's doing quite well.

4 MR. UHRIG: Okay. I hope you're right. You
5 probably are. I had the impression that things --

6 MR. BURSTEIN: Do you have an idea of what kind of
7 dollars we need for the two passive light water reactor --

8 MR. BECKJORD: I don't feel I can give you a good
9 number on that now. As I said, I don't see anything new in
10 severe accidents. That would certainly be a big thing. In
11 terms of the containment testing, if Westinghouse follows
12 through on that, that's going to be to their account.

13 The biggest thing that I know of on the
14 Westinghouse thing would be an integral systems test.

15 MR. BUSH: They don't want to do that. I didn't
16 think they wanted to do that.

17 MR. BECKJORD: No, they don't want to do it, and
18 if the NRC did it, why that would be an expensive test, I
19 mean, some millions of to construct, and a sizeable test.

20 MR. BUSH: I don't see the code as the major
21 problem, to my understanding.

22 MR. BURSTEIN: Well, listening to Eric's
23 description of the low velocity models and the code --

24 MR. BUSH: On the accident situation, it's a real
25 problem with the accident situation, but I meant for routine

1 operation. Is that what you're talking about?

2 MR. BURSTEIN: No. I was referring to the safety
3 review.

4 MR. BUSH: Oh, the safety review. Yes, that's the
5 real problem, as I see it. In fact, I think where you may
6 spend an awful lot of money is, for example, the report
7 coming out of PNL cast doubt on most of the computer codes
8 that have been used for thermal hydraulics. If that's the
9 case --

10 MR. BURSTEIN: Yes. It means more work in that
11 area.

12 MR. BUSH: -- then you have two choices: Do you
13 do experiments, or do you depend on modifying the codes to
14 handle it analytically? That could be very expensive.

15 MR. ISBIN: Eric, I just wanted to make sure I
16 understood what you said. The integral systems loop test?
17 Were you referring to that?

18 MR. BECKJORD: Yes.

19 MR. ISBIN: We heard from Kitner yesterday that,
20 indeed, the industry was to --

21 MR. BECKJORD: Well, I think EPRI has taken the
22 position that Neil had recommended to us earlier, at least
23 that's my understanding because I heard him say that. But
24 Westinghouse is not interested in an integral systems test,
25 and I don't think GE is, either.

1 MR. ISBIN: Well, how can he be so wrong?

2 MR. BURSTEIN: Well, he's not wrong. What he says
3 is that the review committee is going to strongly recommend
4 it. But, you know, Westinghouse is still the one that will
5 be spending the money.

6 MR. ISBIN: I got the impression that they're
7 going further, that they're going to do it.

8 MR. BECKJORD: I don't think this is -- this is
9 EPRI's view, I think. I don't think that's been settled,
10 because I met with Westinghouse in the end of September, and
11 they made it very clear that, as far as they're concerned,
12 it's not necessary and they're not going to do it.

13 MR. ISBIN: Because the view that Dick and I have
14 taken is that the integral tests are necessary.

15 MR. BECKJORD: I think the only question, then, is
16 who's going to do it. Is industry going to do it or is the
17 NRC going to do it? What I'm suggesting is that's the
18 negotiation that has to be --

19 MR. UHRIG: Do you have a ball park figure on the
20 cost?

21 MR. BECKJORD: I know the cost for the BNW, and I
22 know what the tests in Idaho cost. You know, it's something
23 on that order.

24 MR. BUSH: I wonder if you're really justified.
25 It seems to me that that's something that should be the

1 monkey on their back. I think you have the capability to
2 effectively analyze all of the data and agree or disagree.

3 MR. BECKJORD: I don't think so.

4 MR. BURSTEIN: Well, I understand that you've
5 concluded that an integral system test is required to
6 validate --

7 MR. BECKJORD: Yes. You know, I haven't done the
8 analysis to prove it. I haven't prepared a paper which
9 says, you know, "For these reasons, I think it's necessary,"
10 but it seems to me that whenever you have something as
11 complex as a PWR or a BWR, and you're going to provide a
12 water reservoir through gravity drains, there are a number
13 of questions that come up that are systems questions. I
14 mean, where is the water going to go? It's designed to go
15 one place, but have you looked at --

16 MR. BURSTEIN: I thought all of these questions
17 had been addressed to some degree.

18 MR. BECKJORD: Well, I think they have been, to
19 some degree.

20 MR. BURSTEIN: For example, in the case of
21 accumulator flows in the early stages of a PWR loss of
22 coolant scenario.

23 MR. BECKJORD: Yes.

24 MR. BURSTEIN: And we've looked at both the large
25 and small breaks in those terms.

1 MR. BECKJORD: Yes.

2 MR. BURSTEIN: I don't know if there's an
3 equivalent analysis for a boiling water reactor, but it
4 seems to me --

5 MR. BECKJORD: When I say that, I'm not referring
6 to the case where there's a large break. I don't think
7 there's much doubt that the water is going to go where it's
8 supposed to go. But it's these unusual transient events,
9 you know, with the possibility of then a fault with some
10 sequence that hasn't been studied. You may have pressures
11 around the loops which will cause the water to go somewhere
12 else other than where it's supposed to go.

13 MR. BURSTEIN: When we did our ECCS work 15, 20
14 years ago, and our Appendix K and so on, we looked at the
15 range of break sizes.

16 MR. BUSH: But you had a pretty good velocity
17 because the pump was pushing the water --

18 MR. BURSTEIN: Nobody said in a small break you
19 were going to lose your main coolant pumps.

20 MR. BUSH: I didn't say you did. I'm just saying
21 that you looked at fairly good velocities, and that's what I
22 think is the biggest difference.

23 MR. BURSTEIN: Now, if you're talking about a
24 natural circulation phenomena, again, that's something we
25 looked at for a different set of scenarios. My concern is

1 that we are trying to draw a conclusion as to whether we
2 need a lot of dollars in an area where the research has to
3 be done than any of the other advanced reactors for which
4 research needs doing.

5 I guess we're not sure the extent to which that is
6 required, although I guess Herb and Richard have decided
7 from other independent sources that those integral tests
8 would be needed. I guess I'd have to accept that because
9 they've looked at it much more deeply than I have. That's
10 substantial dollars, and it looks like NRC may have to come
11 up with a good part, if not all of it.

12 MR. MORRISON: With regard to those integral
13 systems tests being needed, what's the timing? Does that
14 become a pacing element with regard to the licensing? How
15 long can you wait for a decision or a commitment by somebody
16 to build that sort of plant? Does this extend the schedule
17 by two years, ten years?

18 MR. BECKJORD: Well, you could undertake it as a
19 confirmatory matter on the basis --

20 MR. ISBIN: That's the thrust of the comment.

21 MR. BURSTEIN: Would it be necessary to have that
22 for certification?

23 MR. BECKJORD: The test done?

24 MR. BURSTEIN: Yes.

25 MR. BECKJORD: I don't --

1 MR. BURSTEIN: A certification was requested under
2 the present guise by '95.

3 MR. BECKJORD: You know, certification might be
4 done on the basis of confirmatory research to be done to
5 show that the thing does what it's supposed to do as stated
6 by the designer.

7 MR. BUSH: Well, in the ones that you did, were
8 you recommending that NRC do that integral test, or did you
9 recommend that there had to be an integral test?

10 MR. ISBIN: The statement was simply made that an
11 integral test was essential.

12 MR. BUSH: Okay. I agree with that. I don't fee
13 that NRC necessarily has to do that. The monkey, I think,
14 is on DOE's back.

15 MR. BURSTEIN: I would guess, Mr. Chairman, that
16 we need some R&D money in the next five years for the
17 passive light water reactor designs, but we don't know how
18 much.

19 MR. MORRISON: What I was going to say is we may
20 be making three comments. First, the evolutionary light
21 water reactors and the safety issues associated with them
22 are encompassed within the current program activities.
23 Unless there are some major changes over your experience
24 base in the next couple of years, that's satisfactory.

25 At the other extreme, given the tight budgets and

1 the uncertainties in commitments to things like CANDU,
2 liquid metal, and MHTGRs, it wouldn't be prudent to spend
3 money now until there is such a commitment.

4 But in the passive LWRs, they should continue to
5 monitor the situation because there are some issues
6 recognized that are going to require significant funds that
7 aren't in the present budget. Whether it's a signal from
8 the Commission, or whether it's a signal from the industry,
9 or a signal from NRR, whomever, that would be the triggering
10 event to get it into the budget.

11 Is that what we've been saying around the table,
12 that right now, we can't define what needs to be in there,
13 or when it should be in there, or how much it should be?

14 MR. VOGEL: But intuitively, we know.

15 MR. MORRISON: Intuitively, it feels like it
16 should be in there.

17 MR. VOGEL: Yes.

18 MR. MORRISON: All right. Let me draft something
19 along that line, and I'm not quite sure where it fits.
20 You've already got the comment in the systems part of it,
21 but this'll be drawn back up, I think, probably toward the
22 end of the report.

