

**NUCLEAR REGULATORY COMMISSION**

Title: Advisory Committee on Reactor Safeguards  
Safety Research Programs and Future Plant  
Designs - Joint Subcommittee Meeting

PROCESS USING ADAMS  
TEMPLATE: ACRS/ACNW-005

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Wednesday, November 6, 2002

**ORIGINAL**

Work Order No.: NRC-622

Pages 1-351

NEAL R. GROSS AND CO., INC.  
Court Reporters and Transcribers  
1323 Rhode Island Avenue, N.W.  
Washington, D.C. 20005  
(202) 234-4433

**ACRS Office Copy - Retain**  
**for the Life of the Committee**

TROY

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

JOINT MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

SUBCOMMITTEE ON SAFETY RESEARCH PROGRAMS

~~AND~~

~~SUBCOMMITTEE ON FUTURE PLANT DESIGNS~~

+ + + + +

WEDNESDAY,

NOVEMBER 6, 2002

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittees met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Drs. F. Peter Ford and Thomas S. Kress, Chairmen of the above Subcommittees, respectively, presiding.

SUBCOMMITTEE MEMBERS:

F. PETER FORD, Co-Chairman

THOMAS S. KRESS, Co-Chairman

MARIO V. BONACA, Member

GRAHAM M. LEITCH, Member

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

## 1 SUBCOMMITTEE MEMBERS: (CONT.)

2 VICTOR N. RANSOM, member

3 STEPHEN L. ROSEN, Member

4 WILLIAM J. SHACK, Member

5 JOHN D. SIEBER, Member

6 GRAHAM B. WALLIS, Member

7

## 8 ACRS STAFF PRESENT:

9 RICHARD P. SAVIO

10

## 11 NRC STAFF PRESENT:

12 RALPH CARUSO

13 STEVEN M. BAJOREK

14 FAROUK ELTAWILA

15 JOHN H. FLACK

16 WALTON JENSEN

17 RICHARD LEE

18 SHANLAI LU

19 JAMES E. LYONS

20 JOE MUSCARA

21 JACK ROSENTHAL

22 STUART RUBIN

23

24

25

**NEAL R. GROSS**COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

ALSO PRESENT:

MICHAEL CORLETTI, Westinghouse

ADRIAN HEYMER, NEI

LUCA ORLANI, Westinghouse

VICTOR SNELL, AECL

ROB M. VERSLUIS, DOE

GARY VINE, EPRI

**NEAL R. GROSS**  
COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

(202) 234-4433

[www.nealrgross.com](http://www.nealrgross.com)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

C-O-N-T-E-N-T-S

Introduction . . . . . 4

    Peter Ford

NRR Presentations . . . . . 5

    James Lyons . . . . . 5

    Shanlai Lu . . . . . 23

RES Presentations . . . . . 62

    John Flack

DOS Presentations . . . . . 165

    Rob Versluis

Discussion and Comments from the Audience . . . 215

NEI Presentations . . . . . 220

    Adrian Heymer

EPRI Presentations . . . . . 272

ACRS Subcommittee Discussion of Draft

NRC-Sponsored Research Report . . . . . 336

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

8:35 a.m.

CO-CHAIRMAN FORD: Good morning. The meeting will now come to order.

This is a meeting of the ACR Subcommittees on Research and on Future Reactors. My name is Peter Ford. I'm the Chairman of the Research Subcommittee, and my Co-Chair is Tom Kress, Chairman of the Future Reactors Subcommittee.

The ACRS staff member is Richard Savio. Other ACRS members in attendance are Graham Wallis, Victor Ransom, Mario Bonaca, Steve Rosen, Graham Leitch, Jack Sieber, and Bill Shack.

The purpose of this meeting is to gather information for the ACRS Research Report which is due out early next year. This report will comment on the completeness of the NRC Research's assessment of the regulatory and technical challenges for future reactors.

We have their report, "Advance Reactor Infrastructure Assessment," plus further pre-decisional appendices covering more details on ALWR designs, plus an itemization of activities for fiscal year '03. These are the prime bases for our comments in the report.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

(202) 234-4433

www.nealrgross.com

1           Thus, we shall hear from NRR and RES on  
2 their final reports. We shall also hear from DOE,  
3 NEI, and EPRI on their views on research needs for  
4 proposed advanced reactors. A segment of time has  
5 been set aside for comments from the general audience.

6           The rules for participation in today's  
7 meeting have been announced as part of the notice of  
8 this meeting previously published in The Federal  
9 Register. A transcript of the meeting is being kept  
10 and will be made available as stated in The Federal  
11 Register notice.

12           It is requested that speakers first  
13 identify themselves and speak with sufficient clarity  
14 and volume so that they can be readily heard.

15           The first item of business is NRR. Jim,  
16 would you like to lead off?

17           MR. LYONS: Yes, I will lead off. I'm Jim  
18 Lyons. I am the Director of the New Reactor Licensing  
19 Project Office in NRR. We are responsible with the  
20 project management of any licensing reviews that will  
21 be held as we move forward in licensing new plants.

22           I want to start off with actually a slide  
23 that I showed to you about a month ago. Nothing  
24 really has changed on this, but I would like to walk  
25 through it just a little bit to put things in context

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of where we are and where we are going and what we are  
2 going to work on.

3 I guess in good, I don't know,  
4 presentation fashion, I will do a little highlights of  
5 things to come. Early site permits, we have three of  
6 those coming in in 2003. We are going to be here  
7 tomorrow to talk to the full Committee on the early  
8 site permit review standard and how we're planning on  
9 doing those reviews. So I'm not going to get into  
10 that too much today.

11 I just wanted to let you know that those  
12 are coming. There's a lot of staff effort that is  
13 going into that and to developing how we are going to  
14 review these sites to issue these early site permits.  
15 That is one part of the Part 52 licensing process,  
16 which includes early site permits, design  
17 certifications, and then, finally, combined licenses.

18 CO-CHAIRMAN KRESS: When you talk about  
19 early site permits from the viewpoint of research, do  
20 you see any research needs for that or is that just a  
21 process --

22 MR. LYONS: At this point we haven't  
23 developed any. One of the big areas that has really  
24 changed the way we did siting reviews in the past is  
25 in the seismic area.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 CO-CHAIRMAN KRESS: Yes.

2 MR. LYONS: And there are some  
3 discussions, I think, going on in the seismic area of  
4 reviews, on how we would do those reviews and actually  
5 using the Part 100 appendices for the first time.

6 CO-CHAIRMAN KRESS: I guess we are  
7 supposed to have a discussion on early site permits  
8 later. So I will save my questions for then.

9 MR. LYONS: Right. Okay, good.

10 CO-CHAIRMAN FORD: But just as a kind of  
11 overview for this meeting's sake, is it planned that  
12 there will be a section in the infrastructure  
13 assessment relating to ESPs?

14 MR. LYONS: I don't think there is at this  
15 point.

16 CO-CHAIRMAN FORD: No, there isn't. My  
17 question is, I recognize the living document --

18 MR. LYONS: I think at this point we don't  
19 see the need for that.

20 CO-CHAIRMAN FORD: Okay. So there are no  
21 research dollars put aside, regardless of the source  
22 of those research dollars, for doing work on ESPs?

23 MR. LYONS: Right. But if we see a need,  
24 it is part of our reviews to ask Research to do  
25 certain things for us; we may do that. Right now we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 are in -- and we will talk about this tomorrow -- but  
2 we are in pre-application discussions with the three  
3 applicants and with NEI on exactly what the scope and  
4 the depth we are going to go to. So we are trying to  
5 identify those types of issues and to see where we are  
6 going to need help and where we might not.

7 MEMBER LEITCH: I have a lot of questions  
8 about ESP. I think probably tomorrow's discussion is  
9 a more appropriate time to ask those, but I mean just  
10 the seismic question, for example, how can one approve  
11 a site when you don't know the reactor design that is  
12 involved? I mean, some of these designs are very tall  
13 and others are underground. It seems to me that, in  
14 and of itself, would --

15 MR. LYONS: We'll discuss all that  
16 tomorrow.

17 MEMBER LEITCH: Okay.

18 MR. LYONS: Yes, a lot of that has to do  
19 with the way the early site permit, what do you really  
20 approve as part of the early site program, and we will  
21 get into that tomorrow.

22 MEMBER LEITCH: Okay, good, Jim.

23 MR. LYONS: The other thing upcoming is  
24 AP1000, the design certification. We are in the midst  
25 of that review. We have already issued our request

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 for additional information. We are slated to issue a  
2 draft safety evaluation report on AP1000 in June of  
3 2003, and we'll be coming back to the Committee for  
4 those reviews.

5 Again, I think tomorrow afternoon we have  
6 about a two-hour presentation on the AP1000, so we can  
7 discuss any of those issues.

8 CO-CHAIRMAN KRESS: Can I read this chart  
9 as being in priority order as you go down?

10 MR. LYONS: It's more in chronological  
11 order of when we see things starting, but in the same  
12 place that does kind of define our priorities. Kind  
13 of first-in/first-out is the way we have been working.

14 In fact, we had a meeting with the  
15 industry yesterday, with NEI. One of the things we  
16 raised was, is there a priority amongst the different  
17 projects that they see ongoing? Can industry give us  
18 a priority of what do we need to be really working on?

19 Certainly things that lead directly to a  
20 combined license are things that we would focus our  
21 efforts on. Early site permits go that way. Plants  
22 or designs that are in for design certification are in  
23 that way. The pre-application discussions we are  
24 having with the other vendors are important to move us  
25 forward, but they would necessarily take a back seat

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to some of the other efforts.

2 CO-CHAIRMAN KRESS: Is it too early to ask  
3 where ACRS would fit into that chart? Is it the red  
4 diamonds?

5 MR. LYONS: The red diamonds are where we  
6 see the ACRS having some input at that point or that  
7 we would be coming to the ACRS. Those are our dates.  
8 Obviously, we would come before that to you, probably  
9 a month or so before that, to discuss those issues.  
10 That is why I tried to raise those in red, to  
11 highlight where we see that.

12 The ESBWR pre-application, we've got that  
13 underway. We've decided what we're working on and  
14 where we are going to move forward to. You will hear  
15 a little bit in just a little while from Shanlai Lu on  
16 where we're looking for help and support on ESBWR and  
17 on AP1000.

18 The reason I've got milestone schedules  
19 for AP1000 and ESBWR up here, because those are the  
20 ones we've actually developed milestone schedules.  
21 The others we are still in the process of developing  
22 both through the early site permits and for the other  
23 pre-application reviews. So I would see this chart  
24 expanding and schedule expanding as we have those  
25 milestones established, and then would show how we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N W  
WASHINGTON, D C 20005-3701

(202) 234-4433

www.nealrgross.com

1 would fit into that.

2 But let me walk through some of these  
3 others.

4 MEMBER WALLIS: Could I just ask now, this  
5 design certification, AP1000, there's about a four-  
6 year process?

7 MR. LYONS: Right.

8 MEMBER WALLIS: And then ESBWR, yours ends  
9 with a design certification application. Is there  
10 another four years of that before -- you are going  
11 about six years before you get an ESBWR approved?

12 MR. LYONS: How do I want to say this? The  
13 way that works is, if you look --

14 MEMBER WALLIS: Maybe it is five years?

15 MR. LYONS: In this September-October of  
16 2004, that is when we actually would be issuing our  
17 final safety evaluation report and our final design  
18 approval. That would actually complete the staff's  
19 technical review of the design.

20 Between October of 2004 and December of  
21 2005, that's the time we would see that it would take  
22 to actually develop the rulemaking and notice the  
23 rulemaking that puts the design certification -- that  
24 actually certifies the design as part of the rule.

25 MEMBER WALLIS: So that's got to be added

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 on at the end of the ESBWR?

2 MR. LYONS: That's right. So in this case  
3 we are looking at about 30 months, I think was our  
4 review schedule for AP1000 -- I'm looking back at  
5 Larry to give me a yes -- from when we got started.

6 You have to remember, too, with the AP1000  
7 we were able to realize a lot of efficiencies because  
8 we had already reviewed the AP600, and we are really  
9 just reviewing the changes in that design. For the  
10 other designs, we're starting a lot from ground zero.  
11 So our review time to reach a final safety evaluation  
12 will probably be longer than --

13 MEMBER WALLIS: It might be shorter if you  
14 did some stuff in the pre-application.

15 MR. LYONS: That's true.

16 MEMBER WALLIS: If you did enough work  
17 then, you might not have to spend so much time on  
18 that --

19 MR. LYONS: The pre-application reviews --

20 MEMBER WALLIS: -- design certification.

21 MR. LYONS: Right. The pre-application  
22 reviews help us, help both the vendor and the NRC,  
23 decide what are the key issues, try to resolve any of  
24 those, so that the vendor feels confident in moving  
25 forward with the design certification, so that they

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N W  
WASHINGTON, D.C 20005-3701

1 don't see any major obstacles.

2 In the ESBWR, what we are looking at is  
3 their codes, their thermal-hydraulic codes and their  
4 containment codes, and coupling them together and  
5 moving forward. They see that as one of the major  
6 hurdles. They feel if they can overcome that, then  
7 the rest that they could come in.

8 On these other reviews, ACR700 is the  
9 Advanced CANDU Reactor. That's a new design to the  
10 U.S., but it is certainly not a new design. It is an  
11 evolutionary design of the CANDU reactors that have  
12 been operating throughout the world.

13 As the NCR staff has to bring itself up-  
14 to-speed on some of the issues, one of the things we  
15 have done is we have started discussing with the  
16 Canadian Nuclear Safety Commission how we might  
17 cooperate in reviewing the ACR700, because AECL  
18 technologies, which are bringing the technology here  
19 to the United States, are also -- AECL is also seeking  
20 pre-licensing in Canada and in the United Kingdom.

21 So a couple of weeks ago we had a meeting  
22 amongst the three regulators to see how we might work  
23 together, and to what extent we could do that, and to  
24 what extent we all have our own regulatory processes.  
25 We have to meet and we all have to make our own safety

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 findings, but the sharing of information and the  
2 sharing of knowledge we see as something that can be  
3 very beneficial.

4 MEMBER ROSEN: Did your discussions go to  
5 the sharing of any future research as well?

6 MR. LYONS: Yes, we did. We talked to  
7 some extent -- the Canadian Nuclear Safety Commission  
8 doesn't normally do any independent research like we  
9 do. So one of the things we were looking at exploring  
10 is whether they would want to cooperate with us.

11 They typically go to AECL and ask for AECL  
12 to do the research. But we are looking at the  
13 research that has been done on CANDU reactors and how  
14 we might fit into that, and what kind of information  
15 we need.

16 So part of it is learning what are some of  
17 the key issues in the CANDU reactors. They have a  
18 long history. They can help us a lot in that area.  
19 So we are looking to make that a program that helps us  
20 become more efficient and effective as we move on.

21 CO-CHAIRMAN FORD: Jim, I wonder if you  
22 could comment: These data you have on the board,  
23 there are obviously facts. That's what you have been  
24 presented with right now. As you look forward to  
25 seeing what the technology needs are, make those in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 fact successful, you may have a time crunch in meeting  
2 those schedules, especially for the gas-cooled  
3 reactors.

4 Do you have any comment about how you are  
5 going to avoid that time crunch?

6 MR. LYONS: Well, I think one of the  
7 things, I think this technology assessment,  
8 infrastructure assessment, that Research is putting  
9 forward is a good way of looking forward and trying to  
10 understand, if we are going to do these reviews, if  
11 they actually come into fruition, what are the  
12 information needs we need and what is it going to take  
13 to get ready for those information needs? We see that  
14 as one of the key aspects of their plan.

15 CO-CHAIRMAN FORD: So as we look forward  
16 in the next segment, I mean in the infrastructure  
17 assessment report, document that we have, it gives you  
18 fairly detailed PIRT activities and also  
19 implementation questions. Have they been taken into  
20 account as you look forward to the funding? When we  
21 look at the next section, maybe you could give us a  
22 pre-warning. The work that has been planned for  
23 fiscal year '03, did it go through a formal PIRT  
24 activity as described in the infrastructure  
25 assessment?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 MR. LYONS: I would have to turn to  
2 Research.

3 CO-CHAIRMAN FORD: Okay.

4 MR. LYONS: Because what we have focused  
5 on from our end standpoint is the work that we've got  
6 on our plate. Obviously, with the Pebble Bed Modular  
7 Reactor we had started moving forward very quickly on  
8 that. When Exelon pulled out in April of this year  
9 and that project slowed down in the U.S., because it  
10 certainly is continuing forward in South Africa with  
11 a decision of whether or not they are going to be  
12 building a demonstration unit down there probably  
13 sometime early next year, we've kind of backed away  
14 from looking at the gas reactor technologies.

15 The work we are doing on the GT-MHR is at  
16 a fairly low level. We're still working with General  
17 Atomics to slowly define what we want to get out of  
18 the pre-application --

19 CO-CHAIRMAN FORD: And yet the technical  
20 challenges to both the GT-MHR and the PBMR, which you  
21 will see is back on your list again, are huge and will  
22 need a lot of time to resolve.

23 MR. LYONS: Yes.

24 CO-CHAIRMAN FORD: Does that come into the  
25 overall NRC thinking as to how they are going to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 proactively manage this?

2 MR. LYONS: Well, I think that's where  
3 this infrastructure assessment is the first step in  
4 doing that, is trying to define those issues and those  
5 areas that the staff would need information, and that  
6 we would use that to define how we are going to go  
7 forward.

8 CO-CHAIRMAN FORD: Okay.

9 MR. LYONS: Yes, and let me talk about the  
10 PBMR, although it is at the very bottom there, a  
11 little bit. We have had some further discussions with  
12 PBMR-PTY, the South African company, about their  
13 desire to reestablish a pre-application review  
14 probably in the beginning of fiscal year 2004. So we  
15 are keeping that on the horizon.

16 I think that is part of why we try to keep  
17 communications open with the various vendors, is so  
18 that we know what could be coming in, so that we can  
19 do as much planning as we can. But from a budget  
20 standpoint, it makes it very hard when it becomes  
21 uncertain out in the future what actually is coming in  
22 and what's going to move forward.

23 CO-CHAIRMAN FORD: I have one last burning  
24 question which is going around in this group. In your  
25 thinking about your resources to make this happen, is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the longer-range vision this 50,000 megawatts we keep  
2 hearing about online in 2020?

3 MR. LYONS: I mean, we have discussions  
4 with the Department of Energy on their 2010  
5 Initiative, and we try to understand. We don't think  
6 so much in terms of all those different reactors. We  
7 are looking more at making sure that our process is as  
8 efficient and effective as we can be, to move us  
9 towards that --

10 CO-CHAIRMAN FORD: But being driven  
11 reactively to what is currently coming onto your plate  
12 in the next year or two years?

13 MR. LYONS: Right, yes.

14 MEMBER ROSEN: Jim, you made mention of  
15 the budget and resources. Could you help me  
16 understand how much of this is actually funded by the  
17 vendors and how much is by the agency?

18 MR. LYONS: Well, for the pre-application  
19 reviews, design certification reviews, those are all  
20 fee-billable projects. So once we start into a pre-  
21 application review, we are billing the vendor for the  
22 work we are doing on that. The same with the early  
23 site permits; we are billing the utilities on the work  
24 that we're doing on them.

25 But even though they are fee-billable, we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 still, as the NRC, have to have that within our  
2 budget. We have certain ceilings that we are able to  
3 spend. So just because we can bill them for it  
4 doesn't mean we can do the work. We have to have the  
5 authorization to do that. We are only authorized a  
6 certain budget, and we have to work within that.

7 Obviously, these programs compete with  
8 other programs that are on the operating plants, such  
9 as license renewal and plant uprates, power uprates,  
10 work that is going on now, like on the Davis-Besse  
11 lessons learned. So we compete with all those  
12 resources.

13 MEMBER ROSEN: Seen from one perspective,  
14 that makes good sense. Obviously, no matter how much  
15 money you have, if you don't have the people, trained  
16 people, you can't do it anyway.

17 MR. LYONS: Right.

18 MEMBER ROSEN: So you are resource-  
19 constrained by the availability of trained and  
20 experienced people. So seen from that perspective, I  
21 really have no problem with it. But seen from the  
22 other perspective, that, gee whiz, they're paying for  
23 it, it is a little hard to understand why, other than  
24 the resource constraint, why one would say it has to  
25 be within a budget, a dollar budget, when the dollars

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 really aren't, except I guess a small percentage,  
2 coming from the agency.

3 But that's a good enough answer for me.

4 MR. LYONS: Yes, and what you will see is,  
5 when you start talking about research efforts, if the  
6 research efforts directly are applicable to the  
7 licensing action that we are taking at the time, then  
8 we can bill the applicant. But if it goes beyond what  
9 is needed to make our regulatory decisions, then it  
10 gets into the big, overall pot that the current  
11 licensees pay through their annual fees. That covers  
12 all the overhead and a lot of the research work.

13 MEMBER LEITCH: Jim, I have a process  
14 question. Could you contrast between the pre-  
15 application review and the design certification  
16 review? Is the pre-application review always a  
17 prerequisite to design certification?

18 MR. LYONS: No. The pre-application  
19 review is voluntary. It is part of the Commission's  
20 Advanced Reactor Policy Statement that encourages  
21 early interaction with vendors, especially on  
22 innovative, new designs, so that we could try to  
23 address some of those issues upfront.

24 For example, as I was just thinking, it is  
25 a good segue. On the SWR-1000, they are doing some

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 testing over the next year or two that we would be  
2 interested in observing or being involved, or  
3 observing and seeing, even though they are not really  
4 looking at starting their pre-application review until  
5 calendar year 2004. But they have some things going  
6 on that they can help us look at.

7 But what the pre-application review really  
8 does is it allows us to try to define some of the key  
9 technical areas that would have to be addressed as  
10 part of the design certification and try to resolve  
11 them, if necessary, or at least identify the  
12 information that would be needed to address those.

13 MEMBER LEITCH: So the three bottom lines  
14 on the chart, the GT-MHGR, the IRIS, and the PBMR  
15 don't seem to have a pre-application review or they  
16 are going to go directly to design certification?

17 MR. LYONS: No. The blue lines here  
18 indicate when the pre-application review, we see the  
19 pre-application review running. In there they talk  
20 when we would anticipate receiving a design  
21 certification. I would have to get my glasses out to  
22 see that.

23 MEMBER LEITCH: So that would imply, then,  
24 that the pre-application review for GT-MHGR, for  
25 example, has already taken place?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 MR. LYONS: Right. We have started some  
2 discussions with them on where we want to go with the  
3 pre-application review and have had some meetings with  
4 them, and we have some meetings scheduled with them to  
5 take us forward to actually define what we are going  
6 to address as part of the pre-application.

7 Usually in these pre-application reviews  
8 -- actually, Westinghouse is the one who started it  
9 with the AP1000 -- is you do this what we've started  
10 to call Phase 1, where you have some discussions on  
11 what should we address as part of pre-application and  
12 then agree on that. That kind of completes Phase 1.  
13 The second phase is to look at what we have decided to  
14 look at and then to move forward.

15 MEMBER WALLIS: Why do you need all this?  
16 If you've got a water reactor and you've got all the  
17 codes in place, all they have to do is be sure they  
18 meet the regulations. Why do you have to have all  
19 this pre-application review?

20 MR. LYONS: Well, in a lot of cases there  
21 are issues that the vendor wants to make sure can be  
22 acceptably resolved before they commit to actually  
23 coming in with their design certification. In a lot  
24 of cases, in some of these cases the designs are still  
25 evolving as we are in discussions, and they are

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 solidifying their designs.

2 MEMBER WALLIS: So that's it; they don't  
3 really have a design yet? They have a conceptual  
4 design?

5 MR. LYONS: A lot of them are very, yes,  
6 conceptual, and then they are in varying degrees of  
7 completeness.

8 I have probably taken up more time than I  
9 should because Shanlai has got some more discussion on  
10 the user needs that we actually have, currently we are  
11 working on, for the AP1000 and the ESBWR. So why  
12 don't I turn it over to him?

13 If there are other questions, I would be  
14 happy to answer them as we go through this. I will be  
15 here for most of the day to answer any questions that  
16 you have.

17 Thank you.

18 DR. LU: All right. My name is Shanlai Lu  
19 from Reactor Systems, and I'm a reactor systems  
20 engineer. I am here to give you a brief presentation  
21 about the four user needs.

22 We have already sent three of them, and  
23 one is under discussion with Research. I want to  
24 provide a little bit of details, particularly the  
25 background and the basis, why do we want to have that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 and what we want from Research regarding this user  
2 need, and what's the application, and also I will give  
3 you the status.

4 Actually, Dr. Jensen and Andrzej Drozd from  
5 PRA, all are from NRR. They originated the two user  
6 needs for the AP1000. So we are going to cover that,  
7 too.

8 So at this point we have already sent the  
9 three, No. 1, for years PWR and a few for AP1000, to  
10 Research to ask for assistance from Research regarding  
11 different technical issues. This one, No. 2, we have  
12 been having discussion with Research regarding the  
13 TRAC-M development, improvement for the ESBWR  
14 application.

15 So I am going to go through each one of  
16 them and tell you the technical basis and why we want  
17 to do that, what's the application and the current  
18 status and progress.

19 In turn, for ESBWR application, we got a  
20 non-proprietary package from GE. They are talking  
21 about an ESBWR. We found that they are going to  
22 model, they are going to put GE-12 fuel into the ESBWR  
23 core for their pre-application design.

24 We look at their GE-12 fuel. One feature  
25 here is the large water rods, which each water rod

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 operates three fuel tanks' location. Then the part-  
2 length rods are here; we have the red one. The water  
3 rods, the inlet and outlet are within the active fuel  
4 region. So the water goes to here and getting out  
5 from there. Then we also have part-length rods two-  
6 thirds through the core. It is dependent on the  
7 design. It might be, you know, it might be ones that  
8 are half. It depends on the cycle.

9 To model this for LOCA, for transients,  
10 and stability, we found our code at this point,  
11 RELAP-5 or TRAC-M or TRAC-B, or whatever, we don't  
12 have the necessary accuracy or capability to exactly  
13 match the capability that GE can handle. For example,  
14 the water, we cannot really model the water flow  
15 within the rod. We have to lump it into a bypass  
16 region.

17 That's when we started to think about, oh,  
18 how we are going to model for ESBWR application, and  
19 then we think, okay, maybe let's look at other fuel  
20 vendors. Are there any other fuel types we need to  
21 cover, the availability. They decided, the utility  
22 decided to use a Framatome fuel or Westinghouse fuel.

23 MEMBER WALLIS: Now this GE-12 fuel, is  
24 that just for the ESBWR or is that for other BWRs?

25 DR. LU: Yes. Actually, we found later

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 that, after we examined the capability, we said, "All  
2 right," and, actually, all of the fuel has already  
3 been loaded into the existing operating --

4 MEMBER WALLIS: Yes, it's already there.

5 DR. LU: Yes.

6 MEMBER WALLIS: So why are you now worried  
7 about modeling it? It is already there and being  
8 used.

9 DR. LU: Because GE was claiming this one,  
10 and they used TRAC-G to model this in the ESBWR, and  
11 we want to match that capability as well as we cannot  
12 really, you know, tell what's wrong or anything,  
13 review their application. We don't have the same  
14 level of accuracy in terms of modeling.

15 MEMBER WALLIS: Do they have full-scale  
16 experiments with this fuel?

17 DR. LU: I think so. They ran that for  
18 CPR correlation. That's what I recall.

19 MEMBER RANSOM: When you talk about  
20 models, are you talking about neutronics or thermal-  
21 hydraulics?

22 DR. LU: Both. I will get into, after I  
23 show these three slides, I will give you both  
24 hydraulics and the neutronics company in terms of some  
25 hydraulics I am going to get into there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D C 20005-3701

1 CO-CHAIRMAN KRESS: What's the purpose of  
2 the water rods?

3 DR. LU: Okay, the water rod itself --  
4 actually, I should get to the next page. Okay, here  
5 the higher fuel economy, and what they want to do is  
6 provide additional moderation within the fuel bundle,  
7 so that they can have the --

8 CO-CHAIRMAN KRESS: That's for moderation  
9 then?

10 DR. LU: Right.

11 CO-CHAIRMAN KRESS: Okay. That's because  
12 you have a relatively high void fraction up high  
13 and --

14 DR. LU: That's right.

15 CO-CHAIRMAN KRESS: -- you want to keep  
16 water --

17 DR. LU: Yes, especially in the upper part  
18 of the region.

19 CO-CHAIRMAN KRESS: The upper part? Okay.

20 DR. LU: Otherwise, your fuel bundle may  
21 be undermoderated. Also, for the LOCA it can provide  
22 a heat sink because not all the water can flow out  
23 very quickly out of the water during large-break LOCA,  
24 then the fan blowing -- you have the flash in the  
25 fuel, but still you retain certain water mass there or

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 steam. Then that becomes the heat sink if you uncover  
2 the core.

3 MEMBER WALLIS: Let's go back.

4 DR. LU: Yes.

5 MEMBER WALLIS: GE already has a model for  
6 this in their codes? GE already has a model for the  
7 GE-12 fuel in their proprietary codes?

8 DR. LU: Exactly.

9 MEMBER WALLIS: And these codes are  
10 available to the NRC?

11 DR. LU: Exactly, but we cannot just use  
12 their proprietary code.

13 MEMBER WALLIS: At least you know it is in  
14 there. You can examine the details of it and see how  
15 credible it is.

16 DR. LU: That is what we are going to do  
17 actually for ESBWR review and also for the -- because  
18 at this stage they have not submitted that for LOCA  
19 review, and also we have not received a submitted  
20 package for ESBWR. That is something we are going to  
21 look into that, what's the model.

22 However, as a confirmatory analysis or  
23 basis, we want to have a similar level of accuracy  
24 within our own codes, so that we can evaluate their  
25 calculation results.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER WALLIS: Now we haven't seen many  
2 results from TRAC-M anyway yet.

3 DR. LU: That is the reason we want to  
4 start to use it.

5 MEMBER WALLIS: So, first of all, it has  
6 got to be able to do the things that it has claimed to  
7 be able to do, and then it has got to do this as well?

8 DR. LU: Yes. That's right. Otherwise,  
9 because we look at our codes, the RELAP-5, TRAC-M,  
10 TRAC-B, TRAC-P. None of them, if right now we have  
11 some kind of scenario or transient using one of our  
12 operating BWRs, and if we want to model the fuel  
13 behavior or the hydraulic behavior within the channel,  
14 which has been loaded with GE-12 fuel, we cannot  
15 handle it.

16 MEMBER WALLIS: Maybe I would say we need  
17 to move along this TRAC-M because it hasn't really  
18 emerged to solve the old problems, and now you are  
19 asking it to solve a new problem. So we need to move  
20 it along, so that it's a useful tool and actually has  
21 been used for existing problems.

22 DR. LU: Okay. Yes, I think that might be  
23 the -- I am not in the position to answer that  
24 question. It is probably for Steve.

25 MEMBER WALLIS: Well, he's listening. I

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 hope he's listening, yes.

2 (Laughter.)

3 MEMBER RANSOM: Could I interrupt?

4 DR. LU: Yes.

5 MEMBER RANSOM: One thing you mentioned  
6 several times is accuracy.

7 DR. LU: Correct.

8 MEMBER RANSOM: It would seem that the  
9 uncertainty associated with these codes is a key  
10 component --

11 DR. LU: Right.

12 MEMBER RANSOM: -- of assessing the  
13 accuracy.

14 DR. LU: Right.

15 MEMBER RANSOM: Yet, in the research  
16 programs I have seen there is no effort that I see  
17 addressing this particular issue. Of course, it would  
18 be an issue with the NRC codes that you use as an  
19 audit-type capability.

20 DR. LU: Correct.

21 MEMBER RANSOM: It also is an issue with  
22 the General Electric code, too, but that is their  
23 purview, I guess, to argue how they are going to deal  
24 with that problem.

25 DR. LU: Right.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 MEMBER RANSOM: But as we move towards a  
2 risk-informed basis for licensing, it seems this  
3 uncertainty is a key component.

4 DR. LU: Correct.

5 MEMBER RANSOM: And I am not sure there's  
6 any effort underway right now to build into, say,  
7 TRAC-M the ability to assess its uncertainty  
8 associated with the various correlations, and whatnot,  
9 in the code, as well as some overriding consideration  
10 to allow for inaccuracies or whatever.

11 DR. LU: Okay.

12 MEMBER RANSOM: And why isn't that being  
13 requested?

14 DR. LU: All right, okay. It's not really  
15 my position to justify what's going on with TRAC-M  
16 development, but my understanding, actually, Research  
17 has already initiated the effort, and I think that Joe  
18 Kelly and Steve Bajorek have a significant assessment  
19 effort to assess the uncertainties of the fuels and  
20 the hydraulics and the correlations and physics  
21 models.

22 So that I think it should be better up to  
23 them to give to you the presentation about how to  
24 address the uncertainties here.

25 MEMBER RANSOM: Well, it is their job, but

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I would think that you, as the license reviewer, would  
2 be one to set the need.

3 DR. LU: Yes, but definitely we will pick  
4 up whatever the best can be used for us as an audit.  
5 So that can give us additional comfort.

6 MEMBER WALLIS: Do you have any idea of  
7 what is an acceptable level for uncertainties for your  
8 purposes?

9 DR. LU: At this point and until this user  
10 need is completed, we can't go over and around the  
11 codes and see how well. At that point we probably  
12 will get the GE code, TRAC-G code, so we can see how  
13 much difference is there. Is there any way we can dig  
14 into some results from that TRAC-G results and the  
15 TRAC-M results at that time.

16 Right now this code is not -- right now  
17 even we don't have any functionality. We cannot be  
18 building a --

19 CO-CHAIRMAN KRESS: Asking a question a  
20 different way, if you had the uncertainties in these  
21 thermal-hydraulic models, how would you use them in  
22 your decision process?

23 DR. LU: That's a good question.  
24 Actually, right at this point we are developing a  
25 confirmatory analysis plan and trying to identify what

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 would be the acceptance criteria for our own analysis.  
2 Because if we impose --

3 CO-CHAIRMAN KRESS: You think the  
4 uncertainties somehow ought to show up in the  
5 acceptance criteria maybe?

6 DR. LU: Exactly. Exactly. That would be  
7 done, and within that writeup, I guess, we are working  
8 on that right now.

9 But there is one thing I think we should  
10 be aware: that we do not have that much of a code  
11 development as much as the industry because that QA  
12 process costs a lot of money. Right now if we imposed  
13 exactly the same standard, we will not get it over  
14 there, especially when we don't have a code that can  
15 be used for transient LOCA, gas-cooled reactor, and  
16 the ESBWR, or AP1000.

17 So my opinion is we can use it as an  
18 auditing tool. It can give us additional comfort.  
19 That would be good.

20 MEMBER LEITCH: I'm looking at the lower  
21 tie plate debris filter.

22 DR. LU: Right.

23 MEMBER LEITCH: That's a new feature, is  
24 it not?

25 DR. LU: Oh, I think it has been there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 It has been there. No, it has been there. Even for  
2 GE-10 or GE-8 we have it already there.

3 MEMBER LEITCH: Yes, but I am a little  
4 concerned that that can be a two-edged sword.  
5 Certainly, it is designed to prevent mechanical damage  
6 to the fuel.

7 DR. LU: Right.

8 MEMBER LEITCH: But are you also concerned  
9 that under certain circumstances it could restrict the  
10 flow?

11 DR. LU: No, I don't recall --

12 MR. CARUSO: Dr. Leitch, this is Ralph  
13 Caruso from NRR.

14 The answer is, yes, we have discussed this  
15 with the vendors on quite a number of occasions, and  
16 they assure us that licensees, when they design, when  
17 they buy fuel, they make sure that the suction  
18 strainers, for example, in the ECCS recirculation  
19 system are sized so that debris is caught on the  
20 suction strainers and not on the fuel.

21 I believe there is a NUREG Guide that is  
22 going to be coming out that talks about this, and we  
23 specifically asked that that be included in the Reg.  
24 Guide about two or three months ago. Because this  
25 came to our attention, this exact issue came to our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 attention during the discussions that we hold with the  
2 vendors periodically. They showed us one of these  
3 things, and we looked at it and said, "Wow, that looks  
4 like an opening that's a lot smaller than the suction  
5 strainers."

6 We actually had something reported to us.  
7 One of the licensees was going to buy a particular  
8 vendor's fuel and a particular vendor's debris screen,  
9 and they discovered that screen size was smaller than  
10 their suction strainers. So they had to delay the  
11 feature purchase, I believe, until they did something  
12 about the suction strainers.