23 MR. BUSH: It would seem to me it would be nice to
24 have it in a separate section. It really focuses, then,
25 that this is something that isn't covered in the --

1 MR. MORRISON: Yes.

2 MR. BUSH: I think we're all in agreement on that.

3 MR. MORRISON: Drawing on Eric's presentation here
4 this morning is sort of a way to organize it and focus it.

5 Well, I think we're at a decision point, then. I
6 feel we've probably wrapped up the advanced reactor. It's
7 about twenty minutes to twelve. We could break for lunch
8 early and come back about one, or we could continue longer
9 and deal with some of these other issues. What's your
10 pleasure?

11 MR. ISBIN: Do you think we could finish in
12 another three-quarters of an hour or so?

13 MR. MORRISON: My guess is probably more like an
14 hour, an hour-and-a-half. What we might do in the next 20
15 minutes is talk a little bit about the committee activities
16 beyond today, and that would be an item we wouldn't have to
17 pick up after lunch.

18 MR. BECKJORD: I need to make a phone call. It
19 might take five or ten minutes.

20 MR. MORRISON: Is that one that you need right
21 now, or can we talk a little bit about those activities?

22 MR. BECKJORD: Well, I need to catch somebody
23 before they go out to lunch.

24 MR. MORRISON: Okay.

25 MR. BURSTEIN: Mr. Chairman, some of us would like

1 to check out. I assume that's twelve noon or so around
2 here?

3 MR. MORRISON: Yes. That's as good a reason as
4 any to break.

5 MR. BURSTEIN: I think maybe if we took a few
6 minutes to do that, then you can decide whether you want to
7 continue the break for lunch or come back.

8 MR. MORRISON: Well, let's just continue it and
9 come back at one o'clock.

10 MR. VOGEL: One o'clock.

11 [Whereupon, at 11:42 a.m., the hearing recessed
12 for lunch, to reconvene this same day at 1:00 p.m.]

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A F T E R N O O N S E S S I O N

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[1:00 p.m.]

3

MR. MORRISON: Let's reconvene. For the final session of this meeting of the Nuclear Safety Research Review Committee we have two agenda items left.

6

One is to deal with the special topics or research program procedures as I had identified them in the outline. Second is to talk about future meetings.

9

Let's start with the outline. I listed a half dozen topics there under Research Program Procedures. What other ones should we have on the list? What topics don't we want on the list? What shall we present to the EDO as some special ideas they can consider?

14

MR. ISBIN: Just to help others along, at the bottom of page 4, in the bottom paragraph, and the paragraph on top of page 5 have been omitted. This is in the --

17

MR. MORRISON: Oh, it has been deleted, you mean?

18

MR. ISBIN: Deleted, yes. Since I am responsible for part of it, or most of it, I felt it could be well deleted.

21

MR. MORRISON: Maybe you'll get voted down on that.

23

MR. BUSH: I have a question, not on that. Well, it would seem to be a place it could go. It was an issue I think I raised yesterday. That was the one that it seems to

25

1 be some place in here -- I thought this was the logical
2 place -- that we might talk about shared research.

3 It isn't a matter of knowing what other people are
4 doing so much as the fact that there are very substantial
5 programs with very high leverages, as a point of interest.

6 My feeling was that it would be nice to say this
7 is an excellent way to go, considering limitations on funds,
8 etcetera, to try to continue to pursue this in the
9 international arena.

10 I don't see some of these big programs flying,
11 quite frankly, when you're talking about many millions of
12 dollars, without going this way. That's just a suggestion,
13 Mr. Chairman.

14 MR. MORRISON: But is that to serve a special
15 topic on its own?

16 MR. BUSH: I don't know.

17 MR. ISBIN: I think it's covered in other places.

18 MR. BUSH: Yes, but it seems to me it would be
19 nice to write a short paragraph on it, to indicate that this
20 is something that the Committee has a warm feeling about.
21 That would be my approach on it.

22 MR. MORRISON: I had identified a topic in the
23 outline which I didn't write anything unresponsive.

24 MR. BUSH: That would be a subset of that.
25 Because the -- talks about the fact that, if you want to do

1 certain things it's very difficult to do it within the
2 dollar constraints and the budgetary constraints.
3 Therefore, this sharing is a very good way to accomplish the
4 missions.

5 MR. MORRISON: Let's put it under Funding. A
6 couple of other items that I thought should be under the
7 Funding, but I didn't write on, obviously it's given all the
8 programs that are underway and the needs that we perceive,
9 now is not the time to reduce the budget. In fact, a good
10 research program depends upon a fairly solid budget over a
11 number of years.

12 I think a second element under there that you were
13 talking about, shared resources, principally from an
14 international perspective, I think one ought to identify the
15 differences between industry and NRC responsibilities, under
16 that Funding.

17 MR. BUSH: However, there have been some very
18 successful programs where EPRI and NRC co-sponsored, and
19 results I think have resolved problems that separately they
20 might taken quite a little bit longer to do it.

21 MR. MORRISON: Yes.

22 MR. VOGEL: EPRI, NRC and the foreign
23 participants.

24 MR. BUSH: There are some of those, too, yes. A
25 good example of that is the work in Taiwan on the business

1 of seismic problems with structures.

2 MR. BECKJORD: Yes.

3 MR. BUSH: That would be a good place to put it, I
4 think.

5 MR. MORRISON: Eric, in the letter from ACRS that
6 more or less triggered this whole idea, was ACRS
7 recommending a percentage of the overall NRC budget that
8 should go into research?

9 I think there was a paragraph -- do you remember
10 if there was a figure or a percentage or something?

11 MR. BECKJORD: I don't recall.

12 MR. ISBIN: Didn't we talk about this with
13 Chairman Carr, and he came up with a figure of 25 percent,
14 and then we had been talking about it in our own meetings?

15 MR. MEYER: What they did, the ACRS noted the
16 continual trend down, and then they noted that it had not
17 only been going down as the overall NRC budget was going
18 down, but it was going down disproportionately faster.

19 Then, in an almost rhetorical or suggesting,
20 questioning way, wondered -- speculative, I guess is the
21 word I'm searching for -- wondered whether there should be
22 some minimum fraction below which the budget shouldn't go.
23 Then they offered their opinion that they thought it had
24 gone below that value, whatever it was.

25 So I don't think they ever made a specific

1 recommendation of a percentage, but said there might be one
2 and maybe this Committee might want to --

3 MR. BECKJORD: Well, we can check that out. It's
4 just that I don't remember the specific percentage.

5 MR. MORRISON: Oh, okay, here it is. In Taylor's
6 letter back to Michelson, it said, "Rather than establish a
7 fixed percentage of the budget as support for research as to
8 essentially clearly define the technical areas and merits of
9 research to support specific needs in the Regulatory
10 process."

11 That's when he tossed it to us to take a look at
12 the program content and strategy.

13 MR. BURSTEIN: I think your point earlier about no
14 budget reduction and the need for continuity of a dependable
15 funding level is important. They address this issue in that
16 context.

17 MR. BUSH: I think a part of that is the timely
18 completion of projects which could permit a diversion of
19 money, or shifting of money. Of course, that's always a
20 danger, I suppose. Because any time you start a new one
21 you're never sure if somebody gets the ax out of it.

22 MR. MEYER: You see, Taylor's letter, I think, was
23 taking some exception to the ACRS letter, where they had
24 suggested that you should look for a percentage. Taylor's
25 letter says, no, look at the strategy and content instead of

1 just some percentage of the budget. That was the essence of
2 those two pieces of paper.

3 MR. MORRISON: That approach I certainly would
4 agree with. I don't know if within the Nuclear Regulatory
5 Commission if you could set a percentage. It doesn't seem
6 to be the right way to go.

7 MR. ISBIN: What is the percentage?

8 MR. MORRISON: Well, the budget this year will be
9 about \$465 million. So, it's, what, 22 percent or something
10 like that, 20 or 21 percent. Well, at '94, it would be
11 that.

12 MR. BUSH: If we do much on advance reactors it
13 should get up around the magic figure of 25 percent, ~ so I
14 would think.

15 MR. BECKJORD: Yes.

16 MR. MORRISON: Well, that probably addresses
17 Funding fairly well.

18 We want to back up to the user needs. Let's see,
19 Herb has recommended we strike a paragraph.

20 MR. ISBIN: There were some minor comments on
21 paragraph 3, but you could take that along with the other
22 suggestions that you may get.

23 MR. MORRISON: They're written into the text that
24 you gave me. Thank you.

25 MR. ISBIN: Not into the text, but in separate

1 sheets.

2 MR. BURSTIN: One of the things we have talked
3 about which may fall under User Needs -- or perhaps
4 somewhere else -- is some review of existing regulatory
5 requirements with a view toward their simplification or
6 validation or elimination or something in light of more
7 current or foreseeable data and needs.