13 MEMBER LEITCH: Are you concerned about  
14 the pulverized resin on filter demineralizers working  
15 its way into that part of the system? I don't know  
16 what happens to that resin at, say, 540 degrees. It  
17 may completely disintegrate.

18 MR. CARUSO: I mean, the openings aren't  
19 really that small. I have an idea what resin sizes  
20 are, and they're very, very small.

21 MEMBER LEITCH: Yes.

22 MR. CARUSO: And these are not, these  
23 debris screens are not designed to trap resin beads.  
24 They are designed to trap things like metal shavings  
25 and springs and sort of long things.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER LEITCH: Yes.

2 MR. CARUSO: Maybe very, very thin, but  
3 long, not resin beads. It is not clear to me that a  
4 resin bead could even survive the transport, the  
5 temperatures.

6 MEMBER LEITCH: I think it would probably  
7 dissolve at that time, but I'm not really positive of  
8 that. Okay.

9 MEMBER ROSEN: What suction drainers are  
10 you talking about, Ralph?

11 MR. CARUSO: In the ECCS recirculation  
12 system, during a LOCA, eventually the plant has to go  
13 to recirculation from either the reactor-building sump  
14 or the suppression pool or the torus, or wherever.  
15 Because they are located in the building sumps,  
16 they've got to have screens on them. So there are  
17 requirements about sizing those screens that are  
18 related to head losses and debris and MPSH, lots of  
19 different requirements.

20 There's a new guidance document, I  
21 believe, that's coming out. We included this  
22 particular issue in that -- I'm not sure if it is a  
23 Reg. Guide or an SRP revision, but we have included it  
24 recently.

25 MEMBER LEITCH: But you are talking about

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 BWR? I mean this is a BWR issue?

2 MR. CARUSO: Both. Both. This is an  
3 issue for both types.

4 MEMBER ROSEN: For the BWRs you're talking  
5 about torus suction strainers?

6 MR. CARUSO: Right.

7 MEMBER ROSEN: And the PWR, containment  
8 suction strainers?

9 MR. CARUSO: Yes.

10 MEMBER SIEBER: But these debris filters  
11 are intended for normal operation mostly. For  
12 example, if you had machined inside the reactor vessel  
13 during an outage, left some chips or grindings in  
14 there, you don't want them to go and fret at the grid  
15 straps.

16 On the other hand, during ECCS the flow  
17 regimes are altogether different, where it would seem  
18 to me that the fuel debris filters are not in the flow  
19 streams in the same kind of way that they would be  
20 during normal operation.

21 DR. LU: We are asking a very ambitious  
22 question. If we really want to model the solid  
23 particles that are transporting through the entire  
24 system, then we would need to develop another code to  
25 handle that.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 All right, I'll move along.

2 MEMBER WALLIS: There you're going to have  
3 to decide not just how to model it, but how to model  
4 any debris that might be on it.

5 DR. LU: That's right. That is where it  
6 becomes a water chemistry issue or the entire plant  
7 purification system and the reactor water treatment  
8 system.

9 All right, I will just move along. For  
10 ATRIUM-10 we have looked at GE-12 and we found worry.  
11 How about other vendors? We have ATRIUM-10. There is  
12 square-shaped water rods and part-length rods here.  
13 For Westinghouse fuel it is even more complicated, and  
14 it has water crossings, what they call water crossings  
15 here. There is water here. There is water here.  
16 Then there is not only a different fuel type here,  
17 they have a larger diameter of fuel pins here.

18 So our code right now, as it is right now,  
19 it can handle 8x8 bundle straight tube, the thick fuel  
20 pins, and the non-part-lengths run a four-length rod  
21 all the way through.

22 So we really want to model this and handle  
23 it to match the accuracy of the vendor's code. So  
24 that we can use an audit calculation, we need this.

25 MEMBER BONACA: Just a question --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. LU: Sure.

2 MEMBER BONACA: The ABB fuel I think has  
3 already been used, that fuel?

4 DR. LU: All of these fuels.

5 MEMBER BONACA: Okay.

6 DR. LU: All of the fuels have been loaded  
7 in the existing operating reactor, but the reason we  
8 get into this with the triggering point was we were  
9 reviewing what we needed to do to handle the ESBWR.  
10 It came out with --

11 MEMBER WALLIS: That's what puzzles me.  
12 I've asked the question before. These fuels are being  
13 used now.

14 DR. LU: Yes, it is.

15 MEMBER WALLIS: And, yet, you say you need  
16 to know how they work in order to analyze something  
17 which doesn't yet exist. I think you need to know  
18 them now to analyze what happens in --

19 MR. CARUSO: Dr. Wallis, I make the  
20 observation that there was a confluence of events that  
21 occurred this past summer that really pushed us to  
22 make this request from Research. It was the ESBWR  
23 plus some other topical reports that we are reviewing  
24 from operating reactors where fuel configuration is  
25 very important to be able to model it. So all these

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 things came together this summer.

2 Although we need this in order to be able  
3 to evaluate the ESBWR, we also need it right now to do  
4 some evaluations for operating reactors. That is  
5 because the operating reactors have pushed the fuel  
6 and now they are pushing the analyses envelopes with  
7 that fuel. Their techniques are becoming more  
8 sophisticated. So we are trying to get our techniques  
9 as sophisticated as theirs.

10 MEMBER WALLIS: Well, this is an issue we  
11 came up against with uprates, that the uprates look  
12 okay as long as you really check on the fuel limits.

13 MR. CARUSO: That's correct.

14 MEMBER WALLIS: And so you have to have  
15 tools to do that.

16 MR. CARUSO: That's correct, and as I  
17 said, what has happened is this past summer we  
18 received some topical reports that involved being able  
19 to model this fuel better than we have in the past,  
20 and it is both us and the vendors. So it all came  
21 together this summer, and we decided to push for this.

22 MEMBER LEITCH: Isn't the ESBWR, as I  
23 recall, the fuel is only 10-feet long versus 12 feet?

24 DR. LU: Yes.

25 MEMBER LEITCH: Isn't that another

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 variable that you would have to consider in your  
2 model?

3 DR. LU: Right now, the user needs, what  
4 we worked with Research, should cover that, too. That  
5 is one of the software requirements that the Research  
6 technical people and NRR people will work together on  
7 the software requirement we send to Los Alamos when  
8 they code it this way.

9 So it can handle actually even 8-foot  
10 fuel. We can handle that, too.

11 MEMBER LEITCH: Okay.

12 DR. LU: Right.

13 MEMBER LEITCH: Thanks.

14 DR. LU: All right. Ralph has already  
15 addressed the questions about the existing upper  
16 reading.

17 All the new fuel will have higher fuel  
18 economy and lower linear heat generation rates, which  
19 actually provided a basis for a lot of power breed,  
20 and they provided more margins for the BWRs, and  
21 especially for the EPU plants.

22 So we asked Research -- actually, we  
23 should say it this way: The technical people from NRR  
24 and the Research worked together. We figured out what  
25 we exactly needed to do to use TRAC-M to model the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 fuel bundle, the part-lengths rods, water rods.

2 Since Framatome mentioned that they  
3 planned to use 12x12 fuel for their SWR1000, we put  
4 the limit, the code limit, to model 12x12 fuel pins.  
5 Right now, for GE-12 it is 10x10. Most of them are  
6 10x10.

7 Yes?

8 MEMBER RANSOM: One question: You say  
9 more margins for PCT and minimum critical power ratio.

10 DR. LU: Right.

11 MEMBER RANSOM: My question would be, who  
12 has proven that? I mean, is that something that is  
13 claimed or is it something known?

14 DR. LU: It's something known. Actually,  
15 the LOCA generates a smaller diameter of pins, and the  
16 water also provides additional heat sink and the part-  
17 length rods.

18 MEMBER RANSOM: So that is sort of a  
19 subjective evaluation? Is it confirmed based on  
20 actual analysis?

21 DR. LU: Let me think. I personally have  
22 not done any confirmatory analysis on that.

23 MEMBER RANSOM: But the vendor, maybe that  
24 is based on his work?

25 MR. CARUSO: Dr. Ransom, the analyses for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 the PCT would be done using the normal codes. The  
2 critical power ratio determinations are done by actual  
3 tests of bundles in test facilities. The Columbia  
4 facility, they do this. The vendors do this  
5 regularly.

6 DR. LU: Okay. All right, so the status  
7 right now, I will give you the status. You showed  
8 this one. I think it was in July.

9 Right now the first chunk of code came out  
10 from Los Alamos and ISL on October 30, and everything  
11 was going very well with the management support from  
12 Research and technical people from Research, and we  
13 would be able to get the first chunk of the coding on  
14 schedule.

15 MEMBER WALLIS: This is the TRAC-M coding?

16 DR. LU: TRAC-M coding.

17 MEMBER WALLIS: And it works?

18 DR. LU: The source code just delivered  
19 has been delivered from Los Alamos and ISL, and I  
20 think that it is being tested by Research right now.

21 MEMBER LEITCH: Your viewgraph says,  
22 "Advanced Flowing Water Reactor Fuel Model." Is that  
23 in a generic sense? In other words, does this also  
24 apply to ESBWR?

25 DR. LU: Yes, yes, it applies for ESBWR.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 You can take the 12x12. Right now we haven't seen  
2 that. Although we have heard from Framatome they may  
3 use the 12x12 fuel for the SWR1000, we haven't seen  
4 that yet. But that is what we call the Advanced BWR.

5 MEMBER LEITCH: So it is advanced not  
6 necessarily in the sense of ABWR but advanced in the  
7 sense of any --

8 DR. LU: Fuel. Right.

9 All right, I move to the second user need.  
10 It is a draft user need being discussed between  
11 Research and NRR at this point. What we want to deal  
12 with is specific for ESBWR's pre-application review.  
13 I think GE has come to give a brief presentation about  
14 their features.

15 Two features of our particular concern is  
16 the closely coupled containment vessel interaction  
17 during LOCA, because basically they have to  
18 depressurize it to the level of pressure, so that the  
19 containment of the gravity system can work. That  
20 actually requires the code can capture very dedicated  
21 pressure balance between the primary system and the  
22 containment system. This balance needs to be  
23 calculated reasonably well so that we can calculate  
24 the ECCS injection correctly.

25 So basically in July we looked at the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 codes with Research technical staff. We had two  
2 meetings, technical meetings, that we exchanged the  
3 views as to how we are going to address all those  
4 features, and we came out with a list of items we  
5 needed to improve with the ESBWR, to improve TRAC-M  
6 code to address these unique features of the ESBWR.  
7 Right now it is being further discussed and considered  
8 as the action item, but we don't know where eventually  
9 what we are going to have.

10 MEMBER WALLIS: There's nothing new about  
11 gravity.

12 DR. LU: Yes.

13 MEMBER WALLIS: So what must be new is the  
14 result is more subject to change as a result of  
15 uncertainties or something? You're balancing off  
16 various little efforts here and there?

17 DR. LU: Yes, correct. Exactly.

18 MEMBER WALLIS: So whether it goes this  
19 way or that way depends on your accuracy with which  
20 you can predict things?

21 DR. LU: Exactly, exactly, and I will give  
22 you two examples here. We discussed some technical  
23 items. The reason I did not list that is because we  
24 not really come to any agreement as to where exactly  
25 it needs to be in the code.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But one of the issues we considered is  
2 PCCS non-condensable condensation. You know, you have  
3 steam and the non-condensable through the PCCS. That  
4 drives your pressure response of your containment  
5 significantly differently. If you have different  
6 correlation put over there, or how accurate is that,  
7 it will be quite different. That is one thing.

8           The second issue is traditionally for the  
9 BWR LOCA, for the containment analysis, basically, you  
10 assume basically you have a HPCI, or whatever, the  
11 RCIC running. So basically your initial blowdown  
12 state you do not have any coupling, and you don't have  
13 any backflow from the containment. But this one  
14 relies on this backflow, this pressure interaction so  
15 closely; then we needed to have very good model or  
16 code to calculate the interactions between the  
17 containment and the vessel.

18           So that is the reason we initiated the  
19 talk with Research technical staff and we worked  
20 together again and developed a list of things that  
21 needs to be done. Then we hope this user need can go  
22 forward.

23           MEMBER LEITCH: Now we have a draft, an  
24 advance copy of a paper, "ESBWR Advanced Reactor  
25 Research," that has a number of other apparent needs

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 here other than the two that you have listed. These  
2 are just the two most important in your mind or --

3 DR. LU: At this point these are the most  
4 important because we went through that list and then  
5 we are still discussing that right now for the pre-  
6 application. If we have this handy, this too handy,  
7 we can do some runs already, but without the second  
8 one we will not be in very good shape if we want to  
9 calculate very accurately containment and the vessel  
10 interaction.

11 MEMBER LEITCH: I am not concerned about  
12 those two. I am concerned about the ones that are  
13 listed in this paper that you have not mentioned. You  
14 are just giving us a summary or --

15 DR. LU: Summary. A summary, correct.

16 MEMBER LEITCH: So there are other  
17 research --

18 DR. LU: That is the reason I am saying  
19 that other issues under consideration is covering  
20 that, whatever you probably have. We are discussing  
21 with them at this point.

22 MEMBER LEITCH: One thing I didn't see  
23 there is a whole lot of emphasis on BWR stability  
24 issues.

25 DR. LU: Yes.

1                   MEMBER LEITCH:       With this natural  
2                   circulation chain, no recirc. pumps, it sounds like  
3                   you are sort of always operating in the region where  
4                   there is instability in a sense. I guess that is not  
5                   really the case, but it seems to me we need to be  
6                   taking a hard look at stability issues, and I don't  
7                   see that as highlighted here as one of the issues.

8                   DR. LU: Okay. If you look at one of the  
9                   reasons why we want to have the advanced fuel model,  
10                  it is to address the stability. If we cannot model  
11                  that heat source and part-length rods, then the  
12                  stability characteristics will be different. However,  
13                  the stability issue is not unique for ESBWR. It is  
14                  supplied right now. We are reviewing MELLA Plus for  
15                  the generic application of the BWR, especially for  
16                  EPU.

17                  MEMBER LEITCH: It's not unique, but it  
18                  seems to me that when you omit the recirc. pumps, it  
19                  changes the whole thing significantly.

20                  DR. LU: That's right. In that regard,  
21                  actually, ESBWR has better stability features because  
22                  they never use the jet pumps.

23                  MEMBER LEITCH: We will have to hear more  
24                  about that. That just seems counterintuitive to me.

25                  DR. LU: Well, then that is a question we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C 20005-3701

1 probably need to ask GE: why they think that natural  
2 circulation would work for ESBWR, right?

3 CO-CHAIRMAN FORD: I have a wider question  
4 along the same lines. You have cited four advanced  
5 reactors --

6 DR. LU: That's right.

7 CO-CHAIRMAN FORD: -- related advanced  
8 reactors. Yet, when I look at this Attachment 4 of  
9 all the advance reactor activities in 2003, it is  
10 much, much bigger than the four that you have given.  
11 Why is that? Is there a different model to use, a  
12 different funding source, or what is it?

13 DR. LU: Okay, it's not a question for me.  
14 I am technical staff, and I only give the presentation  
15 on a technical basis for using these. I think there  
16 will be a high-level discussion between Research and  
17 NRR. They need to resolve what exactly should be  
18 done, and I am giving you the basis of what we have  
19 already sent out.

20 CO-CHAIRMAN FORD: Okay, John, will you  
21 comment?

22 DR. LU: Okay, maybe somebody else can  
23 address that question.

24 CO-CHAIRMAN FORD: It will be covered  
25 today because it relates to resources. Okay.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N W  
WASHINGTON, D C. 20005-3701

1 DR. LU: Right. Okay. All right, I will  
2 move to the next one for AP1000. This user need was  
3 originated by Dr. Jensen from the Reactor Systems  
4 Branch.

5 Following a very successful user need that  
6 ADS did last year for Phase 2 review, this particular  
7 user need was issued to Research asking for Research's  
8 expertise regarding the COBRA/TRAC liquid entrainment.

9 The issue here is -- I'll go to the next  
10 page a little bit. I think it probably has been  
11 covered and presented to you. You understand, you  
12 know what is the issue there.

13 Basically, through the ADS and then the  
14 entrainment of the liquid from the vessel through the  
15 hot leg all the way to the ADS valve, where it  
16 impacted the vessel coolant inventory and the  
17 depressurization rate, and those issues Westinghouse  
18 claims they can handle that.

19 So Walt Jensen and Steve Bajorek from  
20 Research worked on this. I think they are on schedule  
21 to resolve all the issues at this point.

22 So basically that is the support for the  
23 Phase 3, AP1000 event --

24 MEMBER WALLIS: This affected the ADS 4  
25 there. Is that relying on the work which is being

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 done out in Washington?

2 DR. LU: I do not know the answer.

3 MEMBER WALLIS: Or Oregon.

4 DR. LU: Oregon.

5 DR. JENSEN: This is Walt Jensen, our  
6 Reactor Systems Branch.

7 We are looking at the results from the  
8 ATWS tests that are ongoing at Oregon State. There  
9 seems to be somewhat more entrainment shown in those  
10 tests than is predicted by Westinghouse for AP1000.

11 We have outstanding questions on that  
12 issue. We have a number of outstanding questions on  
13 the entrainment issue, which Westinghouse has told us  
14 they are going to answer by December of this year.

15 MEMBER SIEBER: So you could actually say  
16 that the problem isn't solved, that you can't predict  
17 with accuracy what's going on in the entrainment area  
18 right now?

19 DR. JENSEN: Well, we're still looking at  
20 it. It's under review. Westinghouse is giving us a  
21 topical report showing sensitivity studies that show  
22 that it really doesn't make a great deal of difference  
23 for cooling what the entrainment prediction is, that  
24 the amount of inventory in the reactor core is  
25 relatively insensitive to the amount of entrainment.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 We are looking at that.

2 But there are additional tests being done  
3 at Oregon State. We would like to factor those into  
4 our review as much as possible.

5 MEMBER SIEBER: An additional question  
6 regarding that: Between the AP1000 and the AP600  
7 there's a different number of valves, different valve  
8 sizes, and different header configurations. On the  
9 other hand, why doesn't the entrainment issue emerge  
10 in the AP600 to the extent that it did in the AP1000?