8 We have had some criticisms that once we adopt a
9 regulation, it stays there no matter what, and we keep
10 adding complexity to the process and we never seem to get
11 toward any distinct effort at simplification. I don't know
12 whether there is a proper place or whether we've reviewed
13 this enough for it to be a matter -- although we have
14 touched on it from time in discussions around this table.

15 We looked at some of that, at perceptions of
16 other's people's regulators in the eyes of the regulated.

17 MR. BUSH: What you're suggesting is a conscious
18 and substantial effort.

19 MR. BURSTIN: I would think it would require
20 Commission direction almost.

21 MR. BUSH: The reason I mention it is that ASME
22 launched a program and funded it through the Pressure Vessel
23 Research Council about three years ago. It was aimed at
24 review and simplification with a possibility that, if there
25 are obsolete items or if there are items that are not

1 appropriate or if there are items that are -- that needed to
2 be strengthened, it should be done.

3 Of course, there was a strong interface between
4 the utilities, the industry generally as well as the
5 regulators. I think you'd have to go through that same
6 mechanism here. It would have to be an exchanged of
7 information in order to converse.

8 MR. MORRISON: Did you mention yesterday, Eric,
9 that some activity like that was underway in Murley's shop,
10 or was that simply looking at standards. I'm recalling
11 vaguely a comment, a retrospective look at what's on the
12 books that was being done.

13 It might have been standards.

14 MR. BECKJORD: No, that was on the rules.

15 MR. MORRISON: Rules?

16 MR. BECKJORD: Review the rules to see if they are
17 necessary and if they should be updated.

18 MR. BUSH: I think the gestation period,
19 unfortunately, is three to six years, at a minimum.

20 MR. BURSTIN: Maybe we ought to ask whether that
21 is something that the staff feels is worth of further
22 pursuit. I am sure some directors would feel it's the
23 lowest priority that they've got.

24 MR. BECKJORD: You're talking about the rules now?

25 MR. BURSTIN: I'm talking about rules,

1 regulations, guides, the body of regulatory requirements
2 that are imposed on licensees.

3 MR. BECKJORD: Well, the Commission is very
4 concerned about it. This is really their priority, the
5 review of existing rules.

6 MR. VOGEL: It seems to me that such a review
7 could lead to impacting research.

8 MR. BECKJORD: The impact is that we write the
9 rules.

10 MR. BURSTIN: I was wondering whether research
11 shouldn't lead this effort.

12 MR. BECKJORD: Yes, that is a task of our's, to
13 review those. It already is. It's in the support for it is
14 in the budget, in the issue resolution part, which we
15 haven't reviewed in detail.

16 MR. BUSH: My experience is that it takes a very
17 conscious effort. For example, you know, NUREG 1061, I
18 don't know how many man-years of effort went into that. I
19 think it was a very worthwhile thing. It changed the
20 direction and it think it will have future impact in the
21 piping area.

22 It also probably ended up with 10 or 12 man-years
23 of effort from within NRC and within the supporting
24 activities, including the organizations, peripheral ones.
25 It's a big effort. That's how you come to grips with some

1 of these problems.

2 In fact, I think that the payoff on that one is:
3 one, it will make it easier from the NRC point of view, and
4 I think from the utility point of view, the savings per
5 reactor will be measured in quite a few millions of dollars.

6 MR. MORRISON: Let me ask -- perhaps, Ralph, if
7 you could take a look at this and draft us a paragraph in
8 there that kind of picks up the sense of what Saul was
9 talking about, but recognizing what has already been tasked.
10 Since we haven't had a lot of time to deal with it in a lot
11 of depth, that might be a way to get it in the right focus
12 and we'll fold it into this User Needs Section.

13 How about maintaining technical capability? Is
14 that a topic we should have in here? Have we hit it well
15 enough in the following sections of the report?

16 MR. ISBIN: I thought that the section could be
17 grossly simplified. First, take out the last paragraph on
18 the thermal and hydraulic research centers, since this is
19 covered elsewhere.

20 I gave you a note in which the first sentence is
21 retained and another sentence is added and the rest of it is
22 omitted. Other committee members may have different points
23 of view. It's simplified. I think it should be there.

24 MR. MORRISON: All right.

25 MR. BURSTIN: Is the thought still contained

1 there?

2 MR. ISBIN: Oh, yes.

3 MR. MORRISON: Very good.

4 MR. BUSH: It seems to me that you need the one
5 supporting the premise, which is the important thing.
6 That's the first line.

7 MR. ISBIN: Oh, yes. Then there's another
8 sentence added which follows through.

9 MR. VOGEL: It seems to me that the first sentence
10 poses the problem, but doesn't give much help as to what the
11 NRC should do about it.

12 MR. ISBIN: Well, the Committee will continue to
13 review the research programs which address this issue
14 involving expertise within the NRC and among the
15 contractors, including universities. This has been a topic
16 in which we've had a continuing dialogue with research.

17 MR. VOGEL: That's fine, but on the NRC side, I'm
18 not sure what continuing review would do to help me.

19 MR. ISBIN: The problems are tough. I mean,
20 they're trying new things from time to time.

21 MR. VOGEL: It seems to me that since we brought
22 the subject up, we should make some suggestions how to help
23 solve it.

24 MR. ISBIN: Well, we do make suggestions from time
25 to time, but some of these are not as practical or as easy

1 to accomplish. It has been on the committee agenda at
2 almost every meeting.

3 MR. VOGEL: I sort of hate to see it brought up.
4 This is sort of a zero thing.

5 MR. MORRISON: When it first got on the
6 committee's agenda, it was really one of the recommendations
7 that the National Research Council made about more
8 university involvement in it. It seems that over the last
9 committee meeting, it's continued that, but has added the
10 dimension of even maintaining the capability with the labs,
11 given that they're competing budgets and competing programs
12 and competing interests within the labs.

13 Unfortunately, we haven't been able to
14 successfully address the first problem with universities
15 very well, although Brian was mentioning one yesterday that
16 seemed like it was going to work out. From the lab side, I
17 guess I don't know what you do with it except throw money at
18 it and that doesn't seem like a good solution.

19 MR. BUSH: First of all, there's quite a bit of
20 money out there already.

21 MR. MORRISON: Yes.

22 MR. ISBIN: For example, the motor head failure
23 work at Idaho Falls has among its objectives, in fact, the
24 second objective is to obtain a critical review of its work
25 from the other national labs. They're proceeding with Oak

1 Ridge, Sandia, and they're trying to work out some
2 relationships with Argonne. I think that's what was
3 represented.

4 The people involved were optimistic, really
5 optimistic.

6 MR. MORRISON: Which people were optimistic,
7 staff, INL or other labs. There were three parties.

8 MR. ISBIN: Well, INL, the people doing the work,
9 believing that they can get constructive points of view from
10 the other national labs. They're trying to do this
11 seriously.

12 MR. BUSH: There is the same kind of program on
13 aging where most -- not all -- but most of the national
14 labs, Los Alamos, Livermore and Sandia, as I recall -- well,
15 I guess Sandia is not -- have participated in the aging
16 program.

17 PNL coordinates, so there's a continuous feedback
18 and peer review type approach which I think accomplishes
19 something like you said. You retain that level of
20 expertise.

21 MR. MEYER: That particular program started out
22 very collegially. I know about this one because I started
23 it. Paul Shewmon, in fact, was the catalyst, an ACRS
24 member.

25 We intentionally looked to see what anyone had

1 done on this subject, including all of the labs and EPRI and
2 anybody else we could find. We had several meetings with
3 everyone making presentations about their past work and then
4 deciding how we would place a contract at one place to try
5 and pull it all together. That one has been collegial from
6 day one.

7 MR. BUSH: That's the low flux problem.

8 MR. MEYER: Lower head failure.

9 MR. BUSH: Caused by?

10 MR. ISBIN: By penetration failures in the next
11 vessel and massive failure.

12 MR. BUSH: The other one that he was interested in
13 was the low flux problem, you know, the low flux, long-time
14 damage which is outside of the --

15 MR. ISBIN: I see.

16 MR. BUSH: He was pushing that one hard, too.

17 MR. ISBIN: You mean on supports?

18 MR. BUSH: Not just on supports, also on the lower
19 part of the vessel.

20 MR. UHRIG: Is there any work being done with TMI
21 on the bottom side of the vessel as opposed to coming in
22 from the top? Is there any opportunity to do anything on
23 that?

24 MR. BECKJORD: The only additional thing that we
25 were looking at doing was to measure the -- to try to

1 measure to see if there was distortion of the bottom head by
2 just taking a surveying instrument.

3 MR. UHRIG: Down in there?

4 MR. BECKJORD: No, to put a meter stick down and
5 measure the distance from the plane across the flange to the
6 point vertically below it which we could identify and we
7 could compare those readings with as-built drawings to see
8 if there was creep distortion.

9 When all was said and done, the cost -- we just
10 didn't have -- finally, they came up with a figure \$320,000
11 to do this.

12 MR. UHRIG: That is high.

13 MR. BECKJORD: Yes. We're not going to do it. It
14 just wasn't worth it at that point.

15 MR. UHRIG: Have you ever looked down under there
16 at all?

17 MR. BECKJORD: Not underneath, no. You just can't
18 get in. It was the idea of snaking a scope down there, but
19 we ran out of money. They want to button the containment up
20 and if it was ever concluded essential to do that, we could
21 probably go back in for something on that order of money and
22 do it, but the money isn't there right now. It just didn't
23 look cost effective.

24 MR. BUSH: Sounds to me as if that estimate had
25 what is known as the discouragement factor built into it.

1 MR. BECKJORD: Well, the final estimate did not,
2 Spence. The initial estimate did. What happened was that,
3 as they got cleaning up in there, the crane needed work and
4 they made some disconnects, and the water system had to be
5 repaired. There were a whole list of items.

6 So, the cost of getting the measurement was a
7 small part of this. This was to pay for essential services,
8 to have people in the containment.

9 Initially the guy didn't want to do it. But I
10 talked with Phil Clark finally about this. Ed has been very
11 supportive of this program all the way along, and Phil Clark
12 was.

13 One estimate that came from the person at the site
14 was over \$500,000. They brought it down. But a bunch of
15 people looked at it and we concluded finally it was worth
16 \$100,000 to us to get that measurement and that was about
17 it.

18 MR. UHRIG: How about the penetrations? Had they
19 looked at that pretty thoroughly?

20 MR. BECKJORD: What?

21 MR. UHRIG: The penetrations from the bottom?

22 MR. BECKJORD: No.

23 MR. BURSTEIN: Only, again, from the inside.

24 MR. BECKJORD: We have the inside, which is one of
25 the anomalies. I mean, it is very interesting about these

1 results, the Argonne measurements and the Idaho
2 calculations.

3 If the temperature is right, then the system was
4 very close, if not just at the point, where those wells
5 ought to have failed. Those wells look fine. So there's a
6 disconnect here.

7 MR. UHRIG: The temperature may not have been that
8 high.

9 MR. BECKJORD: That is one, yes, that's right.
10 We're trying to work that now. It's a very interesting
11 result because it poses this dilemma. I think, by working
12 it we'll get the answers.

13 MR. MORRISON: Well, let's return to the
14 maintaining capability. Dick, I was going to ask you since
15 you have experience on the lab side as well. Do you see any
16 suggestions that we might put in here of a positive nature?

17 Of a positive nature. Dick was raising, I think,
18 a reasonable question if we're going to bring the issue up,
19 shouldn't we at least offer some kind of a solution.

20 MR. VOGEL: I would say one of the things that was
21 suggested was exchange of personnel. The problem was
22 financial. Some of the financial problems were mentioned.
23 I don't know how seriously the attempt has been made to see
24 what could be done about the next step of solving those
25 financial problems.

1 MR. BECKJORD: We looked, and it's about three
2 years since we looked into this, and haven't looked into it
3 since.

4 MR. MORRISON: It probably hasn't gotten any
5 better over that three year period.

6 MR. UHRIG: What about jointly supported research
7 to keep the capability?

8 EPRI would have some of the same motivations, I
9 think.

10 MR. BECKJORD: Yes, we do have joint work with
11 EPRI.

12 MR. UHRIG: That could be one way of doing this,
13 to reduce the burden, if you will, even though it's a
14 technology that isn't absolutely essential at the moment.
15 It's something that you anticipate that you will need.

16 MR. VOGEL: How would you do this, Bob?

17 MR. UHRIG: Well, I'm not sure. It would probably
18 have to be through a project. One of the areas I know that
19 there's some work either underway or anticipated in the near
20 future is in validation and verification of computer codes
21 that EPRI and NRC are -- or maybe it was Expert Systems,
22 wasn't it?

23 Validation and verification work anyhow, which is
24 an area that's going to be critically important in any
25 digital implementation. That could be the basis for NRC's

1 criteria.

2 MR. BECKJORD: Any interaction like that is
3 constructive. But, on programs such as MARVIBEU, and LACE,
4 ACE, participation generally has, on both the EPRI and NRC
5 sides, has involved attending meetings and discussing the
6 program during the meetings and so on. I don't think that
7 kind of cooperation is intense enough.

8 MR. UHRIG: I guess I was thinking of the program
9 the validation and verification, where I think it is
10 actually money from both organizations going into the
11 research. Am I wrong on that, Eric?

12 MR. VOGEL: This is true in these programs I
13 sited, also. But, I think --

14 MR. BECKJORD: I can't tell you, just sitting here
15 whether that is a specifically joint with EPRI on the code.

16 MR. UHRIG: I know there was a big spec out on it
17 that was joint.

18 MR. VOGEL: You may be right. It's just I --

19 MR. UHRIG: Whether it was ever actually funded
20 jointly or not, I honestly don't know. But I know there was
21 a joint bid spec out several months ago.

22 MR. BECKJORD: It seems to me to maintain
23 technical capability you've got to have people doing hands
24 on work, not just sitting in committees advising.

25 MR. UHRIG: I agree, and I think this is.

1 MR. VOGEL: Yes.

2 MR. BECKJORD: It seems to me that the matter of
3 maintaining the technical capability follows. If you have a
4 strong research program with interesting problems to work on
5 you're going to maintain most of the capability.

6 In the last couple of years there has been
7 competition with DOE programs at the labs, some people have
8 left. But out at Sandia last week they told us that their
9 people, in spite of all of the problems we've had, they like
10 to work on NRC programs. You know, they like the work. So
11 they've been able to keep good people. That's what they
12 told us.

13 MR. VOGEL: One way that might be helpful in
14 maintaining this technical capability would be to drag some
15 of the old guys in and have them work at NRC for periods of
16 time. I am reminded of the use that you made of the
17 Stanford professor who came in and reviewed a bunch of
18 programs for six months here. What was his name?

19 MR. BECKJORD: Sher, Rhudy. Rhudy Sher.

20 MR. VOGEL: You know, there must be a half dozen
21 or a dozen of these old guys around.

22 MR. ISBIN: Are you volunteering?

23 MR. VOGEL: I'm even older than that. Why not
24 think about putting these guys to work?

25 MR. BECKJORD: Well, there are a couple of guys

1 from Westinghouse that have showed up in the last two weeks
2 who are going to be going out of there and looking for the
3 possibility of -- one of them in the instrumentation area
4 who knows --

5 MR. UHRIG: Who is it?

6 MR. BECKJORD: Gallagher.

7 MR. VOGEL: Get people like that who have some
8 capability of teaching and passing on expertise and
9 experience, it might be useful. You've got Bob Avery who,
10 presumably, is retired at Argonne. It would be a good idea
11 to put him to work. Of course, he just got married.

12 MR. MEYER: At the other end of the spectrum, if
13 you remember back in the early '70's, after the Calvert
14 Cliffs decision, there were massive infusions of laboratory
15 people to the AEC, and on a loaner program in some cases.

16 There were problems with that, associated with the
17 court decision and its implementation, where the court said
18 the AEC had to have an independent technical capability, and
19 borrowing it wasn't having it, so that eventually the time
20 came that the people either had to hire on or go back.

21 MR. VOGEL: I'm thinking of the retired college
22 professor types who might be put to work.

23 MR. BUSH: I guess the question I have is that,
24 unless we change the words, access to credible technical
25 capability to me indicates that it does not have to reside

1 fully within the NRC. That if you can reach out and tap
2 people for special needs, you accomplish the needs. You
3 need a basic capability, but if you have a specialized one
4 you can do it.

5 Incidentally, in this respect, the next item,
6 particularly the parenthetic statement relates strongly to
7 what we're talking about here. You have to consider two of
8 them. In other words, Tom Murley's remarks, you know, about
9 the closure item relates strongly. Because, if you take Tom
10 Murley's statement in here about cancellation of contract,
11 effectively he is concerned that you, in essence, have a
12 total loss of technical capability. Now, I don't think that
13 happens in many, many areas. But there could be some where
14 I suppose hypothetically you could lose all capability.

15 MR. MORRISON: Let's bring the Maintain Technical
16 Capability in a sense to a close right now. Let me ask for
17 two things. One, if any bright ideas strike you within the
18 next week, jot them down on a piece of paper or fax them to
19 me and we'll include them in here.

20 Second, Ralph, maybe both you and I looking
21 through the transcript since we had a long discussion of
22 this yesterday, we might find some pearls of wisdom that
23 escape my memory right now. And if you give it a look at
24 the same time we can see if there's anything else in there.
25 Because I think we spent perhaps maybe a half hour yesterday

1 talking about it. We've got the transcript, so there's no
2 sense regurgitating that here.

3 All right, closure. Near and dear to a number of
4 people slouched around the table.

5 MR. BUSH: This would be a stronger statement when
6 we make the statement, the closure has been -- over the last
7 several years -- if we had one or two instances. It adds a
8 few words, but it makes the point, I think. I have trouble
9 thinking of too many closure items, quite frankly.