11 DR. JENSEN: There were a number of  
12 integral system scale tests done that were scaled for  
13 the AP600. Some of those were done at Oregon State at  
14 the APEX facility. Some were done at SPES.

15 We felt that the data for AP600 was more  
16 applicable than these same tests for AP1000. For  
17 AP1000, the hot leg, it is the same size for AP600,  
18 but the ADS 4 it's much larger, and I think it is  
19 supposed to be like seventy-something percent more  
20 flow going through ADS 4 for AP1000.

21 MEMBER SIEBER: But the Oregon tests are  
22 still small-scale tests that are scaled up for either  
23 plant?

24 DR. JENSEN: That is true.

25 MEMBER SIEBER: So it is not clear to me

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 that scaling isn't part of the problem.

2 DR. JENSEN: There have been scaling  
3 studies done for AP600 and AP1000. We are still  
4 discussing with Westinghouse whether the original  
5 Oregon State test at the APEX facility that were done  
6 for AP600 would be applicable to AP1000.

7 There will be additional tests done at  
8 Oregon State. They are being funded by the Department  
9 of Energy. For those tests, the facility has been  
10 rescaled and reconstructed to look more like AP1000.

11 MEMBER SIEBER: And that is along the  
12 lines of the presentations on scaling that we heard  
13 four or five months ago?

14 DR. JENSEN: Yes. Yes, that's true.

15 MEMBER SIEBER: Okay, thank you.

16 MEMBER ROSEN: Since we are on this point,  
17 can I ask a question about the qualification of these  
18 valves for different liquid entrainment levels?

19 DR. JENSEN: We're relying on this test  
20 data. There has been no full-scale test of these  
21 large ADS 4 valves for either plant.

22 MEMBER ROSEN: It seemed to me that they have to  
23 be qualified over whatever liquid entrainment range  
24 you expect, including uncertainties.

25 MR. CORLETTI: This is Mike Corletti from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 Westinghouse.

2           Maybe we could talk about this tomorrow,  
3 but I guess in regards to the qualification of the  
4 valves, I think the entrainment is not a major design  
5 feature. Maybe I need a little bit more help with the  
6 question in regards to the qualification.

7           MEMBER ROSEN: Well, valves that are  
8 qualified for steam are one thing. Valves that are  
9 qualified for steam and a certain quality of water is  
10 another thing.

11           MR. CORLETTI: Okay, yes. These are what  
12 we call our squib valves. They are a full-pressure,  
13 high-pressure, high-temperature valve. How we model  
14 them in our codes is really the valve loss  
15 characteristics. So in regard to their operation with  
16 steam or water, we are really interested in the  
17 pressure drop characteristics of the valve.

18           MEMBER ROSEN: Well, from a modeling  
19 standpoint, for sure, but I am interested in their  
20 survivability during the transient or accident.

21           MR. CORLETTI: Oh, they will be qualified  
22 for the duty that they will see, which would include  
23 single-phase and two-phase conditions.

24           MEMBER WALLIS: But the modeling I think  
25 is important. We saw that there are transients in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 this hot leg and you get surges of water that go up  
2 the pipe, and there is different amounts of storage of  
3 liquid in the vertical leg. Then slugs of liquid go  
4 to the valves.

5 So you have to get the transient pressure  
6 fluctuations of the valve throughout the system in  
7 order to do an analysis of whether or not they grow or  
8 decay, and so on. So the auxiliary transients can be  
9 important here. So you've got to get a reasonable  
10 model of the valve receiving quite a range of  
11 qualities.

12 MR. CORLETTI: Yes, and maybe to clarify,  
13 the valves do not close. These are a one-time-opening  
14 valve. So they are not closing against two-phase or  
15 steam conditions.

16 MEMBER WALLIS: No, there is just a  
17 resistance once they are opened.

18 MR. CORLETTI: That's right.

19 MEMBER WALLIS: Right.

20 DR. LU: Okay, I'll move forward to the  
21 next one, the last item I will cover.

22 MEMBER WALLIS: I'm sorry, when you say  
23 status on schedule, I think you need to have a more  
24 critical evaluation of whether or not it is giving you  
25 the results that you need. We have been through this,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and maybe we need to revisit this with RES. This  
2 Committee or the Subcommittee has been looking at  
3 these results and had some questions about whether or  
4 not the needed results would be achieved.

5 DR. LU: All right, do you have any  
6 comments?

7 DR. JENSEN: Our schedule that we see at  
8 NRR is the questions we have sent to Westinghouse and  
9 the answering of the questions, and so far that work  
10 is on schedule. We don't plan to hold up the  
11 licensing of AP1000 because of any delay in these  
12 tests.

13 MEMBER WALLIS: That's very interesting.  
14 So you are going to make the decision whether or not  
15 you have the information?

16 DR. JENSEN: We hope to. Westinghouse has  
17 told us that the results are insensitive to the  
18 entrainment. We have outstanding questions on that  
19 issue. If they can prevail and show us that the  
20 sensitivity, it's within the range of our knowledge,  
21 then that should be acceptable.

22 DR. LU: All right, I will go over the  
23 last one, and Andrze Drozd from NRR/PRA Branch, he  
24 originated this need, asked the Research team to work  
25 on the severe accident stuff.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 Overall, he has emphasized we are trying  
2 to get at whether to evaluate the applicability of the  
3 conclusions from AP600 in-vessel retention and the  
4 fuel coolant interaction review and to see whether it  
5 can be applied, directly applied, to AP1000, and to  
6 perform the MELCOR analysis and for risk-dominant  
7 accidents.

8 Right now we have three milestones. The  
9 September milestone provided recommended RAIs and  
10 prepared the MELCOR input deck for AP1000 and finished  
11 on October 2nd, and the review of AP600 in-vessel fuel  
12 coolant interaction.

13 CO-CHAIRMAN KRESS: Does that include the  
14 in-vessel retention review also?

15 DR. LU: Yes, that's my understanding.

16 CO-CHAIRMAN KRESS: Both of them?

17 DR. LU: Yes, that's my understanding.  
18 That's part of the support; he needs to review that  
19 portion.

20 CO-CHAIRMAN KRESS: Yes. So we haven't  
21 seen that document yet. It's just recently been  
22 completed?

23 DR. LU: I don't know too much about that  
24 and I didn't do that.

25 So that's our schedule right now. There

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 are other tests -- okay, hold on. Richard?

2 MR. LEE: Richard Lee from Research.

3 Tom, this is the review of the AP600  
4 previous document written for AP600, the applicability  
5 of the methodology, and so forth, to AP1000. But we  
6 will be doing analysis of that later.

7 DR. LU: Thanks. All right, that's  
8 basically what I need present. Overall here, the  
9 status is the ongoing three user needs requests have  
10 been going on very well. The technical staffs from  
11 both offices are working together to get all the  
12 issues resolved, the technical issues resolved, code  
13 developed. Right now everything is on schedule. We  
14 hope it stays on schedule so that we can get the code.

15 MEMBER WALLIS: I think I would be happier  
16 if, rather than talking about schedule, you talked  
17 about technical achievements that need to be achieved  
18 in order to get from A to B, and you could reassure me  
19 that these technical milestones have been passed,  
20 rather than that some time milestone had been passed.

21 DR. LU: Okay, okay. Actually, when I  
22 prepared this one, I thought it would be, I was  
23 thinking, probably 15 minutes or 20 minutes. I did  
24 not prepare that. Actually, it was in my original  
25 handouts.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 I was thinking maybe should I get into the  
2 details of what exactly has been achieved and whether  
3 that would take maybe another half-an-hour to talk  
4 about that. So I did not, but if you need that, we  
5 could give you a copy of the user needs.

6 MEMBER WALLIS: Of what you would have  
7 said if you had longer?

8 DR. LU: I have already exceeded my time.

9 MEMBER WALLIS: Yes, yes.

10 DR. LU: But if you need that, we can give  
11 you the user needs, what exactly we passed to  
12 Research, and then a copy of that, and you are going  
13 to see that. Okay?

14 MEMBER LEITCH: I am just a little  
15 confused about the priorities here. We have the draft  
16 papers about ESBWR and ACR700. I am a little  
17 confused. I would have thought your presentation  
18 would be on ESBWR and the ACR700.

19 DR. LU: Both, the ESBWR and -- no, no.

20 MEMBER LEITCH: Are we going to hear later  
21 about ACR700?

22 DR. LU: No, that was not from me. That  
23 would not be from me, no.

24 Regarding whatever the draft, the ESBWR  
25 paper, I think --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER BONACA: But the improvements you  
2 are making on TRAC-M seem to be supporting also the  
3 other two designs, insofar as the needs that you have.

4 DR. LU: That's right. That's right. For  
5 example, the containment coupling with TRAC-M can be  
6 used to apply any coupled containment interaction if  
7 you do need to model the containment backflow, if we  
8 cannot couple the containment analysis from the  
9 primary system.

10 CO-CHAIRMAN FORD: I think if we've got a  
11 thing that is on the board of things that still need  
12 to be discussed, it is very much your question,  
13 Graham, about how the prioritization of these four NRR  
14 user needs projects relate to what we have seen in the  
15 infrastructure assessment, and hopefully we'll hear  
16 that in the next talk.

17 In the meantime, let's adjourn until 10  
18 o'clock.

19 CO-CHAIRMAN KRESS: Not adjourn.

20 CO-CHAIRMAN FORD: Not adjourn? What is  
21 the word?

22 CO-CHAIRMAN KRESS: Recess.

23 CO-CHAIRMAN FORD: Recess.

24 CO-CHAIRMAN KRESS: Take a break.

25 CO-CHAIRMAN FORD: Take a break until 10

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 o'clock.

2 (Whereupon, the foregoing matter went off  
3 the record at 9:50 a.m. and went back on the record at  
4 10:05 a.m.)

5 CO-CHAIRMAN FORD: I'd like us to come  
6 back into session.

7 The next presentation is by John Flack on  
8 the research presentations and primarily an update on  
9 what's happened since our July 18th memo on the REV-1.

10 MR. FLACK: Right. That is correct.

11 Good morning. My name is John Flack, the  
12 Branch Chief of the Regulatory Effectiveness and Human  
13 Factors Branch, which is the home of the Advanced  
14 Reactor Group in the Office of Research.

15 To my left is Steve Bajorek, who will be  
16 addressing the ESBWR and the ACR-700 additions to the  
17 infrastructure plan.

18 Basically what I'll do is I'll briefly go  
19 through some background on the plan, which we now  
20 consider to be really an infrastructure assessment.  
21 So as we move forward, I'll be referring to it as  
22 that.

23 We'll discuss the responses to the ACRS  
24 comments that we provided back to you. I'll provide  
25 an overview of the SECY that's on its way up to the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D C 20005-3701

1 Commission, which is really a summary of the plan  
2 itself, and then we'll talk about the additions, which  
3 is, again, the ESBWR and the ACR-700, and then Steve  
4 will do that part of the presentation. Then I'll come  
5 back and talk to you a little bit about activities  
6 that we plan to do this coming fiscal year and then  
7 summarize.

8 CO-CHAIRMAN FORD: John, on the very  
9 question of changing the title of that document from  
10 plan to infrastructure assessment, is that just  
11 tipping your hat to the fact that in that original  
12 document there was no milestones, no budgets, no  
13 management implementation activities itemized?

14 MR. FLACK: Yes.

15 CO-CHAIRMAN FORD: And so this just simply  
16 here are the gaps in the technology for putting in  
17 advanced reactors.

18 MR. FLACK: Right, right. The plan would  
19 be a bigger thing, which would include actually  
20 execution of the infrastructure itself. Having gone  
21 through this, recognizing that really the purpose is  
22 to identify the gaps that you describe, it's pretty  
23 much that.

24 It's an assessment of needs. Now, when we  
25 go to exercise those needs, how much we actually do

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 will depend a lot on how much we see from the  
2 applicant and how much has been accomplished in other  
3 places as well.

4 So its real purpose is to do just that.  
5 It's to look at the infrastructure, identify gaps, try  
6 to link to ongoing research throughout the world, and  
7 bring it into a common document, and that's the  
8 document.

9 CO-CHAIRMAN FORD: Now, in the covering  
10 letter, I believe, to the infrastructure assessment,  
11 mention was made to fiscal year '02 to '06, I think it  
12 was, which is a planning time frame.

13 MR. FLACK: Yes.

14 CO-CHAIRMAN FORD: So really when you're  
15 talking about the technical gaps, it is not time  
16 dependent; is that correct?

17 MR. FLACK: That is correct. Originally  
18 we were planning on establishing what work we would  
19 need to do over that period of time, but it evolved to  
20 more of just a gap analysis, which is pretty much  
21 where we are right now.

22 CO-CHAIRMAN FORD: Okay, and when will we  
23 see the plan?

24 MR. FLACK: Well, the planning process is  
25 a process in itself. The idea is to bring forth those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 things that we will need to do and then prioritize  
2 those with respect to other activities going on in the  
3 office.

4 So the actual prioritization is bigger  
5 than just the advanced reactors. At one point, the  
6 advanced reactor was fenced off. We had monies  
7 allocated just for that activity, but as we speak  
8 today, it's really across the office. So it actually  
9 competes with other ongoing projects within the office  
10 for resources.

11 So we have, and I'll touch upon it a  
12 little bit about how we go about doing that planning  
13 process.

14 Okay. With that I'll start. This  
15 viewgraph is just to reflect on the meetings that took  
16 place that set the stage for the advanced reactor  
17 work. Last year there were three key workshops that  
18 took place, the first being the ACRS. That was early  
19 on, and it brought together vendors, DOE, and the  
20 staff to talk about technology challenges associated  
21 with these advanced designs.

22 That was followed with a workshop by NRR,  
23 which talked about early site permits and COLs, and  
24 then finally there was a workshop by Research that  
25 pulled experts around the world to try to understand

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what the status was on this research going on in the  
2 high temperature, gas cooled field.

3 This year we had a number of interactions,  
4 as you remember, with the ACRS. We gave a briefing at  
5 the full committee in April, which was very brief  
6 actually in contrast to the following meeting which  
7 occurred later that year in July, where we did spend  
8 a day going through pretty much all of the areas that  
9 are in the plan and the technical issues and  
10 challenges they presented.

11 That generated -- well, we went to the  
12 full committee following that subcommittee. That  
13 generated a letter from the ACRS with a number of  
14 comments, and that was in July of this past year.

15 We responded in August to those comments,  
16 and I'll go through those in a moment.

17 We also appeared before the ACNW for  
18 information only. We briefed them on that part of the  
19 plan that was relevant to our nuclear waste and  
20 materials, and then today, of course, is a joint  
21 subcommittee.

22 So that pretty much gives -- that's not  
23 all of the meetings obviously that took place, but  
24 those were some of the key meetings that certainly  
25 took place.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           With respect to the comments in the  
2 letter, there were ten comments that were made by the  
3 ACRS in their letter, and we responded by first  
4 indicating that things had changed from earlier in the  
5 year where Exelon and pebble bed, of course, had a  
6 high priority and then as Exelon did pull out of the  
7 pre-application review, we did shift our focus  
8 somewhat, recognizing that there is the need also to  
9 continue this work at some level, but not as  
10 compressed, as you might say, as it was envisioned  
11 when Exelon had it at pre-application.

12           We do have the application, of course,  
13 with GT-MHR, which is ongoing right now, but again, at  
14 a somewhat lower level.

15           CO-CHAIRMAN FORD: Could I ask a question  
16 on that one?

17           MR. FLACK: Sure.

18           CO-CHAIRMAN FORD: Because the two gas  
19 cooled reactors, they are both now on the books. The  
20 PBMR will be on the books again. It's not dead  
21 entirely.

22           MR. FLACK: Yeah.

23           CO-CHAIRMAN FORD: The technology  
24 challenges are considerable and will require a lot of  
25 research over a long time period. Just because your

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 priorities have changed because of the stress of other  
2 advanced light water reactors, is that a good enough  
3 reason? Is a risk not still there, the risk defined  
4 by the risk of not doing the work times the likelihood  
5 of it being actually a successful applicant?

6 What's the rationale behind dropping the  
7 priority on the gas cooled reactors?

8 MR. FLACK: Well, it lowered it. It  
9 didn't eliminate it certainly. I think we're working  
10 within a fixed budget, and needs as come up on the  
11 horizon as to really what industry is looking for.

12 We do not, again, want to be a pinch point  
13 in the process. We want to be best prepared to deal  
14 with designs as they come in as we can. So certainly  
15 the ones that appear to be immediate future would take  
16 the higher priority since we want to get those through  
17 the system as effectively and efficiently as possible.

18 So as we change our priorities as these  
19 new pre-applicants come in, there still remains many  
20 challenges ahead in the HTGR world, and so what we  
21 have done now is kind of look more towards what else  
22 is going on in the world and trying to capitalize in  
23 the meantime on what else is out there instead of  
24 trying to just forge ahead on our own.

25 So I think in some sense it's giving us

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 time to do that, to find areas in which the work is  
2 going on and where we can draw cooperative agreements.

3 At the same time though, it is important  
4 that we do maintain a certain level of research going  
5 on in our own office in that field. So I don't know  
6 if that addresses your concern completely, but again,  
7 because of the way the budget is fixed in some regards  
8 --

9 CO-CHAIRMAN FORD: Now, what was the risk  
10 associated with that? If you're putting many of your  
11 regs. into the collaborative lessons learned from  
12 other people, Europeans, Japanese, et cetera, has  
13 anyone assessed the risk of your not getting the  
14 relevant information from these organized issues?

15 MR. FLACK: Well, the risk is, again, time  
16 dependent, you know. It's the sort of thing as when  
17 do I need the information to make what kind of  
18 decision.

19 And there's always a risk that something  
20 could happen a lot faster than you thought, and so one  
21 has to continuously adjust to accommodate that risk,  
22 and that's why this document is really a living  
23 document.

24 Each year we're planning to come back and  
25 reflect on where we are at that time and then use it,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 recognizing the needs that are there. Again, it's a  
2 place where we can see the terrain and come back to  
3 that and decide at that point how we need to adjust  
4 again.

5 But I don't think there's one answer. I  
6 think it's something that's very time dependent and  
7 you have to feel your way through.

8 Okay. As mentioned, the scope has  
9 expanded now to these additional advanced light water  
10 reactors, and what I'll do now is go briefly through  
11 our responses to the ten comments that were raised by  
12 the ACRS in their letter back in July.