10 MR. MORRISON: Do you want to change it to
11 closure, a very few.

12 MR. BUSH: No, no. All I am saying is, it would
13 be very nice to say e.g., such and such, because you are
14 really saying there that, indeed, it has been a -- it has
15 occurred and I'm trying to think of big programs that might
16 have done this.

17 Perhaps thermal hydraulics is an example. That's
18 the one I can think of.

19 MR. MORRISON: We can suggest that, yes.

20 MR. MEYER: We did. At the beginning of all of
21 this in Eric's presentation, we listed -- this was at the
22 last meeting. We listed a number of accomplishments,
23 previous accomplishments which were in the nature of
24 wrapping up issues.

25 The revised ECCS rule was one of them. The

1 hydrogen rule, containment spray additives. There were
2 several areas and there were a number of those that you
3 could look back at, if you wanted to cite some examples.

4 MR. BUSH: I would look at some of those and I
5 would ask myself, have I seen an appropriate diminution in
6 funding level in the support areas. Thermal hydraulics, I
7 think, is clearly a case that is, indeed true.

8 Some of the others where there have been rules
9 written, I'm not sure if there's been much of a drop in the
10 curve or not.

11 MR. BECKJORD: A lot of problems crop up in a new
12 forum. Materials issues --

13 MR. BUSH: But it would be nice to point to a few
14 cases where, indeed, programs have been used to resolve an
15 issue and as the issue was resolved, the program
16 disappeared. I think it would strengthen the point that is
17 being made here.

18 MR. MORRISON: As I recall, at our June meeting,
19 Eric had made a statement that one of the documents that was
20 just released -- that there were no open safety issues. I
21 had that in the draft of the minutes. Saul took issue with
22 that and then he went back and saw the particular piece of
23 paper and agreed with it.

24 MR. BECKJORD: The end result was that safety
25 issues.

1 MR. MORRISON: There must be some results of
2 research in there. Is that the same list that Ralph was
3 talking about or are there other things we can cite in the
4 EG area here?

5 MR. BECKJORD: I think Ralph's list was specific
6 research projects, rather than --

7 MR. MEYER: Yes.

8 MR. BUSH: Unresolved safety issues. Of course, I
9 think of some generic issues as being safety issues, and
10 some of those, I would classify as resolved yet.

11 MR. BECKJORD: Well, it's that particular
12 classification of USI which is the top priority level. It's
13 true that there are generic safety issues which are safety
14 issues, but they didn't make -- do you recall the definition
15 of the unresolved safety issue?

16 There are, I think, four or five criteria that
17 determine -- that get something elevated to USI.

18 MR. BUSH: I thought A-11 was in that one. I know
19 it's obviously --

20 MR. ISBIN: What's A-11?

21 MR. BUSH: That's the upper shell.

22 MR. BUSH: Yes, it's the upper shell and it's only
23 partly resolved. It's been worked on for about five or six
24 years now. They delegated that to Section 11. That may not
25 meet the criteria for unresolved, I guess.

1 MR. MORRISON: Am I hearing that we are generally
2 happy with the statements if we can ge some examples in?

3 MR. BURSTIN: That's a parenthetical expression,
4 Mr. Chairman.

5 MR. MORRISON: That's the easiest thing to do with
6 it.

7 MR. BUSH: It ties it back. You could make some
8 kind of statement that you'd like to retain capability.

9 MR. MORRISON: All right, well, we've discussed
10 funding. Performance, is that the issue with inhouse or at
11 universities, contractors?

12 It really comes back to one of the reasons that we
13 were established and asked to address in our early charter,
14 does NRC get the best performers and the highest quality
15 work? Do we feel comfortable with it, is what I was really
16 getting at here.

17 The program content is exciting enough that it
18 attracts the right sort of people? It's being managed well
19 enough that the results are credible and useful? The
20 quality of the work is high or do we feel something
21 otherwise?

22 MR. BUSH: I wouldn't get that meaning out of
23 that? What I heard you say -- if I read the word,
24 "performers," I wouldn't come up with that opinion.

25 MR. MORRISON: That's part of our original

1 charter. It deals with the performance of the research.

2 MR. BUSH: Okay.

3 MR. ISBIN: I don't really think this is an item
4 that is current with all of our activities and again, we
5 continue to be looking at it. I don't think we're in a
6 position to make many definitive statements now.

7 MR. VOGEL: I was just saying that when you
8 evaluate performance, it's almost automatically a
9 comparison. I guess it's kind of tricky. There is an awful
10 lot involved.

11 MR. ISBIN: I suggest that we wait. I think that
12 we can be more positive as time goes along.

13 MR. VOGEL: One can be critical, for example, of
14 Sandia, but on the other hand, it's pointed out that they're
15 one of the few laboratories in the desert with a lot of room
16 around to do big experiments. It's just another factor
17 that's involved in selection of them to do certain work.

18 To put it another way, if I were in the NRC's
19 shoes, I think I would have frequently have made the same
20 decisions the NRC made as to the placement of work.

21 MR. BURSTIN: You also discussed the matter of
22 peer reviews; is this the place to include that?

23 MR. VOGEL: Could be.

24 MR. ISBIN: It's part of the ongoing activity. In
25 waste management, we've talked at length about peer reviews.

1 We've talked about peer reviews on various projects that we
2 mentioned. In the lower head failure, we've talked about
3 peer reviews.

4 MR. VOGEL: In general, when one -- a laboratory;
5 let's say Argonne or Sandia or anyplace, comes out with a
6 topical report covering an item, I don't think it gets good
7 peer review. I know, because I have been on the other end
8 of that procedure, and I've tried -- as a Division Director
9 at Argonne, I tried various devices.

10 One of the things I tried was to have internal
11 peer review. We had some hundred projects going on and I
12 had teams reviewing other people's work. Well, the group
13 was so friendly amongst themselves that they wouldn't
14 critique it.

15 I then tried to get other divisions at Argonne
16 involved and they were so friendly and so busy that I didn't
17 get anything there. The net result was that we did probably
18 a pretty good peer review as far as English and layout of a
19 report was concerned, because it has an editorial group, but
20 poor old Dick Vogel was doing the peer review for everybody.

21 Well, this was possible when the work, at least of
22 my division, was rather narrow. But there came a period
23 when in the late 60's and the early 70' when the work of the
24 division was broadened and I couldn't possibly cover all of
25 the disciplines involved to do a good job.

1 I left before I solved that problem. I don't
2 think my experience is different than anybody else's in a
3 national laboratory. I don't think that on a topical report
4 basis that these things are getting good peer review. It's
5 my suspicion.

6 MR. BURSTIN: When you talk about performers, you
7 talk about the quality of the product. I guess --

8 MR. BUSH: It's not necessarily the written word.

9 MR. VOGEL: It needs to have a good internal
10 review, because there you have an evaluation of personnel
11 and the written product and how the work was done, but I
12 know -- I suspect that there's certain reports that came out
13 of Sandia that lacked good peer review.

14 MR. MORRISON: Well, certainly some statements can
15 be made about that and I can probably draft a few.

16 MR. VOGEL: I would really like to see some
17 creative thinking done to solve the problem.

18 MR. BUSH: The best that I have seen -- and I am
19 biased, I guess, in that respect -- the University of
20 Chicago has the system that the used on the IFR where they
21 had three subcommittees looking at specific areas. They
22 don't worry about the documents.

23 What they worry about is the content of the
24 programs and the directions of the programs and their
25 comments are aimed at; this is inadequate or it's going on

1 the wrong direction or you should add something to it, et
2 cetera.

3 Then there's an upper level committee that, in a
4 more broad, general sense, tries to weave the things
5 together.

6 MR. VOGEL: Are these university people?

7 MR. BUSH: None of them are from the University.
8 They fund it.

9 MR. VOGEL: Sure.

10 MR. BUSH: Max Carpenter chairs the thing in the
11 fuels area. I tried to skim the cream of the metal people,
12 so I had Savannah River and I had GE and Rockwell and the
13 fast reactor and EPRI that could do that. It was the same
14 thing in the safety area.

15 I don't see too many of that type of peer review.
16 You look at the whole program that way. You don't worry
17 about the written word. You have your staff go through it.
18 It's a difficult thing.

19 MR. MORRISON: It's expensive.

20 MR. BUSH: It's not cheap; I agree.

21 MR. MORRISON: You say that's the IFR?

22 MR. BUSH: It's the IFR program.

23 MR. VOGEL: I think that's an interesting model
24 and might be very --

25 MR. BUSH: I only mentioned it in that context;

1 that I'm not sure how applicable it is, but because,
2 effectively, it amounts to three reviews followed by a super
3 review on the thing, and effectively, it's used as a
4 marketing tool because the ultimate reports which goes out
5 over the signature of the president of the University, goes
6 to Watkins.

7 It had been very successful, because the dollars
8 tend to go this way. As contrasted with a lot of trends,
9 that's the bottom line.