13 The first comment was to focus -- and it's  
14 more or less our response -- yeah, we'll be focusing  
15 HTGR research primarily on the generic level and not  
16 have it so much design dependent. There's many  
17 challenging generic issues like the fuel and materials  
18 that are quite generic and we remain focused on that.

19 Of course, there's a GT-MHR, and that is  
20 ongoing at the pre-application review.

21 Fission product release for TRISO fuel is  
22 a key research area. We see that as a key research  
23 area.

24 By the way, we agreed pretty much with all  
25 of the ACRS comments, which is good to know.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1           The number two will obviously be  
2 supporting or play a role in supporting or providing  
3 technical basis to some of the policy issues I'm sure  
4 that you see coming forward right now.

5           So, yes, we see that as an important area  
6 to continue research on.

7           Framework for licensing, we consider that  
8 at this time of year to be a high priority up to this  
9 point, and I do have a viewgraph on that. We have not  
10 done a whole lot, but this coming year we plan to do  
11 much more.

12           And number four was we wanted to consider  
13 fission product releases for high burn-up fuel, and  
14 we've added a piece into the plan on that to continue  
15 to consider that and the source term that evolves from  
16 the higher burn-ups of the fuel.

17           CO-CHAIRMAN KRESS: Are you having any  
18 success in getting the VERCORS data?

19           MR. FLACK: Let me see. Where is Richard  
20 Lee?

21           MR. LEE: The answer to your question,  
22 Tom, that we are getting the VERCORS data, and we  
23 already have the two reports on the high burn-up fuel,  
24 the MOX fuel from VERCORS, and they are preparing an  
25 assessment report of all the data, and this report is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 in preparation right now by IRSN, and we are going to  
2 get this report once they are completed.

3 CO-CHAIRMAN KRESS: Wonderful. Thank you.

4 MR. FLACK: Okay. The fifth comment had  
5 to do with selecting design basis events, and we  
6 already had started pursuing that as part of the PTMR,  
7 using risk insights and discussing not so much design  
8 basis, but licensing basis events which cover a  
9 spectrum of events, including beyond what we would  
10 consider the design basis today.

11 And this is also part of a policy issue  
12 that is now moving up to the Commission on how we  
13 select accidents.

14 Number six had to do with the question of  
15 how do we establish priorities, and that, as mentioned  
16 earlier, we use PIRT to rank, and we use the planning,  
17 budgeting and performance management process to  
18 prioritize, and that process is used across the  
19 office, as well as, which I hadn't mentioned on there,  
20 but stakeholder input, of course, which is through  
21 workshops, meetings with the ACRS and others.

22 CO-CHAIRMAN FORD: Will you discuss this  
23 particular item because it relates to Graham's  
24 questions and my questions about the ranking of the  
25 user need ones we heard just before the break versus

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 the listing that you have supplied for 2003? So we'll  
2 hear about this?

3 MR. FLACK: Well, I could talk about it a  
4 little bit now. There's really two types of work that  
5 goes on. One is fee billable in support of pre-  
6 application, design certification, and so on, and then  
7 there's from the general fund a more global kinds of  
8 research, which involves infrastructure development.

9 So both of them, again, come out of the  
10 same budget. We have only allowed so much funds, but  
11 part of it is, again, supporting through user needs  
12 the reviews of licensing submittals, RAIs, evaluation  
13 of those RAIs, providing input to safety analysis  
14 reports.

15 And then there's the other part of  
16 research that deals with understanding beyond, for  
17 example, design basis accidents, margins, providing  
18 confidence in decisions, providing technical basis for  
19 decisions and the confidence that goes with that.

20 So that type of research is broader in  
21 extent and does go beyond just the immediate need for  
22 user needs.

23 CO-CHAIRMAN KRESS: You don't have to pry  
24 into user needs.

25 MR. FLACK: That's right.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 CO-CHAIRMAN KRESS: That's for NRR to do.  
2 I mean, that's an automatic priority.

3 MR. FLACK: We have to do that work right.

4 CO-CHAIRMAN FORD: Okay. So in answer to  
5 Graham's question and mine, I guess, just because we  
6 only saw four programs in the previous presentation  
7 doesn't mean to say that there's only going to be four  
8 programs on advanced reactors --

9 MR. FLACK: That's right.

10 CO-CHAIRMAN FORD: -- in 2003.

11 MR. ELTAWILA: I think in general that's  
12 true.

13 This is Farouk Eltawila again, and Gary is  
14 behind me. He can correct me if he wants.

15 I think the immediate need --

16 (Laughter.)

17 MR. ELTAWILA: -- the immediate need right  
18 now that you saw it is to try to complete the pre-  
19 application review, and so that they identify models  
20 that need to be put into the quote to be able to do  
21 counterpart analysis to see if there are issues that  
22 need further investigation or not.

23 What you see in the plan that we provide  
24 to you, that we have additional information that we  
25 need because in order for us to provide NRR with a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 qualified tool, we have to look at the range and the  
2 applicability of all the high ranking phenomenon  
3 models in the code.

4 So we need to arrange the parameter, and  
5 we need to look at the experimental data, and we need  
6 to run some experimental. We have the facility at the  
7 PUMA facility, for example, and we assess the code  
8 against it.

9 And at that time, we will say that the  
10 code is ready for the certification. So the immediate  
11 need that we have right now is just to make the tool  
12 available right now to be able to do analysis, but the  
13 final product with a certified quote from the Office  
14 of Research, and this code has met all of our  
15 assessment process and things like that; that's the  
16 additional work that you see in the plan.

17 The other part of it, again, because we  
18 expect it to do the same thing, for example, several  
19 accident, we know that there are issues in severe  
20 accidents like in AP1000, although you don't see the  
21 need right now from NRR because it's not part of the  
22 pre-application review, but we are identified it in  
23 the plan, and we are going to continue negotiation  
24 with NRR and see if these are the issues that need to  
25 be discussed and followed on or not.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And that's how we merge together and  
2 eventually every fiscal year you will find a new  
3 activity to be carried on, you know, that we will  
4 perform based on a discussion between us and the user  
5 office.

6           MEMBER LEITCH: I'm still confused on this  
7 Attachment 4 that we received, just the one page list  
8 of activities scheduled for fiscal year 2003. I don't  
9 see any AP1000 activities on that list at all.

10          MR. FLACK: Yeah, that is more for  
11 infrastructure. I'll come back to that list in the  
12 end.

13          MEMBER LEITCH: Okay.

14          MR. ELTAWILA: Let me answer that  
15 question. I'm sorry, John.

16          MR. FLACK: Yeah, sure.

17          MR. ELTAWILA: We believe that the only  
18 things that we have right now for AP1000 is as  
19 indicated by Shanlai Lu, is the issue of entrainment  
20 and de-entrainment right now, and we have a program  
21 right now at Oregon State University to supplement the  
22 work that DOE is working.

23                 That work, although it's not specific for  
24 AP1000, it's for code assessments so we consider that  
25 part of the developing the infrastructure for our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 tools and things like that.

2 MEMBER LEITCH: I see.

3 MR. ELTAWILA: But we have not identified  
4 any major issue that in the AP1000 that would need  
5 additional research at that time. Based on the pre-  
6 application review, we have not identified any issue.

7 The work that Richard will talk about  
8 about the applicability of the AP600 severe accident  
9 data in core melt retention and fuel coolant  
10 interaction and issues like that, we are reviewing  
11 them right now, and if the issue comes out, that  
12 review, we'll be discussing it and we'll identify this  
13 issue as happened.

14 But as far as I'm concerned, I don't try  
15 to take too much time here. The issue of in vessel  
16 melt retention, NRR did not give credit to  
17 Westinghouse for the AP600. It was there. It may  
18 work, but we really did not take full credit for it in  
19 the certification process.

20 Whether that's going to be the same way  
21 they are going to deal with it for AP1000 or not,  
22 that's a need to be determined.

23 MEMBER LEITCH: Okay. Let me just ask one  
24 other question. The list that we -- well, you're  
25 going to come back to Attachment 4. I'll defer the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 question until that time, John.

2 Thank you.

3 MEMBER RANSOM: John, I have a question  
4 relative to number six. The use of the PIRT process  
5 for establishing research needs, that assumes a panel  
6 of experts, I guess, would rate and rank them.

7 MR. FLACK: Yes.

8 MEMBER RANSOM: Do you have a panel?

9 MR. FLACK: Well, we choose from experts  
10 in the field. We just had a PIRT last week on fuel,  
11 TRISO fuel. What are the issues? What are the things  
12 that we need to focus on? And how does that rank as  
13 far as priority? Which scenarios play out to be the  
14 most important, and so on?

15 MEMBER RANSOM: Well, are you doing this  
16 sort of area by area or are you --

17 MR. FLACK: Yes.

18 MEMBER RANSOM: How do you do the generic  
19 prioritization?

20 MR. FLACK: Well, I would say the closest  
21 thing we got was this workshop that I described back  
22 last year where we brought experts in from around the  
23 world to try to get a status and to try to understand  
24 what other important issues for HTGRs anyway.

25 And so from there we went forward and from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 there to identify specific areas. Now, these areas  
2 are very complex, just like fuel is in and of itself.  
3 So it really needs to be looked at as a specific fuel.

4 MEMBER RANSOM: Have those results been  
5 documented so that they're available to review who was  
6 involved?

7 MR. FLACK: The workshop?

8 MEMBER RANSOM: The workshop or --

9 MR. FLACK: Yes, there was a report  
10 written on the workshop. We can get you a copy. The  
11 PIRT that just took place, there will be a report that  
12 comes out on that as well.

13 CO-CHAIRMAN KRESS: Farouk, could I ask  
14 you another question about the AP1000?

15 MR. ELTAWILA: Yeah.

16 CO-CHAIRMAN KRESS: In vessel retention.

17 MR. ELTAWILA: Yeah.

18 CO-CHAIRMAN KRESS: One of the concerns I  
19 had with that was with the higher power of the AP1000,  
20 that all of the -- and they will turn on and put the  
21 water in there, even though they're not taking any  
22 credit for it; that that will hold up the molten fuel  
23 for a while and allow it to perhaps stratify and  
24 segregate the metal from the oxide.

25 MR. ELTAWILA: That's correct.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 CO-CHAIRMAN KRESS: And then the failure  
2 location is likely again to be where the metal is.

3 MR. ELTAWILA: That's correct.

4 CO-CHAIRMAN KRESS: And what you have then  
5 is an ideal situation for an injection of a hot,  
6 molten metal into a water pool that's connected to the  
7 containment, which is an ideal situation for fuel  
8 coolant interaction, which is like a high pressure  
9 metal injection, and actually the failed containment  
10 is the same time, have a lot of fine particles  
11 expelled to the air.

12 Is that on your radar as something to --

13 MR. ELTAWILA: I think you hit the point  
14 exactly because we really believe, based on the  
15 information that we have seen from Moscow and the  
16 Raspolov Programs in Russia, that because of the high  
17 power rating retention, the vessel might require some  
18 design changes.

19 But based on the old information that we  
20 have, you might need to design the insulation around  
21 the vessel and so on. So retention, in vessel  
22 retention is not highly assured for high power  
23 reactor. So the issue that becomes very important is  
24 exactly as you indicated, is ex vessel fuel-coolant  
25 interaction, and that's what we are going to focus

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 most of our work on in the analysis and see if there  
2 are experimental data to support analysis of that  
3 issue or not.

4 CO-CHAIRMAN KRESS: Thank you very much.

5 MR. FLACK: Okay. Moving right along,  
6 number seven. We did add a piece in the plan to  
7 investigate the correlation or the link between  
8 activity in the primary and potential latent failures  
9 of fuel so that as an indicator for future performance  
10 of fuel at higher temperatures or under accident  
11 conditions.

12 That was brought to our attention. That  
13 was a new area that we've added, and --

14 CO-CHAIRMAN KRESS: How are you  
15 approaching that?

16 MR. FLACK: Carefully. I don't know. Stu  
17 Rubin is with us. He could probably respond to that.

18 MR. RUBIN: Repeat that question again.

19 MR. FLACK: The question on how --

20 CO-CHAIRMAN KRESS: I wanted to know how  
21 you're approaching that particular --

22 MR. FLACK: We are approaching the  
23 relationship of coolant activity with latent fuel  
24 failures.

25 MR. RUBIN: Oh, yeah. The issue --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FLACK: Stu, the microphone.

2 MR. RUBIN: Yes, sorry about that. Stu  
3 Rubin, Office of Research.

4 The ACRS raised an issue which had been  
5 mulling in our own mind for some time, and that is the  
6 effectiveness of coolant activity monitoring systems  
7 that are going to be used in HTGRs to monitor fuel  
8 performance, and they basically do this by monitoring  
9 noble gas activity in the helium.

10 And so this is the kind of a system that's  
11 been used going back to the earliest HTGRs, and the  
12 issue in our mind is not so much the detection of  
13 failed fuel in operation. That can be correlated  
14 fairly easily with test data, but rather, the ability  
15 of these monitoring systems to detect what we would  
16 call latent failures. These are conditions that may  
17 arise from manufacturing, such as so-called fuel,  
18 manufactured fuel outside the specification that  
19 somehow gets through the QA process, let's say, or  
20 weakening of fuel due to operating the fuel at  
21 conditions beyond the design, hot spots, let's say,  
22 where local temperatures are higher than expected.

23 These kinds of conditions can lead to a  
24 weakening in the fuel that may or may not be  
25 detectable by such an on line core monitoring system

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 and only would be revealed by, let's say, an accident  
2 condition.

3 And so our thought was to include in the  
4 research plan some work which would involve both  
5 analytical work, as well as irradiation testing and  
6 accident testing.

7 And with regard to the evaluating of  
8 whether or not the core condition monitoring systems  
9 could detect a weakening fuel that would slowly be  
10 revealed as failures during operation or not, we would  
11 plan to include in the irradiation program testing at  
12 higher temperatures to see if those higher  
13 temperatures would result in failures during  
14 operation, and take that same fuel whether or not it  
15 did or didn't result in failures, and then put it  
16 through an accident heat-up test.

17 And so the idea there would be that if the  
18 fuel did not reveal higher failure rates due to the  
19 higher operating temperatures, but did see increased  
20 failures in the accident regime, that might be  
21 problematic for an on line monitoring system to detect  
22 latent failures due to operations conditions outside  
23 design.

24 And with regard to the fuel fabrication  
25 issue, the thought was that you can't very well take

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 fuel that is manufactured at various degrees of  
2 variance from the manufacturing specification. That's  
3 not a practical approach, but the thought would be to  
4 do sensitivity studies with analytical code where you  
5 can actually simulate fuel performance during  
6 operation and during accidents and crank in different  
7 fabrication anomalies, so to speak, and see how that  
8 would play out during operations and during the  
9 accident sequence.

10 Again, if the operations phase of the  
11 simulation didn't result in increased failures, but we  
12 saw it in the accident, that also may prove to be  
13 somewhat problematic for an on line monitoring system.

14 So we are picking that up in the plan.

15 CO-CHAIRMAN KRESS: Sounds good. Thank  
16 you.

17 MR. FLACK: And more than you asked for,  
18 right?

19 But thanks, Stu.

20 Okay. Number eight, we're certainly  
21 tracking what's going on in Generation IV near term  
22 deployment by continuing representation on the NERAC,  
23 and aware of DOE activities in that area.

24 Number nine was research activities to  
25 assess the full range of ex vessel severe accident

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 phenomena. I think we just discussed a little bit  
2 about that, and that's in the plan.

3 And ten, there was a comment on license by  
4 test concept and the need for large scale testing, and  
5 that was also addressed in response to that question  
6 and comment within the context of our regulatory  
7 process.

8 So that pretty much covered the comments  
9 and our responses to the comments.

10 I do have one viewgraph on framework,  
11 which pretty much you've seen somewhat before. The  
12 work, again, will be starting in FY '03. It's  
13 currently under development. It's going to capitalize  
14 on Part 50 work and risk informing Part 50, utilizing  
15 a top-down approach that begins with the goals  
16 supported by cornerstones and then strategies and  
17 tactics to insure that those cornerstones provide the  
18 protections needed to protect the public health and  
19 safety.

20 The undertaking will also capitalize on,  
21 you know, risk informing current LWRs, Reg Guide  
22 1.174, and so on, and ground that has been broken in  
23 that regard.

24 It will certainly be key or have to  
25 dovetail certainly with the policy issue paper that's

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 coming in front of the Commission in December, and as  
2 well as the technical issues that are coming about as  
3 we discuss them.

4 And also using the input from NEI, and I  
5 think you'll hear more about that this afternoon, and  
6 other stakeholders as we need.

7 So that's all I --

8 CO-CHAIRMAN FORD: Now, we heard from Mary  
9 Drouin some time ago. We had the impression that the  
10 framework in 2003 was low priority. That is no longer  
11 the case?

12 MR. FLACK: Well, I guess the question is  
13 how do you put it in perspective. I don't know what  
14 context she described it as low priority.

15 CO-CHAIRMAN FORD: Well, that was the  
16 impression that I personally came away from the  
17 meeting with, and I think many of the other members  
18 also had the same impression.

19 The reason why it's puzzling is that in  
20 the infrastructure assessment you see quite  
21 specifically that the framework work is a basis for  
22 many of the other priorities and prioritization of  
23 many other technical challenges and, therefore, it has  
24 got to be high priority.

25 MR. FLACK: It would be part of that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C 20005-3701

1 process, yeah.

2 CO-CHAIRMAN FORD: So I take it that the  
3 framework work is high priority?

4 MR. ELTAWILA: The answer is it is a  
5 funded activity in fiscal year '03, but we don't have  
6 funds anyway, so it's irrelevant. I'll answer anyway.

7 So we are on a continuance resolution, and  
8 every two weeks we'll get some money to spend. But  
9 for fiscal year '03, we have budget to start the  
10 framework. So it is ranked high among the budget  
11 activity, and it is going to be funded once we get our  
12 full allotment of funds.

13 CO-CHAIRMAN FORD: Now, what is the timing  
14 on that, bearing in mind it's the baseline for all of  
15 your subsequent prioritizations? Presumably you've  
16 got a very fast objective to be met, milestone.

17 MR. ELTAWILA: Okay. Let me try to answer  
18 that here. I just want to make it clear to you that  
19 for light water reactor, they can be licensed and  
20 certified under existing framework. So they don't  
21 have to wait for the new framework to get  
22 certification.

23 Now, we are talking now about gas core  
24 reactor and other non-light water reactor. So the  
25 time frame for that is definitely much more relaxed

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 than when Exelon was in the figure and tried to  
2 certify the PBMR.

3 All indication then we're getting from  
4 G.E. and from the PBMR, Limited, indicate that their  
5 time horizon is on the order for early 2007 to 2010.  
6 So we're really going to provide, develop that  
7 framework not on accelerated time frame like we were  
8 thinking before, but it's going to be continuously  
9 developed, but will not get this accelerated --

10 CO-CHAIRMAN FORD: I'm concerned that some  
11 of the technical problems which were based on the  
12 framework -- this is for the gas cooled reactors --  
13 will take some time, and even though they commercially  
14 may want to go on line in 2010, they've got to be  
15 doing the technical work now.

16 MR. ELTAWILA: We actually, as Stu  
17 indicated, we have identified some key issues that  
18 need a long lead time, and we're continuing working on  
19 this issue, for example, but we are limited not  
20 necessarily by resources, and I want to make that  
21 clear. We are limited by availability of fuel, for  
22 example, to run the test on.

23 So if I want to run tests on fuel, I have  
24 to have the table's fuel or GA fuel to be able to run  
25 the test. That's one limitation.

1           The second limitation is that NRC will not  
2 be able to fund this fuel testing alone. So we have  
3 to rely on DOE, and DOE has a plan right now. We are  
4 continuously interacting with them. So if DOE cannot  
5 run the test, they will not be deployed. So we are  
6 not really going to be behind the schedule in this  
7 case, you know.

8           So as far as the fuel is concerned, I  
9 think we are in good shape because, again, they are  
10 not going to deploy until DOE performs the test for  
11 this new type of fuel.

12           There are other issues like material issue  
13 and graphite issue, and I think Joe Muscara, if he  
14 wants to add something, we are working in this area.

15           So the critical issues we are working on,  
16 and in some cases we are relying in cooperative  
17 agreement and we're relying on memorandum of  
18 understanding with DOE. So we have not stopped  
19 completely, but we are not on the same pace like we  
20 were about a year ago.

21           MEMBER BONACA: Well, first of all, I'm  
22 kind of anxious to see what this framework will be, of  
23 course, and so that's why I'm interested in this  
24 question, but, you know, in the plan there is a clear  
25 reference to starting with some thoughts for Option 3,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 which makes sense.

2 And so there if you look at Option 3, it  
3 speaks of some apportionment quantitatively to  
4 prevention versus mitigation, and clearly there we  
5 understand how the structure is.

6 So I've been trying to understand who, for  
7 example, for HPGR you would go about answering those  
8 kinds of questions there, and if you need to do  
9 research on fuel and understanding fuel before you can  
10 set certain quantitative criteria there or vice versa.

11 I mean, that's really what I would like to  
12 understand. I mean, I don't have an expectation that  
13 you have the framework already ready, but at least a  
14 thought process to support it. It would help me if we  
15 at some point in the near future, we had just an  
16 understanding of how you're reflecting on it. At  
17 least it would give me comfort that you're thinking  
18 about it if you're not working on it.

19 MR. FLACK: Oh, no, we are thinking about  
20 it. I think the work that is going on on the policy  
21 issues paper is very important because I think that's  
22 going to set the stage, and a lot is going to depend  
23 on how the Commission views those issues and how they  
24 go about doing that.

25 Once it passes through that process, then

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 the question is a technical one really. Can you  
2 provide a technical basis to make this come true?

3 There's one thing in saying it, and the  
4 other there is demonstrating it. So I think it  
5 involves both sides, the policy as well as the  
6 technical, and they really dovetail together as you  
7 move forward.

8 But having said that, I don't think we  
9 need to wait for a framework document in order to do  
10 what we're doing. I think going forward with the  
11 policy issues, and it will evolve, and I think the  
12 thing will certainly get back to the ACRS many times  
13 on this, I'm sure, but it will be something that is  
14 evolutionary. It's going to need to take into  
15 consideration stakeholders' comments, and it's not  
16 holding up anything at this point in time.

17 We can move forward and license the plants  
18 that are coming in on the pre-application review with  
19 the process that we have in place. So it's again  
20 moving forward, and I think those are the lines on  
21 which it's moving forward.

22 MEMBER BONACA: Yeah. The point I'm  
23 making is that if, however, you have a well delineated  
24 process by which you're going to get to that  
25 framework, the thought process you're going to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 develop, and the policies issue may be the first one,  
2 in fact.

3 MR. FLACK: Yeah, I think that --

4 MEMBER BONACA: Then that may help you in  
5 prioritizing what steps you have to accomplish for  
6 different designs to bring them to a technology  
7 neutral framework.

8 MR. FLACK: Yes, because it will flesh it  
9 out. It will get the things out on the table, the  
10 discussions, defense in depth, and what we mean by  
11 that, and so on.

12 MEMBER BONACA: So the policy document  
13 will be the first --

14 MR. FLACK: It's going to be a major step  
15 forward in that.

16 MEMBER BONACA: We will have it some time  
17 this month, I understand.

18 MR. FLACK: Well, it's due up to the  
19 Commission in December, and we held a workshop two  
20 weeks ago. I guess it was a public workshop on it.  
21 I don't know what exactly the schedule is to come  
22 back. The full committee probably before it  
23 technically gets sent up, yeah.

24 MR. FLACK: John?

25 MR. MUSCARA: If I might follow up on

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 Peter's question about how are we handling the issues  
2 that have a long lead time to get a resolution, in the  
3 materials area, clearly we did get a reduction in  
4 emphasis and budget, and what we have done in this  
5 area is to essentially stretch out the program.

6 Originally we had a five to six year  
7 program. Now we have planned a nine to ten year  
8 program. What we are doing is addressing the issues  
9 first that we need to have answers for, for example,  
10 in designing the plans, things, for example, that have  
11 to do with fatigue life, crack initiation, those  
12 things being addressed in the earlier years.

13 Items having to do with problems you might  
14 expect in service, such as crack growth rates, those  
15 now being addressed in the latter part of the ten year  
16 program.

17 So we've had a reduction in budget. We've  
18 shifted the program, stretched it out, and addressing  
19 questions that we need answer to at the design and  
20 licensing stage, and in those areas, we will be doing  
21 work on fatigue, stress corrosion cracking and creep.

22 In the graphite area, we're depending a  
23 great deal on work being conducted in Europe, but we  
24 will be doing some work in that area also starting in  
25 '08.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   And I guess let me mention also that we do  
2 have work ongoing to review and evaluate design codes  
3 and standards and updating those codes and standards  
4 because those are some of the things we need to have  
5 done early on in the process. So that work is ongoing  
6 right now.

7                   CO-CHAIRMAN FORD: You don't think it's  
8 going to be ten years before you get the final results  
9 of many of these materials questions. You don't think  
10 those are going to be limiting on the  
11 commercialization of a gas cooled reactor.

12                  MR. MUSCARA: That's correct. That's  
13 correct. I mean, those will be questions that will  
14 come up during the operation of the plants, and if  
15 there is a problem, we'll have enough time to deal  
16 with those kinds of questions.

17                  CO-CHAIRMAN FORD: Okay. So we'll be  
18 regulating as we go, so to speak.

19                  MR. MUSCARA: For the kinds of problems  
20 you expect in service. For the design stage, where  
21 you want to design a plant so that it does last its  
22 design period, that work gets completed by FY '06.

23                         That is, we will have enough work done to  
24 be able to ask questions about is there an effect on  
25 the environment and fatigue. We'll have enough work

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 done to identify the problem if it's there, and  
2 possibly not enough work to update the codes, but at  
3 least we'll have enough work done so that we can  
4 request additional information.

5 CO-CHAIRMAN FORD: This is not a question  
6 for you, Joe, but for other of your colleagues. It  
7 seems that many of these prioritizations and reactions  
8 to what may come down the line is forcing you to go  
9 towards a "regulate as you go" stance. Is it healthy?

10 MR. MUSCARA: I see this as regular as  
11 needed. I'm not sure as you go. I think we still  
12 have enough lead time to address the issue and  
13 determine whether there's a potential problem.

14 A lot of the questions that we have in the  
15 materials area are based on lessons learned from light  
16 water reactor, and clearly we think those may happen  
17 also in the advanced gas cooled reactors.

18 But there's no data to say one way or the  
19 other. So I think we're doing enough work to be able  
20 to identify the problem, determine if updates are  
21 needed, and I believe on a timely basis so that they  
22 can be addressed either in design or later on during  
23 operation.

24 CO-CHAIRMAN FORD: Okay. Thank you, Joe.

25 MR. FLACK: Also, if I can just add to the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 comment, I guess the feedback that we get from  
2 operating plants is very important in making  
3 decisions, and so as we regulate, we try to raise the  
4 questions up front obviously to try to get as many  
5 answers and get things nailed down as much as you can,  
6 but then feedback as the plant operates is important  
7 to validate and confirm what our expectations are.

8 So I wouldn't necessarily call it regulate  
9 as we go, but certainly take regulatory action as we  
10 need, if it's not consistent with, you know, what's up  
11 front. But it's very important not to underestimate  
12 the need to get these questions and answers as best we  
13 can up front, I mean, certainly.

14 CO-CHAIRMAN FORD: Well, do any of my  
15 colleagues? I mean, Jack, you are intimately involved  
16 in some of the start-ups of the current light water  
17 reactor fleet. Does it not worry you? It doesn't?

18 MEMBER SIEBER: No. I think that's been  
19 the past practice for some time now or at least some  
20 version of it, and I think that we've managed to  
21 address problems.

22 MEMBER ROSEN: Peter, it does worry me.  
23 I guess the history of light water reactor development  
24 is the key to understanding why I'm worried. We spent  
25 literally the 40 year period from, say, 1960 to the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 year 2000 working on materials problems that showed up  
2 during operation.

3 Now, if you don't learn from the past, I  
4 guess you're doomed to repeat it. So I didn't make  
5 that saying up, by the way.

6 So here we are about to design, license,  
7 and build and operate a whole new family of reactors  
8 and find out what's wrong with them. You know, we'll  
9 do enough work to license them and then deal with the  
10 licensing issues.

11 But we never seem to find the resolve to  
12 do enough work to find out, get a handle on what the  
13 operating issues might be at a time before we actually  
14 operate them, and that's troubling.

15 And I guess there's a Catch-22 involved in  
16 the thought process. You can't know what you don't  
17 know about operating until you operate, but I wish  
18 there was a way that somebody could come along and cut  
19 that knot and help us with it because otherwise you  
20 just -- the operator of the plants have potentially  
21 the same sort of fate in front of them as the ones  
22 that ran the light water reactors for the last 30 or  
23 40 years.

24 MR. FLACK: Well, there's no question  
25 about that concern, but I think the whole concept of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 trying to look at the infrastructure, what we're doing  
2 now, and trying to find out where the gaps are and  
3 what questions to ask is really trying to get at that.  
4 Be prepared; ask the right questions. What are the  
5 areas that are dominating as being the things of the  
6 highest uncertainty? What are the risk implications?

7 All of these questions are the things  
8 we're struggling with as we go right now with this  
9 infrastructure, and that's why I think it's very  
10 important to lay that out now in some systematic way,  
11 identifying where we need to focus our resources so  
12 that we don't end up with surprises later on.

13 And it's not an easy thing to do, believe  
14 me. It's a challenging top, you know, as you could  
15 see in the size of the document. There are just a lot  
16 of things, a lot of areas to consider.

17 MEMBER BONACA: You need to limit yourself  
18 to safety issues. That's a possibility.

19 MR. FLACK: Well, certainly.

20 MEMBER BONACA: Well, I mean, some of the  
21 experience we've had, it's a learning experience, and  
22 you know, some of the issues were not of a safety  
23 nature. They were really more of an operability  
24 nature of the components and the cost to the licensee.

25 So the burden is heavy on designers for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 these.

2 MR. FLACK: That's right.

3 MEMBER ROSEN: Yeah, I think you're right,  
4 Mario, that what we saw during the light water  
5 framework that we just lived through was a whole slew  
6 of things evince themselves as operability or  
7 reliability issues rather than safety, direct safety  
8 issues.

9 The trouble with that thinking though is  
10 that as plants struggle to deal with the operability  
11 and reliability issues, they get diverted, and there's  
12 a lot of attention paid to those kinds of operability  
13 and reliability issues to the detriment of a broader  
14 view.

15 And so I think it's important to create a  
16 framework for the new operators of these plants that  
17 doesn't have so much distraction in it. I don't know  
18 how to do it, but, Peter, you invited questions about  
19 who was troubled by it, and I certainly am.

20 MEMBER LEITCH: And I'd like to add my  
21 voice to those that are troubled. You know, when you  
22 see the struggle that it has been to remediate some of  
23 the existing fleet by changing out materials and  
24 applying different chemistry methods, not to mention  
25 the cost and radiation exposure to make some of those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 modifications, it certainly argues against waiting for  
2 operation to reveal problems if, in fact, those  
3 problems could have been foreseen and revealed in the  
4 design phase.

5 MEMBER SIEBER: I think one of the things  
6 that in the past -- and I guess I'm old enough to have  
7 lived through that -- the practice years and years ago  
8 was to build prototype reactors. The Navy did it.  
9 The first commercial reactor was a prototype, had  
10 oodles of margin.

11 And so the safety challenges really  
12 weren't there, and the plants were docile. And what  
13 people were trying to find out was were pumps  
14 adequate; were the flow adequate, you know; can you  
15 control the plant; how stable is it?

16 And you know, obviously the anticipated  
17 transience and severe accidents have enough margin to  
18 take care of it.

19 Where the industry began to get in trouble  
20 with this, when they would take -- the vendors would  
21 say, "Well, I can sell more megawatts in the same  
22 package," and so the temperatures went up. The  
23 pressures went up. The linear heat flux went up. The  
24 fuel design became more sophisticated, and the  
25 operators now spent a lot of time worrying about

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 margin, scratching their head in the materials,  
2 whether it's a new plant or an old plant, a prototype  
3 plant or not. The materials are always out there, and  
4 the very minute you fabricate them, they begin to  
5 corrode, right?

6           You know, it's like the day you're born is  
7 the day you start to die, and so those problems are  
8 always with us.

9           On the other hand, I think it's a mistake  
10 if anybody thinks that they're going to take a new  
11 concept of a plant and build a plant with very high  
12 productivity and capacity and very little margin and  
13 get it right the first time.

14           And I think you have to take that into  
15 account when you do your research, and you need a  
16 little extra margin for those things where the  
17 uncertainty is a little higher than you would like for  
18 it to be.

19           And so having lived through that process,  
20 and I, frankly, enjoyed the process because I learned  
21 an awful lot about plants without having so many of  
22 the production headaches that plague current day  
23 operators. It was sort of fun.

24           I think that's a way for an industry to  
25 grow. I'm not sure that the industry can afford to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 grow that way now, and the engineering and research  
2 tools are much better now.

3 And so maybe we can skip part of that step  
4 and not be so timid. On the other hand, I think that  
5 we need like the pebble bed concept some kind of a  
6 prototype out there where we can do a little learning.  
7 And so that's the basis for my conclusion.

8 CO-CHAIRMAN FORD: John, if you take those  
9 comments, and Mario's comment about, well, let's try  
10 and keep the proactive work to safety related items,  
11 about a year ago Dana Powers reported on the pebble  
12 bed and, by extension, the gas cooled turbine reactor  
13 with some fairly severe safety related comments, which  
14 are physics based insuperable in terms of the  
15 instability of the core, in terms of defense in depth  
16 because of the asymmetry of some of the pebbles.

17 Have those been addressed?

18 MR. FLACK: Well, they're in the plan.  
19 The plan, you know, reflects those areas that he was  
20 concerned about. It's work that needs to be done. So  
21 --

22 CO-CHAIRMAN FORD: These are fundamental  
23 safety related, you know, physics insuperable  
24 problems. Should they not be, therefore, if you take  
25 Mario's argument, that they should be done now? They

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 should be examined right now?

2 MR. FLACK: Well, yeah. The PIRT process  
3 is really the process by which to determine, you know,  
4 the significance of these issues, and we're going  
5 through that exercise right now. We had the fuels,  
6 for example, PIRT just recently that took place.

7 CO-CHAIRMAN FORD: And was that discussed,  
8 those items?

9 MR. FLACK: Well, I --

10 MR. RUBIN: Let me just give you an  
11 example. My recollection is one of the issues that  
12 Dana had was the effective air ingress into the core  
13 and whether or not that would lead to fuel failures to  
14 a level that would be well beyond what we would find  
15 acceptable.

16 And the PIRT process that we went through  
17 last week got into the phenomena that affects fuel  
18 oxidation, including the oxidation rates on the  
19 graphite, the matrix material on the various layers,  
20 whether they're phenomena of temperature, fluance,  
21 burn-up, et cetera, to try to really understand the  
22 phenomena at its most basic level and then to build up  
23 what the data needs are and what the modeling needs  
24 are to truly analyze what would be expected to happen  
25 under, let's say, a worse case air intrusion and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 beyond that worst case.

2 So that in our plan, and we started with  
3 the first step last week of developing those detailed  
4 phenomena that play into that concern.

5 CO-CHAIRMAN KRESS: The strategy we heard  
6 before on air ingress accidents was twofold: one,  
7 to determine the actual frequency to be very low so  
8 that on a risk basis it's a low frequency event and  
9 high consequence, but the product may be acceptable.

10 The other was that the amount of air  
11 available for this interaction could be limited so  
12 that it could be oxygen limited in terms of the total  
13 amount of oxidation you would go through, and that  
14 would limit the amount of material interacting and the  
15 amount of release.

16 Are those still on the table as strategies  
17 to go with air ingress accidents?

18 MR. RUBIN: Yes. In fact, at the PIRT, we  
19 got a presentation by INEEL of some preliminary  
20 studies that they've done for various volumes of air  
21 that would be available in an accident and see what  
22 level of oxidation and fuel failures that you would  
23 see for those, and clearly if there was an unlimited  
24 amount of air to temperatures that we might predict  
25 for a large break, things do get serious, and that has

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to be, I guess, weighed against the probability that  
2 we would result in that amount of air because you  
3 start out with a volume that is the confinement space,  
4 and that's not infinite. That's far short of  
5 infinite, but you need to think about how you can get  
6 some air replenishment through holes, so to speak, in  
7 the confinement space and whether or not those holes  
8 can be plugged by human actions, et cetera.