10 MR. VOGEL: This sounds like an extension of the
11 revisional review committees at Argonne.

12 MR. BUSH: To a degree, something like that,
13 except they're all outsiders.

14 MR. VOGEL: They were all outsiders.

15 MR. BUSH: In fact, it's basically the same
16 approach.

17 MR. VOGEL: Yes. No, I coped with them for many
18 years and they were useful.

19 MR. MORRISON: By mentioning peer review here,
20 would it be appropriate, or is it best left not said, the
21 peer review process on the DCH, for example, as a way to get
22 some sort of convergence on an issue?

23 That's a slightly different use of the word, peer.

24 MR. ISBIN: We do have some statements with
25 reference to the open process of resolving the Mark I liner

1 failure. That's in a separate place. I still suggest that
2 this is a topic that we need to look at more in depth in
3 future meetings, in order to come up with some more
4 quantitative evaluation.

5 MR. VOGEL: I don't really know, for example, the
6 procedures which Sandia uses and Oak Ridge and Argonne now
7 on making sure that their products are good. Maybe we
8 should investigate that.

9 MR. BUSH: Argonne hasn't changed that much.

10 MR. ISBIN: That's what I'm saying.

11 MR. MORRISON: Well, if there's enough uncertainty
12 about it, we don't even need to raise it here.

13 MR. BUSH: I think that one of the problems you
14 have is that when you talk about peer review, you could talk
15 about it somewhat cursory. Normally, you use internal
16 people, people within the organization which may or may not
17 be successful.

18 Obviously, they can't be the one that are hands
19 on. They have to be someplace else. Then you go to the
20 next step which looks at a bit of the program and picks out
21 people who have expertise, and the third one is where you
22 try to pull it together to look at the broad aspects of the
23 programs.

24 The second and third are quite expensive, in time
25 and in money both. I guess the question you want to ask is

1 -- somebody has to ask because somebody is going to have to
2 pay for it; what level do you need to accomplish the
3 purpose?

4 MR. MORRISON: Well, let me just ignore that part
5 of the report then. There doesn't seem to be any really
6 strong feeling about it. Do we need some other words on
7 international programs, since we've mentioned it a couple of
8 times in the report?

9 MR. ISBIN: I think it's sufficient in the report.

10 MR. VOGEL: I can't think of anything more we can
11 say.

12 MR. MORRISON: Any other topics? We've got at
13 total of four in this part of the report. Everybody is out
14 of good ideas today.

15 MR. ISBIN: I think we've come a long way in
16 taking your draft and adding comments.

17 MR. MORRISON: Making a silk purse out of a sow's
18 ear, I guess is what we're saying. Very good. Well, what I
19 will do is try to redraft this and given my schedule. I'm
20 not sure it will be before Thanksgiving.

21 We will expect the transcript in a week?

22 MR. MEYER: Five days. Five working days.

23 MR. MORRISON: A week. Give me a call as soon as
24 it comes in, Ralph. I'd like to pick it up so I can work
25 with it.

1 MR. BECKJORD: Do you need a list of anything that
2 you need from us?

3 MR. MORRISON: I think there were a couple of
4 items.

5 I'm reasonably sure that I'm going to have to get
6 back either to you, Ralph, or to probably Frank Kaufman on
7 the human factors area, or to straighten this whole part of
8 the report up.

9 Hopefully we can do most of that over the phone,
10 but I may have to come out and spend an hour or so
11 straightening it out.

12 All right, is there anything else we ought to have
13 in the report?

14 MR. VOGEL: I'm reading this business on
15 substitution of zirconium and I'm happy.

16 MR. BUSH: It's made the case. It's an upper
17 bound case and it may not bear any relation to reality and
18 I'm not sure you can guarantee it's an upper bound value.
19 Obviously what they've done is, they've picked a highly
20 exothermic process.

21 MR. VOGEL: In addition to that, they haven't so
22 far said anything about the chemical kinetics between
23 chromium and steam.

24 MR. BUSH: There was an indication of the
25 exothermic value.

1 MR. VOGEL: That's thermodynamics. That doesn't
2 necessarily mean kinetics.

3 MR. BUSH: I agree. Obviously, if you have a high
4 enough value, it's a strong suspicion of the kinetics.

5 MR. VOGEL: It will go fast.

6 MR. MEYER: If I could comment on this, keep in
7 mind the old question of whether you're doing an experiment
8 to get an answer that you're going to use directly in the
9 full scale reactor case or whether there is an element of
10 validating some analytical method.

11 I believe the approach is the latter. In weld
12 scale tests, if you're able to interpret it well with
13 chromium, you should be able to do the same thing for
14 zirconium.

15 MR. VOGEL: Even if the hydrogen, for example, is
16 released at a different rate? With chromium, you really
17 don't know what the rate is.

18 MR. BUSH: I don't believe that idea of the
19 pressure ratio giving an essentially complete conversion,
20 either.

21 MR. VOGEL: I guess another thing that was
22 unsettling was that the Farouk seemed to have too firm a
23 faith in this. He really seemed to believe that this was
24 okay. He didn't have his tongue in his cheek and he should
25 have.

1 MR. ISBIN: The committee adds a word of caution
2 with regards to the interpretation of this test and I just
3 want to be sure that Dick had a chance to review this. You
4 see no need to change our remarks?

5 MR. BECKJORD: No.

6 MR. BUSH: This will not convince me that it tells
7 me how zirconium is going to behave in this type of an
8 accident.

9 MR. VOGEL: Yes. I'm afraid that's so.

10 MR. BUSH: If you're going to use it in a
11 probabilistic model, what it does is give you an input that
12 may have very little validity.

13 MR. MEYER: The thing is that there's a lot of
14 physical activity here that you need to get some ballpark
15 modeling of. You're ejecting molten material and the rate
16 of oxidation is going to depend on the degree of
17 fragmentation and the relative flow velocities and things
18 like that.

19 I really believe that you can get a lot of
20 information relative to those processes from a test with
21 simulant material.

22 MR. VOGEL: One of the problems that I have is
23 that I would agree with you on studying physical phenomena.
24 When you begin to mix up these physical phenomena with
25 ongoing chemical reactions, there I begin to get a gas pain.

1 I don't think chromium will be the same as zirconium and I
2 don't thin that your scaling procedure takes different
3 chemical behaviors into consideration.

4 For purely physical phenomena, scaling is fine.

5 MR. BUSH: If they want to run the test, fine. I
6 think there --

7 MR. VOGEL: It's already done, I guess.

8 MR. BUSH: My feeling is that you have to exercise
9 caveats with regard to just how much you can extrapolate
10 from that one to any other.

11 MR. VOGEL: Exactly. The thing that was worrying
12 me was that Farouk seemed to be believing it.

13 MR. BUSH: As soon as you believe that this is
14 gospel, you've got trouble.

15 MR. VOGEL: Yes.

16 MR. MEYER: I agree completely with your last
17 statement. We're going to have to talk about this.

18 MR. BUSH: I'm not against doing the experiment,
19 but hedge it in with --

20 MR. MEYER: You don't know how you're going to
21 apply it.

22 MR. BUSH: You can apply it to a degree, but you
23 do not apply as this represents the specific value and that
24 the zirconium is going to behave like it. That's the
25 hooker.

1 It's a bounding calculation. That's all it really
2 is and that's the way it should be looked at.

3 MR. BURSTIN: I hope he gets it closer than that.

4 MR. BECKJORD: As I understand it, what we want to
5 know is the hydrogen production in this. The question is;
6 if you react the expected amount of chrome, are you going --
7 is there anything that can confound the production of
8 hydrogen that would be like the production if it were
9 zirconium.

10 MR. VOGEL: You might get the same total amount
11 out of it, but it will come out at a different rate. That's
12 the hooker, I think.

13 MR. BUSH: The distribution of the form is going
14 to be a very critical factor.

15 MR. MEYER: Analytically, the problem is
16 horrendous in the cavity because you've got compressible
17 flow and supersonic velocities and the degree of
18 fragmentation and the slip of the fluids and everything is
19 really a difficult calculation.

20 To do a test that's driven by steam with the
21 oxidation included in the test, in contrast to all of the
22 previous tests where you were driving it with an inert gas,
23 is a major step forward. I don't believe for a minute that
24 it's going to answer all of your questions, but, by gosh,
25 this is a big question that it is going to address by

1 finally including this very major phenomenon in the test
2 parameters.

3 MR. BUSH: This is the tail end. You've already
4 gone through a series of probabilities in order to get to
5 the probability that you have this core -- you add a value
6 of what? Ten to the minus -- what value do you want to put
7 on it?

8 MR. BECKJORD: Somewhere around 10 to the minus 6.

9 MR. BUSH: Or less. My gut feeling is it would be
10 less than that, but I won't argue with that. This is a step
11 beyond.

12 MR. MEYER: When you think about the TMI
13 observations that we're seeing right now and they're having
14 trouble rationalizing the apparent high temperatures. I
15 don't know that the conditional probability of ejecting
16 debris is all that low if you're going to have a core melt.

17 MR. BUSH: If you have those apparent high
18 temperatures and you have water and then on the basis of
19 what they were talking about, they should have had ignition,
20 to a degree, and possibly explosion. As far as I know,
21 nobody ever reported that.

22 MR. MEYER: Should have had what?

23 MR. ISBIN: An explosion, he said.

24 MR. BUSH: You certainly would have ignition,
25 rapid burning and that's one step removed from explosion.

1 MR. VOGEL: They had burning of hydrogen at Three
2 Mile Island in the containment. While we're burning it,
3 let's not burn it in the core.

4 MR. MORRISON: All right, let's talk about the
5 future. Over the last couple of years, we've been working
6 through subcommittees with one meeting of the committee of
7 the whole per year, roughly. Unless there's a strong
8 feeling otherwise, I thought that this year, because we have
9 some people who are relatively new to the committee -- and
10 we'll be getting a few more as time goes on here -- that we
11 probably ought to work as a committee this year.

12 I'm thinking in terms of perhaps three meetings
13 next year in '91. Sitting here with Eric, based upon a
14 meeting I believe you had last week or the week before last
15 out at Sandia, it was Eric's feeling that it would be a good
16 time to cover the severe accident program in detail again,
17 probably in a late January/February timeframe.

18 I know that what used to be the old sphere
19 accident committee benefitted by seeing some of the
20 facilities at Sandia. I suspect the whole committee may
21 benefit by that. Some of the people haven't seen those
22 facilities out there.

23 I would propose that we would have that meeting in
24 Sandia to discuss the severe accident program.

25 MR. VOGEL: Sandia in January?

1 MR. MORRISON: Or February, probably.

2 MR. BUSH: Late February?

3 MR. MORRISON: I don't know. Let's see, are there
4 bad times in the January-February timeframe?

5 MR. BUSH: Let's see, the last week of January and
6 the first two weeks, to the end of the third week in
7 February, I'm gone. Not that that matters much, but for
8 effectively three and a half weeks before we can.

9 MR. UHRIG: From the end of January until about
10 February 8. Then I've got the twentieth and twenty-first
11 out.

12 MR. MEYER: Could I suggest that, as you try and
13 get a date, Dave, that maybe you leave it as tentative and
14 give me an opportunity after the meeting to contact everyone
15 and confirm their calendars when they get home?

16 MR. UHRIG: Can we still review the calendars?

17 MR. MEYER: So that we can have an opportunity to
18 reschedule if we find that we're running short.

19 MR. MORRISON: Yes. It sounds like just on two
20 people's bases here, that it would be the last week of
21 February.

22 MR. BURSTEIN: It would or would not be?

23 MR. MORRISON: It would.

24 MR. BUSH: I have to be some place else.

25 MR. BURSTEIN: You just ruined a farewell.

1 MR. BUSH: I'm not going to argue with you in San
2 Diego. I'm sorry, Sol.

3 MR. BURSTEIN: I made a date with a very pretty
4 girl in San Diego, and he stands me up.

5 MR. BUSH: I have a date with another girl at that
6 time.

7 MR. BURSTEIN: If it's your own wife, I'm not
8 going to comment at all.

9 MR. BUSH: So, the last week in February? Is the
10 tentative date for the last week in February, and we'll
11 await Ralph's further advice?

12 MR. MORRISON: Sounds good from the calendar. So,
13 let's make it tentative the last week in February.
14 Somewhere around 25 or 26, 27 or 28, or whatever.

15 MR. VOGEL: Sounds to me like it might be more
16 than a two day meeting by the time you tramp around looking
17 at facilities.

18 MR. BECKJORD: Well, you can -- you know, half a
19 day I think is sufficient to see the facilities that we can
20 see there.

21 MR. UHRIG: For those of us on the east coast, we
22 go out in the evening the night before, but coming back you
23 would have to leave around noon, so it might be --

24 MR. VOGEL: Either that, or you go all day and
25 leave the next day.

1 MR. UHRIG: Yes. The next day's shot anyhow, so a
2 two and a half day meeting would not be out of line.

3 MR. VOGEL: You east coast guys don't expect any
4 sympathy from me.

5 MR. BUSH: Though I hate it when I arrange them
6 along those same lines, you know, when I have a meeting on
7 the west coast, to let people get out of there by around
8 noon which means they get home.

9 MR. MORRISON: A second meeting, probably back
10 here in Bethesda, within the May or June timeframe, I don't
11 think it needs to be scheduled any closer than that today,
12 unless there is an optimum time.

13 MR. UHRIG: June would be bad for me.

14 MR. MORRISON: June is bad for you. Is May also
15 bad?

16 MR. UHRIG: There's a week in there that's bad.
17 The 19th to the 24th is bad. But otherwise, May is alright.

18 MR. MORRISON: Well maybe the last week in May is
19 a possibility if that would fit other calendars. Ralph can
20 check that.

21 The topic on that one would be to go into more
22 depth on the advanced reactor program. I think the feeling
23 was that there would be some decisions made by then that we
24 can react to. The program plans that are in preparation now
25 would be available to review.

1 MR. BUSH: I was going to say that it might be
2 valuable to have the input from this current study, but my
3 guess, that study isn't going to converge at that time.

4 You might be able to, though. They might have
5 enough so that they come in and report if Murley and company
6 would approve it.

7 MR. BECKJORD: I think we'll have something that
8 we can give you in advance of an end of May meeting.

9 MR. BUSH: I was thinking of some of these that
10 would say there are major glitches in certain things, you
11 know, which would indicate that you might have to go this
12 way in contrast to that way, technicality.

13 The last time I looked, the PWR was supposed to be
14 in rough draft form in December. My guess is now it's going
15 to be February or March. That would still be adequate for
16 the use of it here. The BWR would probably belag that as a
17 report.

18 MR. BECKJORD: That's not the only document,
19 though.

20 MR. BUSH: No, that's not the only document. It's
21 just that that is a fairly extensive study, and several
22 hundred thousand dollars. So, it would be nice to have some
23 of that information. I think there might be enough to even
24 if we could supplement.

25 MR. BECKJORD: I would think that the Murley and

1 company would be quite willing to share that information
2 before the report comes out.

3 MR. MORRISON: The third meeting, I'm thinking in
4 the fall. October is just a month to suggest. Dealing in
5 depth with human factors and possibly adding aging and high
6 level waste. I think we need to look at that and see
7 whether that's too heavy an agenda.

8 MR. BUSH: Let me ask a question because this
9 issue is going to come up. It came up at ACRS in September,
10 there have been several write-ups since then, and I have a
11 strong suspicion we'll find out soon that, because of the
12 problems which you might subsume under aging with regard to
13 the vessel, may very well throw the whole PWR flex off the
14 track. My gut feeling now is that there's no way that
15 Yankee is going to continue because the cost per installed
16 kilowatt will be horrendous.

17 MR. BURSTEIN: I hear last week that all those
18 problems are behind us. From Yankee.

19 MR. BECKJORD: That's interesting, because I had a
20 letter that hit my desk last week from Neil Randall
21 protesting to Murley about the fact that they even let them
22 operate.

23 MR. BURSTEIN: I don't know what the status is.
24 I'm really totally confused here, Spence.

25 MR. BECKJORD: Well, if they want to spend that

1 much money, I guess that's their privilege.

2 MR. BURSTEIN: It's not unreasonable to consider
3 the aging emphasis despite what we said earlier today.

4 MR. BECKJORD: Well, I would judge from what I've
5 heard they are seriously considering the annealing.

6 MR. BUSH: Oh, if they anneal, that only solves
7 part of the problem. Because right now they can't inspect
8 that, that's all.

9 MR. UHRIG: They can't?

10 MR. BUSH: Cannot.

11 MR. UHRIG: Because of the construction?

12 MR. BUSH: Sites. Two and a half inches is what
13 you have toward the -- plus the fact you have -- finger
14 print cladding which means you have to come up with a
15 process that will work through finger print cladding.
16 That's a special case.

17 MR. BURSTEIN: Necessity is the mother of
18 invention.

19 MR. BUSH: In October, are you having any specific
20 weeks?

21 MR. BURSTEIN: October is usually a bad month.

22 MR. BURSTEIN: The first week and the middle week
23 are already specified for some meetings, both here -- well
24 the National Academy has meetings on the second and third
25 here. Then, the 17th, you have a meeting in Chicago, if

1 you're still there, as I do.

2 MR. BECKJORD: How about early?

3 MR. BURSTEIN: September?

4 MR. BECKJORD: Early October.

5 MR. BURSTEIN: After the first week I would think
6 that would be alright.

7 MR. MORRISON: Second week.

8 MR. BURSTEIN: The second and third days, the days
9 of October, October 2 and 3, would be awkward, therefore
10 that week.

11 MR. BUSH: If you're going to be at the Academy,
12 then you're right here.

13 MR. BURSTEIN: Unless there's a pier committee on
14 the fourth. But we'll worry about that.

15 MR. MORRISON: Maybe September 30 and October 1
16 would be the dates. Why don't you check those out, Ralph,
17 if you would?