9 CO-CHAIRMAN KRESS: I guess, and this is  
10 an ancillary question, is NRC going to put that on the  
11 agenda as a design basis accident or would it be  
12 beyond the design basis? And do you have some  
13 criteria for evaluating --

14 MR. FLACK: Well, I think, you know, the  
15 whole concept of design basis itself is now, you know,  
16 considered to be licensing basis and what do we mean  
17 by that and so on, is under discussion.

18 CO-CHAIRMAN KRESS: It's all under  
19 discussion.

20 MR. FLACK: Yeah.

21 MR. RUBIN: The PBMR and GTMHR have  
22 presented a licensing approach, not to start from a  
23 new framework for regulation, but a licensing approach  
24 which one would eventually plot for various scenarios  
25 consequences versus probability, and you've seen those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 plots, and there are limits for various probabilities  
2 in terms of dose limits, let's say.

3 And one of those data points is air  
4 intrusion, and what amount of air for that air  
5 intrusion. And one has to reflect upon where that  
6 probability is for that level of air for an air  
7 intrusion event, and make some decisions on whether or  
8 not that needs to be considered in the licensing  
9 basis.

10 But we don't have enough information on  
11 the consequence models and the PRA models to think  
12 much more at this point.

13 CO-CHAIRMAN KRESS: Yeah. What concerns  
14 me there is that the natural tendency is to use the  
15 prompt fatality safety goal as a top level criteria  
16 for deciding, and I think that would be a mistake.

17 And the reason I think that is in our  
18 ingress accident, it leads to consequences that are  
19 far beyond prompt fatalities in terms of land  
20 contamination and how far it goes and latent cancers.

21 MR. FLACK: Right, right, sure.

22 CO-CHAIRMAN KRESS: So I hope we don't get  
23 stuck on the LERF prompt fatality safety goal as the  
24 driving force for this.

25 MR. FLACK: Well, that's one of the things

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we'll be looking at as part of the framework  
2 development, sure.

3 MEMBER ROSEN: This discussion also raises  
4 in my mind one other nuance, and that is that we  
5 always think or I always thought of confinement and  
6 containment as functions of a device to keep things  
7 from getting out.

8 Now we're talking about a containment or  
9 confinement which has two functions. It's multi-  
10 functioned. It's intended to keep radioactive  
11 releases from getting out, but it's also intended from  
12 keeping air from getting in.

13 MR. RUBIN: That's true.

14 MEMBER ROSEN: And those two functions may  
15 be contradictory in some designs that I could envision  
16 and might create quite a challenge to designers.

17 CO-CHAIRMAN FORD: John, I'm looking at  
18 the time here.

19 MR. FLACK: Yeah, I know. I am, too.

20 CO-CHAIRMAN FORD: How are you going to  
21 fare under the time needed?

22 MR. FLACK: Yeah. What I suggest is we'll  
23 skip the next three viewgraphs, if I can. They really  
24 talk about the SECY paper, which is really the subject  
25 that we've been talking about here. I don't see

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 anything new on these viewgraphs that would --

2 MEMBER LEITCH: John, I just have one  
3 question before you leave the framework. If today I'm  
4 trying to license an advanced light water reactor, the  
5 present licensing is still applicable and would be  
6 adequate for licensing an advanced light water  
7 reactor. But if I was coming forward with a plan, I  
8 might be confused by or I might tend to defer that  
9 action pending a new framework being developed, a new  
10 risk informed framework being developed.

11 So I guess I could see a real decision  
12 point here, whether to license a new advanced light  
13 water reactor with the existing framework or wait for  
14 this new framework document, which seems to be quite  
15 some time off.

16 And I guess basically my question is:  
17 have we thought about need this document be technology  
18 neutral or could it be for light water reactors and  
19 another one later for gas reactors?

20 MR. FLACK: Well, I think that's what this  
21 one is really seeking. The work is really focused on  
22 the non-light water reactors, the reactors that are  
23 not in the immediate future, but ones that relate to  
24 the policy issues that are currently now or that will  
25 be before the Commission at the end of the year, which

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 are the non-light water reactor policy issues, the  
2 containment, the confinement, and that sort of thing.

3 But there is always spinoff. I mean, it  
4 comes down to efficiency and effectiveness of the  
5 regulatory process, and that's really what you want,  
6 an effective and efficient process.

7 So what can be capitalized on, the  
8 development of this framework even though it may be  
9 years from now before it's complete, I would expect  
10 there will be spinoff that could be used currently,  
11 but I wouldn't necessarily wait for that because I  
12 think the process is in place now that can be used to  
13 license and certify the design.

14 So if there is something that comes along  
15 that connects the process, certainly we'll take  
16 advantage of that.

17 MEMBER LEITCH: Thank you.

18 MR. FLACK: Okay.

19 MEMBER RANSOM: John, I have just one  
20 quick question.

21 MR. FLACK: Sure.

22 MEMBER RANSOM: On your next slide there,  
23 commission paper?

24 MR. FLACK: Yes.

25 MEMBER RANSOM: What is that?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. FLACK: Oh, the transmittal of this  
2 document that you've reviewed is to the Commission.  
3 The paper that I talk about on those viewgraphs is  
4 just a summary of what's in there, and --

5 CO-CHAIRMAN KRESS: That's why we call it  
6 the Tom King paper?

7 MR. FLACK: No, no, this is not Tom  
8 King's. This is the infrastructure assessment paper.  
9 It's two papers.

10 CO-CHAIRMAN FORD: It's a formal  
11 transmission of what we --

12 MR. FLACK: That's right. The formal  
13 transmission of the larger document. There's four  
14 attachments to the SECY. The one is the thick  
15 document which you've been reviewing. Two of the  
16 attachments, one is on ESBWR and ACR-700 that Steve is  
17 about to go through with you, and then there's a  
18 fourth attachment which lists the activities for FY  
19 '03.

20 MEMBER SIEBER: Would you tell us what the  
21 SECY number is?

22 MR. FLACK: Oh, it's to be --

23 MEMBER SIEBER: You don't have it yet?

24 MR. FLACK: Not yet. Right, it's on its  
25 way up.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CO-CHAIRMAN FORD: Is this essentially the  
2 draft letter?

3 MR. FLACK: Pre-decisional, yes. That's  
4 right.

5 CO-CHAIRMAN FORD: But essentially that?

6 MR. FLACK: That's it, yes. It hasn't  
7 changed very much at all from what you're seeing.

8 Okay. AT this point in time, Steve, I'll  
9 turn it over to you.

10 MR. BAJOREK: Thank you, John.

11 MR. FLACK: Do you want to use this or  
12 that?

13 MR. BAJOREK: No, I'm going to try to use  
14 high tech.

15 MEMBER WALLIS: Why did you pick Steve to  
16 make this technical presentation?

17 (Laughter.)

18 MEMBER WALLIS: No, I mean, seriously.  
19 Why are the only technical presentations which we're  
20 getting today having to do with thermal hydraulics?  
21 I would think the hydraulics is in good shape because  
22 we got all of this work over the decades, and the  
23 things which we need to worry about are the things  
24 which are not in good shape, and we just hear  
25 generalities about them.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1           But I just have this strange question.  
2           Why is it, you know? Why did you pick to only present  
3           thermal hydraulics today in terms of any detail?

4           MR. FLACK: Well, it was the additions to  
5           the plan that we wanted to come to the committee with  
6           since you had seen much of it before.

7           MEMBER WALLIS: Maybe they're the only  
8           ones where there's anything concrete going on.

9           CO-CHAIRMAN FORD: They'll be covered in  
10          Appendix 4.

11          MEMBER WALLIS: Okay. Well, I'm grasping  
12          for the right question, but you know, that's what  
13          puzzles me.

14          MR. FLACK: I'm grasping for the right  
15          answer, but we were here to brief you on what has been  
16          an edit to the plan in our thinking, and things have  
17          changed since we started with what was very heavily  
18          focused on HTGR and now is shifting to light water  
19          reactors because of the immediate need.

20          And Steve was going to go over those  
21          additions to the plan.

22          MEMBER WALLIS: Just the immediate need,  
23          which is why we're here.

24          MR. FLACK: Which is the pre-applications.

25          MR. BAJOREK: And kind of in reference to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 that, too, I'm not going to try to talk just only  
2 about thermal hydraulics, but also about some of the  
3 fuel issues and also to cover some of the severe  
4 accident issues as well.

5 All right. Well, good morning. One of  
6 the things that I would like to at least let you know  
7 at this point, I'm going to try to focus most of what  
8 I'm going to talk about on ESBWR and the SWR-1000. I  
9 can talk about AP1000, those issues if you'd like.  
10 I've got some presentation material on that, but I  
11 really want to try to focus on some of the new  
12 designs, those two in particular.

13 It really wasn't until, I guess, the  
14 advance reactor's research plan was completed in about  
15 April. The ink was almost dry when we got four new  
16 applications very quickly over the course of the  
17 summer. ESBWR, we began talking with General Electric  
18 in the beginning. I guess it was around June. They  
19 have put in an application now for precertification.  
20 They submitted a lot of their documentation, but not  
21 all of it at the end of August, the beginning of  
22 September. We've begun to take a look at that.

23 SWR-1000, another passive BWR was  
24 submitted also for precertification review. We don't  
25 have the documentation on that, but we've had a couple

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D C. 20005-3701

1 of presentations from Framatome. We've looked at that  
2 design. We see a lot of issues and things that we  
3 would want to take a look at that are very much  
4 related to ESBWR.

5 More recently we've begun to take a look  
6 at I'll call it the advanced CANDU, but the ACR-700  
7 light water cooled, but heavy water moderated CANDU  
8 type of reactor, and most recently Westinghouse came  
9 in, gave us a presentation I guess it was in the  
10 beginning of October talking about the IRIS design.

11 So over the course of the last two or  
12 three months, we've begun to try to reassess our  
13 infrastructure. What experimental data might we need  
14 to obtain? What code development might we need to  
15 entertain here over the next, two, three, four years  
16 looking further downstream so that when we have to  
17 support NRR and when we have to make decisions for  
18 severe accidents and perhaps even fuel related issues,  
19 we can start to develop those tools now and have them  
20 ready when these four units get into the design  
21 certification phase.

22 AP1000, we think we know what the issues  
23 are. They've been on the table now for several months  
24 at least, and we have programs ongoing to try to  
25 resolve those issues, but it's these newer

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 applications where we have the most concern.

2 What I would like to do this morning is  
3 talk about ESBWR, highlight what are the design  
4 changes, the design differences between SBWR and other  
5 boiling water reactors that we need to concern  
6 ourselves with. Likewise, the same for ACR-700, and  
7 try to highlight what are those areas where we think  
8 we're going to need code development and potentially  
9 more data.

10 We've tried to address this I would say in  
11 sort of a PIRT type thought process. In looking at  
12 these designs, and we have to admit that we don't have  
13 all of the documentation, and in some cases the design  
14 isn't complete, but what are those physical processes  
15 which are going to be the most dominant ones that  
16 we're going to have to address ourselves with when it  
17 comes to the kinetics, the fuel design, thermal  
18 hydraulics, and the severe accident issues?

19 Now, in getting into discussions with NRR  
20 and other researchers in thermal hydraulics, severe  
21 issues, fuel, it kind of comes up, well, why should  
22 you have any research related issues for these newer  
23 reactors.

24 We've been dealing with BWRs, PWRs for 30,  
25 40 years. We've got codes that have been approved for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 looking at numerous issues here. I'd like to throw  
2 out four reasons why we think there is going to be  
3 additional work necessary.

4 First of all, most of these units are  
5 essentially driven by passive safety systems. These  
6 rely on natural circulation, low driving heads,  
7 relatively low flow rates from some reservoir of  
8 liquid into a vessel that's partially voided.  
9 Regardless of what code you use, one of these codes  
10 don't like to do nothing.

11 They operate better with large driving  
12 heads, more of a large break type of scenario when  
13 we're trying to analyze problems where the delta Ps  
14 around the loop are very small. We find ourselves in  
15 the situation that these codes can be very divergent  
16 and give us a very wide range of answers if we're off  
17 in one of those components, be it the friction, the  
18 interfacial drag, the gravitational head that we might  
19 expect.

20 So trying to analyze these very low flow  
21 rates and natural circulation leads to relatively high  
22 uncertainties.

23 MEMBER ROSEN: Let me ask you a question  
24 about that particular point. Is that uncertainty a  
25 function of the codes or of the phenomenon?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 MR. BAJOREK: To cover it, I think I'd  
2 probably like to say both because I think there are  
3 some of those processes which have relatively large  
4 uncertainties. So even if I have a code that is  
5 perfect and I know how to analyze and model a  
6 particular system, those uncertainties can lead to  
7 large differences in answers because these transients  
8 proceed over hundreds of thousands of seconds.

9 A small uncertainty in a thermal hydraulic  
10 model can propagate in time, okay, and lead to, you  
11 know, a large uncertainty in whether it's core  
12 uncover (phonetic), pressure in the containment, you  
13 know, a large uncertainty in one of those critical  
14 parameters that you're trying to assess.

15 The other thing that you see time and time  
16 again is if you take someone and you have them do a  
17 calculation with RELAP. You have someone else do a  
18 calculation with COBRA/TRAC. We'll take someone else  
19 and have them do a TRAC evaluation. The same problem,  
20 the same boundary conditions.

21 The one thing you can assure yourself,  
22 you're going to have three different answers. So I  
23 think, yes, the processes themselves, the uncertainty  
24 in the models lead to confusion and issues here, but  
25 also the fact that we're looking at using computer

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 codes by differing organizations for new systems.  
2 That also can lead to uncertainties in what your  
3 answer is going to be.

4 MEMBER ROSEN: But you understand my  
5 question is that no matter how good the code is, if  
6 the friction factor you're using for a piping system  
7 turns out actually to be different than what you  
8 thought it was or maybe it varies, maybe it's time  
9 variant during a long transient because of some  
10 surface phenomena that occur, that without the driving  
11 heads of these big displacements, you know, pumping  
12 systems, these kinds of small changes which would  
13 normally be swapped by the kind of safety systems  
14 we've operated in the past, become important in the  
15 actual phenomena.

16 MEMBER SIEBER: In other words, what  
17 you're saying is could Plant A, which is supposed to  
18 be identical to Plant B, act differently because it  
19 has more corrosion build-up or some subtle feature is  
20 slightly different?

21 MEMBER ROSEN: Yes, that's what I'm  
22 saying.

23 MEMBER SIEBER: Yeah, I think that's a  
24 real possibility.

25 MEMBER ROSEN: I'm also saying that Plant

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 A, if it had the accident five years after operation,  
2 would be different than Plant A if it had the accident  
3 in the first year.

4 MEMBER SIEBER: Yeah, and I'm not sure how  
5 you deal with that analytically, but I would like to  
6 hear.

7 MEMBER WALLIS: Well, on this passive  
8 safety feature, the world has been told for several  
9 years now that passive is better. This is a real  
10 advance in nuclear safety because we've gone away from  
11 these accumulators and pumps and things that drive  
12 flows and now we have nature doing it, and that's  
13 better.

14 So now you're changing the tune and saying  
15 it may be worse.

16 MR. BAJOREK: No, not necessarily saying  
17 it's worse.

18 MEMBER WALLIS: Well, there are more  
19 uncertainties associated with it.

20 MR. BAJOREK: The difficulty in analyzing  
21 the transient --

22 MEMBER WALLIS: Well, that's a bad  
23 feature. That's a bad feature of a design if you  
24 can't analyze it accurately.

25 MR. BAJOREK: It's more difficult to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 analyze.

2 MEMBER WALLIS: Not sure which way the  
3 flows are going and things. That doesn't sound like  
4 a good design.

5 MR. BAJOREK: But I think the focus is  
6 changing, however, rather than -- and that's why I  
7 wanted to throw the other bullet up here -- is because  
8 these traditional accident scenarios that we have been  
9 looking at for traditional reactor systems are also  
10 changing.

11 Yes, they're a stronger function of these  
12 smaller driving heads and smaller uncertainty in the  
13 friction factors and things like that.

14 MEMBER WALLIS: No, no. I don't think.  
15 Is it really so? I mean, if you've got a big tank up  
16 here of water and you've got a reactor down here,  
17 gravity is going to pull the water from here into  
18 here. Now, it's not going to go the other way. So  
19 there are some simple reasons why this passive design  
20 is good.

21 MR. BAJOREK: Yes. I think in all of  
22 these designs the question has gone away from how high  
23 the temperatures will get in your hot assembly to  
24 whether you would have core uncovering and what might be  
25 the depth of that core uncovering.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1           So I think that, yes, they're clearly  
2 safer and they have more margin than the earlier  
3 designs, but assuring our answers have become more  
4 difficult because we're looking at different  
5 scenarios, and we're looking at processes that we  
6 haven't focused on over the last 20 years in our  
7 research programs.

8           MEMBER RANSOM: Just one clarification.  
9 It's my opinion though the uncertainty is not in the  
10 behavior of the plant, but in the ability to model  
11 that behavior.

12           MR. BAJOREK: Okay.

13           MR. FLACK: One might almost go as far as  
14 to say that the human error has now shifted from the  
15 operational side of the plant to the design part of  
16 the plant and the ability to analyze the plant.

17           MR. BAJOREK: This is not so much the case  
18 for ESBWR. Maybe it somewhat applies to ACR-700, but  
19 in the case of the SWR-1000 and IRIS, we see new plant  
20 components, aspects of the plant, features of the  
21 plant that we haven't encountered before. So we know  
22 those are areas that we're going to have to sharpen  
23 our pencils on, perhaps develop some new components.

24           And finally, I would say it's the state of  
25 the art in boiling condensation in two stage flow. We

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 find ourselves looking at processes that inherently  
2 have relatively high uncertainty. I think that's  
3 where we see problems in the AP1000.

4 We're looking at entrainment now driving  
5 the question on whether we're going to have core  
6 uncovering, how deep it is. Entrainment is inherently  
7 very difficult to try to model and analyze, and as a  
8 result, there's a high uncertainty in those  
9 correlations that are really available to us right now  
10 to put in those codes. So that's harder for us to get  
11 a handle on.