18 MR. BUSH: As I said, I've got to find out about
19 some of them. Because I don't know what my PVR city dates,
20 or IBM CS dates, or a few other committees are.

21 May should be alright unless I have to be at
22 Pierce, which I'll find out in about a month.

23 MR. VOGEL: You're going to come forth with a
24 draft and fax it to us?

25 MR. MORRISON: Either Fax or Fed Ex, or whatever,

1 depending upon the length.

2 MR. VOGEL: Every fax I get, it costs me \$2.50 per
3 page.

4 MR. MORRISON: It costs you \$2.50 per page for a
5 fax?

6 MR. VOGEL: To get it, yes.

7 MR. MORRISON: To get it?

8 MR. UHRIG: Why?

9 MR. VOGEL: I use a commercial outlet. I don't
10 have my own.

11 MR. BECKJORD: Do you have pieces that are coming
12 in?

13 MR. MORRISON: Spence is the only one that has
14 another piece, right? You were going to mark up --

15 MR. BUSH: I did have. I gave it, and I've done
16 mine. As far as I know, I cleared the decks, unless you
17 tell me you want some more.

18 MR. MORRISON: No, that was the only one. Because
19 I got the input from Herb and Dick this morning that they
20 had written up, either marked up the draft or written some
21 other comments. Sol has given me his marked up version of
22 the human factors which, again, has to be redressed in light
23 of some of our discussion this morning.

24 MR. BECKJORD: What about Ed? Is he -- I don't
25 remember from yesterday.

1 MR. MORRISON: He escaped without assignment.

2 MR. BECKJORD: That's between you and him, then.

3 MR. BUSH: Having watched this off and on, you're
4 talking the human factors and spend a day or so on it.
5 Somehow or other, somebody had better write something on
6 what we're going to try to accomplish, because quite
7 frankly, I've found that trying to get my arms around human
8 factors is not easy. In other words, I can read all the
9 words and that doesn't help me a damn bit because it doesn't
10 really tell me what they're converging on.

11 MR. BURSTEIN: I heard something that you might
12 use, and that was to get some common sense into the program.

13 MR. BUSH: I won't argue that. But I'm just
14 saying that I don't need to have to listen to a day and a
15 half about the issue to get results.

16 MR. UHRIG: I wrote down a few things here, the
17 essence of which was the obvious aspects such as location of
18 instruments, labeling of dials and controls, etcetera.

19 The ergonomics of displays, especially computer
20 generated displays is still being studied, but at least it's
21 based on sound principles. The really important and
22 complicated aspects, such as the allocation of functions
23 between men and machines is still an area of research.
24 Though there are many theories, there is relatively little
25 hard science to back it up.

1 Progress is being made piecemeal and,
2 unfortunately, the field is not ready for an integrated
3 implementation into nuclear power plants.

4 Our friend from Ohio State may be very upset at a
5 statement like that, I don't know.

6 MR. MORRISON: What are the words?

7 MR. UHRIG: I was going to give it to you. I
8 would suggest you talk to him before you use any of these.

9 MR. BURSTEIN: What we have said is that all of
10 these are synonymous comments.

11 MR. BUSH: I was talking about the meaning a year
12 from now. That what I was talking about.

13 MR. BURSTEIN: These are unsigned.

14 MR. MORRISON: That's why I was going to come back
15 and try to get clarification from you, Spence, by what you
16 mean. You feel that the briefings by the staff are not
17 sufficient to give you the focus to make some judgments or
18 to gather an understanding of the program?

19 MR. BUSH: I didn't plan to reserve that much
20 focus, that's part of my problem.

21 MR. UHRIG: Were you talking about a pictorial?

22 MR. BUSH: Well, I don't know what. I'm just
23 asking a question, because I will not be able to listen for
24 a day. I'd like to see something that comes out of it.

25 MR. UHRIG: It took hours at the beginning by --

1 who is it, Sherod at MIT who headed that committee?

2 MR. BECKJORD: Yes, Tom.

3 MR. UHRIG: Tom Sheridan. It might be a good way
4 to start off. I don't know, just a random thought.

5 MR. BUSH: You see, I've been exposed to that
6 stuff off and on. But I think Sol had a very good point.
7 That, until you get a strong interface and the user, or the
8 ones that are familiar with the use, and the human factors,
9 I don't think you've accomplished much. Now, if you can
10 come up with something that would begin to do that, then I
11 think it would be very worthwhile.

12 MR. VOGEL: Human factors in a vacuum is very
13 abstract.

14 MR. BUSH: That's what I'm saying. I would hope
15 it wouldn't be that way. If I could begin to see an end
16 product that would come up. There are some things that are
17 very obvious, I agree.

18 MR. UHRIG: Yes. Obvious things, such as location
19 of dials as we talked about this morning, having such --

20 MR. BECKJORD: Why don't we get a prospectus out,
21 then you can comment on it.

22 MR. UHRIG: Good.

23 MR. BUSH: Okay. That's the idea. I'd like to
24 see something. We've got lots of time to do it, but to come
25 here and comment in a vacuum so to speak and listen, I don't

1 know.

2 MR. BECKJORD: We'll get that out to you by the
3 end of the year, and if you could give us feedback by this
4 February meeting, that gives plenty of time.

5 MR. UHRIG: NRC did sponsor a workshop on human
6 factors about a year and a half ago, and the report on that
7 is out. This was SAIC, I believe it was, was the
8 coordinator for that, and they wrote the report.

9 I have a copy of that. It dealt with a relatively
10 narrow aspect of this problem. It wasn't a broad base.
11 very heavily oriented to some of Rasmussin's theories and
12 how you implement the human factors.

13 MR. BUSH: Yes. I think a prospectus would be an
14 excellent idea. Something to give me a feel for it, so you
15 can essentially respond to it and say, well it looks to me
16 as if, you know, or stronger if you covered something like a
17 summary.

18 MR. MORRISON: Are there any other comments?

19 MR. UHRIG: On the human factors, I liked our
20 British visitor's comments about make the system fault
21 tolerant against human error. I like that concept.

22 MR. BURSTEIN: In which case we wouldn't have very
23 much competition, and you would have never built a B&W plant
24 in this country. Shall I name you a few more?

25 MR. UHRIG: I agree with that statement.

1 MR. BURSTEIN: I agree, too. But we have had for
2 a number of years in England a paternalistic nationalist
3 utility.

4 MR. UHRIG: That helps sometimes.

5 MR. BURSTEIN: Damn right it does. It alleviates
6 all the problems.

7 MR. UHRIG: EDF does very well, too.

8 MR. BULLARD: I think one of the difficulties is
9 applying many of these off shore lessons to our system and
10 to our environment. I'm not sure we would apply the way
11 they do, but the just the concept of making the system
12 resilient.

13 MR. BECKJORD: Some of the really good work has
14 come out of the U.K. I mean, this guy Reasoner who just
15 came out with a book and these studies that Jeff referred
16 to. I've seen two of them and the inquiries are really
17 excellent. I mean, very well documented and very carefully
18 reasoned.

19 MR. UHRIG: One of the problems is that there has
20 been good work, but within the constraints of the U.S.
21 regulatory process, it would be very difficult to apply some
22 of this.

23 MR. BECKJORD: Well, that's another question, yes.

24 MR. UHRIG: Well, it's a very important question,
25 because you could spend a lot of money and end up with no

1 way of applying that meaningful information, you haven't
2 accomplished very much.

3 MR. UHRIG: That brings up the more fundamental
4 question of what does it take to change the Regulatory
5 process.

6 MR. MORRISON: We'll extend the afternoon or
7 something. Close the meeting, I'll tell you.

8 MR. BUSH: Either that or invite the utilities in
9 and decide to sit there for a week.

10 MR. MORRISON: Any other comments before we close?
11 Well, I thank all of you for your participation. I believe
12 it's been a good meeting. I just hope I'm up to the task to
13 getting a report that reflects all of this wisdom that has
14 been spent here.

15 MR. BECKJORD: I think we've covered a lot of
16 ground.

17 MR. BUSH: The initial draft was very helpful, Mr.
18 Chairman. I think that made it possible for us to focus.

19 MR. MORRISON: Thank you.

20 MR. BUSH: I pity you, though, Mr. Chairman,
21 because the next draft is going to be a lot more work on
22 your part.

23 MR. MORRISON: Well, I'm sure it will be. But
24 that's what I get paid for. As Chairman, the salary here
25 and the perks are really great.

1 [Laughter]

2 MR. MORRISON: With that, let's adjourn the
3 meeting.

4 [Whereupon, at 2:32 p.m., the meeting concluded.]

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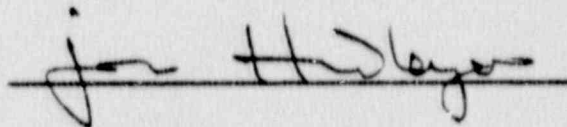
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