12 If we take a look at ESBWR, and I think  
13 the same can be said for SWR-1000, we're going to be  
14 dealing quite frequently with condensation in the  
15 presence of a noncondensable gas, another process that  
16 we didn't really have to depend on getting a good  
17 answer for for large break calculation, but now to try  
18 to come up with a quantifiable answer for many of  
19 these small break type scenarios in ESBWR and similar  
20 types of systems, we have to be able to assess how  
21 well we can get condensation heat transfer  
22 coefficients in the presence of a noncondensable gas.

23 And, again, another process that has a  
24 relatively large uncertainty that we have to model in  
25 a transient that has a very significant length.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER RANSOM: Steve, one comment that  
2 I'd like to have. I didn't see on your list the  
3 anomalous behavior of codes, and every code that I've  
4 seen so far, and if it's been eliminated in TRAC-MN,  
5 why, just tell me, but it's variously called water  
6 packing or, you know, phase transitions and things  
7 like this, which cause pressure perturbations that do  
8 overwhelm the driving heads of these natural  
9 circulation reactors.

10 And so I think that's a key issue. I  
11 don't see anything being said about that, but like I  
12 say, if it has gone away, why, just tell me

13 MR. BAJOREK: We won't claim that it has  
14 gone away at this point, but I guess in that case we  
15 would look at that as being almost a generic problem  
16 as part of the codes, whereas for this infrastructure  
17 assessment, we want to try to look at those things  
18 which are very peculiar or incident to the advanced  
19 reactors, but you know, that's a good point.

20 MEMBER RANSOM: Well, it is something  
21 that's important now, whereas in large break LOCA and  
22 some of the others, it was overwhelmed --

23 MR. BAJOREK: Yes.

24 MEMBER RANSOM: -- even though we're  
25 dealing with higher pressures, higher driving heads,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 and it wasn't so much of an issue.

2 But I know from experience in modeling  
3 the SBWR that it hasn't gone away in RELAP-5, and I  
4 doubt if it's gone away in TRAC-M.

5 MR. BAJOREK: I would doubt that, too, but  
6 I think that also factors into the earlier comment on  
7 some of the user uncertainties and the assumptions on  
8 input parameters, almost the boundary conditions.

9 It's very small differences, okay, that  
10 either the user throws in or the code decides to toss  
11 into the mix that can cover up some of the real  
12 effects of those processes that you're trying to  
13 analyze.

14 What I'd like to do is kind of step  
15 through the two designs, ESBWR and then the ACR-700;  
16 just kind of point out in sort of a broad brush  
17 fashion what are some of the major differences that we  
18 see that would affect the codes and potential use of  
19 data.

20 Start off with the ESBWR. A couple of  
21 points that I think ought to be made is this is a  
22 relatively high power BWR system, 4,000 megawatt  
23 thermal, and you can see the comparisons to SBWR,  
24 ABWR, and the BWR-6. So we're looking at a relatively  
25 high powered core, relatively high power density. Of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 major significance is there's no recirculation pumps.  
2 I guess that's a good way to get rid of the jet pump  
3 types of problems, but eliminate those altogether and  
4 now it's natural circulation that derives your flow,  
5 will not only during the accident scenarios, but  
6 during normal operation as well.

7 Now, they compensated for this by making  
8 the vessel taller so that you have more of a driving  
9 head in the downcomer, a taller chimney. There's  
10 significantly more water in the vessel at the start of  
11 any type of a transient, more subcooled water to the  
12 vessel itself, and that extra inventory helps to make  
13 transience a bit more forgiving than what they may  
14 have been in the SWR or some of the other types of  
15 design.

16 The higher power is accomplished by  
17 having, you know, a lot of more fuel bundles within  
18 the core and sort of a wider, shorter core, as  
19 compared to the other systems, and of course, it's the  
20 passive safety systems.

21 MEMBER WALLIS: Now, the main thing that's  
22 different is the chimney. Everything else we've seen  
23 before.

24 MR. BAJOREK: Yes.

25 MEMBER WALLIS: And there are many real

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D C 20005-3701

1 questions about how a 'chimney will behave,  
2 particularly if there aren't many baffles in there.  
3 There will be large scale circulation patterns. Maybe  
4 the steamer will go to one side and swirl around and  
5 what comes into the separators will not be a uniform  
6 mixture and all.

7 That's the new thing that you ought to  
8 focus on, it seems to me. Everything else you've seen  
9 before. All of these other components have been in  
10 BWRs for a long time.

11 MR. BAJOREK: We've seen a lot of work in  
12 the compression pools.

13 MEMBER WALLIS: Yeah.

14 MR. BAJOREK: One of the newer features  
15 that I think Shanlai had pointed out is there is a  
16 relatively tight coupling between what goes on in the  
17 containment and the safety systems and how it affects  
18 delivery from the GDSCS back to the vessel. We see  
19 that as being different.

20 I'm not sure we phrased it real well  
21 within the advanced reactor's research plan for ESBWR,  
22 but we are concerned with this idea of several flow  
23 loops that we have to be able to analyze accurately  
24 using, you know, code like TRAC-M.

25 Now, we focused at this point more on

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 those loops and those low driving head flow patterns  
2 that get GDCS into the vessel and drive a mixture of  
3 air and steam up through the PCC heat exchangers. We  
4 see those as perhaps being a more difficult research  
5 issue and potentially more important from the safety  
6 issue because that's how you're going to get the decay  
7 heat out of this system over the long term.

8 So that has kind of been maybe the highest  
9 of the highs.

10 MEMBER WALLIS: But you don't know yet.  
11 I mean, if you run -- when you've got your TRAC  
12 working and you run it, it may be that you show that  
13 this is a very robust system. You can put in all  
14 kinds of assumptions about entrainments and whatever,  
15 interface friction and so on, and it doesn't matter.  
16 Gravity brings everything into the right place.

17 It may be that it isn't a problem. We  
18 don't know yet. I think the first thing to do is get  
19 this TRAC so that it can run some simulations and do  
20 some sensitivity studies.

21 MR. BAJOREK: I'm going to come to that,  
22 and I want to maybe contradict a little bit what we  
23 heard earlier from NRR in terms of where we're at with  
24 TRAC-M because, in fact, we do have a fairly long list  
25 of assessments that we have been working on over the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 last several months. Okay? We're not as far along as  
2 we would really like, but when it comes to taking a  
3 look at processes for the ESBWR, we have been doing  
4 things like the Oak Ridge level swell experiments,  
5 modeling those. We did the G-2 level swell. We're  
6 doing Achilles right now.

7 We're looking at things that help us with  
8 the interfacial drag within the vessel. Now, we're  
9 still working on those. In comparison to how TRAC and  
10 RELAP would behave, TRAC-M seems to be right in there.  
11 Some tests are better; some are worse, but we're at  
12 the point where I think we'll be able to characterize  
13 how well the code is doing, and that's going to be  
14 important for looking at this inter-vessel level swell  
15 for ESBWR and ESWR-1000, but I'll talk about that a  
16 little bit later.

17 In terms of what we need to do in the  
18 advanced research plan, try to break this up into  
19 three larger areas. What we might need to do in terms  
20 of fuel behavior, be able to model and kinetics,  
21 thermal hydraulics, and then I'll talk about severe  
22 accident. I'll take what hopefully is the easier one  
23 first.

24 The ESBWR fuel, I think as we saw earlier,  
25 is going to be a GE-12 type fuel bundle design. This

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is the same picture that Shanlai had up there earlier.  
2 It has water rods, part length fuel rods, a number of  
3 differences in that fuel bundle that makes it a little  
4 bit different than some of the earlier designs that  
5 have been used.

6 Reporting in models into TRAC-M to try to  
7 account for these geometric differences, but in terms  
8 of a research issue, do we need data? Do we need  
9 significant code development?

10 Our answer to that is no, certainly not  
11 for ESBWR because our expectation is we don't get much  
12 core uncoverly. So some of these individual features  
13 of the fuel assembly, we wouldn't expect those to  
14 matter a whole lot, and I think that is sort of backed  
15 up by G.E.'s PIRT that ranks a number of these fuel  
16 heat transfer, fuel related issues as relatively low  
17 in comparison to other issues.

18 I think it was pointed out earlier that,  
19 hey, wait a second. We've also gotten rid of the jet  
20 pumps, and we know that in BWRs there is a question on  
21 power stability. In our initial look at ESBWR, we  
22 flagged that as well because now we look at a shorter  
23 core, which should help, but a wider core which should  
24 make stability a little bit worse, and we're going to  
25 have to start up this plant without the benefit of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 recirculation pumps to drive the flow.

2           You're at a little bit of the mercy of the  
3 flow starting, perhaps condensing up in the chimney  
4 region, and having a flow reversal. So we look at  
5 stability as something that we need to address.

6           Our initial reaction is that between what  
7 can be done with TRAC-M, TRAC-M coupled with PARCS,  
8 experimental data that we've obtained from the PUMA  
9 facility where we're running tests right now to look  
10 at stability type issues, give us a database to try to  
11 assess that.

12           Our preliminary assessment is that our  
13 computational tools and data are probably okay for  
14 ESBWR. We think we're at least as good for doing this  
15 plant as we are for other BWRs, not to say that there  
16 isn't any work to be done, but we think that we're on  
17 relatively good footing there.

18           More work to be done in the thermal  
19 hydraulic area. I point out in particular this flow  
20 loop that originates in the drywell where in the case  
21 of either a main steam line break or a LOCA we would  
22 be pushing some fraction of the noncondensable gases  
23 to hide out somewhere lower in the drywell, up through  
24 the PCC heat exchanger, developing a head of liquid  
25 that will eventually go back to the vessel, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 perging the noncondensables down into the wet well.

2 As we've observed and we've talked with  
3 General Electric, we think it's going to be very  
4 important for us to get this correct. Okay? And we  
5 would see the need at least to do a fair amount of  
6 assessment, potentially some model development in  
7 order to be able to model condensation, the presence  
8 of noncondensable gases within this PCC heat  
9 exchanger.

10 There is a relatively large amount of data  
11 that's available through the PANTHERS test that G.E.  
12 has run. So we think that there's relatively good  
13 data there. We have some from other Purdue tests.  
14 There's other data out in the literature.

15 But we see this as being important for  
16 long-term decay heat removal because this is what's  
17 ultimately going to help recover the vessel, keep  
18 liquid inventory in the vessel, and will eventually  
19 drive what your containment pressure is during the  
20 long-term cooling.

21 MEMBER RANSOM: And one thing you might  
22 point out, Steve, that vent line goes down into the --

23 MR. BAJOREK: Yeah.

24 MEMBER RANSOM: It's not shown on the  
25 viewgraph very clearly.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. BAJOREK: Yeah. The soda straw kind  
2 of just dips down into that.

3 MEMBER RANSOM: That's where the  
4 noncondensables go.

5 MR. BAJOREK: Right, right. And also in  
6 those PANTHERS tests, this wasn't a nice, steady flow  
7 behavior. It chugged. I guess you would build up  
8 ahead before you pushed some liquid in, and the gas  
9 would purge itself periodically into the wet well.

10 So I think in terms of, well, gee, if  
11 we've got to get this thing right and this is  
12 something that we're going to have to start taking  
13 seriously right now in order to get the right models  
14 and the right assessments in place and identify if we  
15 need any additional data for this type of a flow loop  
16 and this type of a condensing system in order to model  
17 this appropriate for the ESBWR.

18 MEMBER ROSEN: You know, we have quite a  
19 bit of experience with chugging and large forces in  
20 drywell Tauruses, Tauruses and BW MARK Is, for  
21 example, and the remedies for that, including those  
22 ram's heads and diffusers and the like and the very  
23 large forces that can be imparted at least through BWR  
24 MARK I.

25 So are you thinking about those kinds of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 things here, too, or are we talking about now in  
2 process or are the forces that could be expected  
3 during these kinds of events similar to what we have  
4 calculated would be expected in MARK I events?

5 MR. ELTAWILA: Can I help on that? I  
6 think what you're talking about, Steve, was from the  
7 primary system. The driving force was very hot. This  
8 is a very low pressure system here. So the charging  
9 loads are not going to be as high as the one that  
10 we've seen in MARK I and MARK II design. That's why  
11 we add the -- I'm surprised that you called it ram's  
12 head. You know, that's the old -- they have quencher  
13 now, dequencher, and things like that, yeah.

14 So that's not the same issue. I would  
15 like to add, too, that even though that what Steve  
16 identified as an important modeling phenomena, what  
17 we've seen in the PANDA facility that, again, this is  
18 a self-correcting problem. You know, you build up  
19 enough pressure and you are going to push the  
20 noncondensable out.

21 So it's a modeling issue, not a phenomena  
22 that is going to affect the safety of the plant or  
23 anything. It's just how we can make our code predict  
24 that phenomena.

25 And again, so there are a wealth of data

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 from the PANDA facility and to a certain extent from  
2 the PUMA facility on that.

3 MEMBER RANSOM: Along that line, you may  
4 be the inappropriate person to ask this question to,  
5 but sine I agree that you want to model the phenomena  
6 and understand it and that drives the research that  
7 you're doing, but the other question is: what is  
8 going to be the licensing basis for these points? You  
9 know, what are you going to look for?

10 The core doesn't uncover, and as long as  
11 it remains covered, you're not going to have peak clad  
12 temperature as, say, an indicator, and I'm wondering  
13 has that question been answered as to what are we  
14 looking for.

15 MR. BAJOREK: I think NRR would need to  
16 answer that one, but right now in the calculations  
17 that we've seen from G.E., peak cladding temperature  
18 isn't a real concern. The core stays covered. I  
19 think there is even for the GDCS line break there's  
20 still a meter of water above the top of the core.

21 Where I would expect them to put more  
22 attention is going to be in containment pressure.  
23 After 72 hours, the containment pressure is still  
24 within the design limit, but is relatively high, okay,  
25 and I think in earlier meetings that's been raised as

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 something that they would want to take a look at  
2 because it doesn't meet one of the general design  
3 criteria that says that after so many hours' period of  
4 time, your pressure should be decreasing, and it  
5 doesn't seem to do that.

6 So I would think that it's going to be the  
7 events in containment which are going to be more of  
8 the regulatory criteria issues that will drive what's  
9 going to go on in the ESBWR.

10 MEMBER BONACA: The only other one I can  
11 think of is reactivity accidents, which would have to  
12 do with instability, and I don't know if that's really  
13 a concern or not.

14 MR. BAJOREK: That's not an area where I  
15 believe research has gotten into discussions  
16 considerably. I think that in terms of analyzing, if  
17 we're requested to look at that, I think that the  
18 TRAC-M PARKS and the data that we have from PUMA,  
19 yeah, we have a pretty good start on doing that.

20 But I believe that traditionally some of  
21 the frequency domain codes, the core and some of the  
22 other industry codes to try to look at stability  
23 first.

24 With regards to the ESBWR thermal  
25 hydraulic, the issues that we're going to pay

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE , N.W.  
WASHINGTON, D C 20005-3701

1 particular attention to at this point is going to be  
2 the distribution, the effects of the noncondensable  
3 gases throughout the containment.

4 How they're transported through the  
5 containment, be it the PCC heat exchangers or the  
6 suppression pool, in the plan we've mentioned, well,  
7 we also have to take a look at what happens when the  
8 vacuum break. We get condensation in some parts of  
9 the accident, and the vacuum breakers let gas back  
10 into the drywell from the wet wells.

11 Well, looking at those, invariably it's  
12 looking at where the noncondensable gases are, what  
13 their effect are on condensation, what their effect  
14 would be as they go through suppression pool. Those  
15 are the ones that we think at this point are the most  
16 important.

17 We would anticipate having to improve the  
18 models in TRAC-M. That's been identified previously  
19 as an area that we think is fairly weak. We think  
20 that we're going to have to do the assessments for  
21 that.

22 And also we need to really get moving on  
23 the assessment of what I would call the integral tests  
24 for natural circulation. We have started some of  
25 those, looking at things like ROSA 3, FIST, GIST.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 We're in the beginnings of those.

2 We will likely also need to continue  
3 assessment of TRAC-M for other types of tests at low  
4 pressure that involve lots of natural circulation.  
5 Maybe the OSU tests and the APEX facility, not  
6 strictly for BWR, but things that we need to do and to  
7 assess the code to insure ourselves that it's doing a  
8 good job when it's dealing with natural circulation.

9 And I think as Farouka pointed out, this  
10 is an assessment that needs to be done, potentially  
11 some model improvement. There's a relatively good  
12 database for condensation with a noncondensable gas.  
13 We'll look at those. We're probably in good grounds,  
14 but we don't want to rule out having to do anything  
15 else at --

16 MEMBER WALLIS: So there are no new  
17 phenomena. All of these phenomena have been met  
18 before. All of them are modeled in the codes one way  
19 or another.

20 MR. BAJOREK: Yes.

21 MEMBER WALLIS: What you're concerned  
22 about is how well the code represent them. So we're  
23 getting back to questions of uncertainties in the  
24 codes.

25 MR. BAJOREK: Yes, yes.

1 MR. ROSENTHAL: If I might interject, you  
2 know, before we just get into the severe accident  
3 side, typical Level 1 PRA, you drew an event tree, and  
4 you said, "Do I have my normal complement of ECCS?"  
5 And you used Chapter 15 very conservative analysis,  
6 and if you said yes, you drew a line and you said  
7 okay.

8 And your whole focus was on the  
9 unreliability of active components, and the  
10 uncertainty in how well you predicated your Level 1  
11 PRA results was tied up in how well you thought that  
12 you modeled your active safety systems and the data  
13 that supported how good were these active components.

14 Okay. Now, with respect to Level 1, as I  
15 said, just before we get on the severe accident side,  
16 you're going to want to draw your PRA and your event  
17 trees again, and you're going to be putting in passive  
18 systems, and you may find out as you go through that  
19 that, in fact, the uncertainties in your predictions  
20 are dominated not by active component reliability, but  
21 rather by your ability to do analysis and how well do  
22 you think that you faithfully replicate what's going  
23 on in the plant?

24 If we are used to thinking in terms of ten  
25 to the minus three, ten to the minus four systems for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 active components with multiple trains, then for the  
2 same level of knowledge, we would want to know these  
3 phenomena to some degree of accuracy.

4 And what I'm saying is a concept that's  
5 driving us to recognize that we want to be able to do  
6 better in our analysis, in our predictions.

7 MEMBER WALLIS: It's not just that, but  
8 the PRA must reflect these model uncertainties because  
9 that's where the uncertainties are, and so --

10 MR. ROSENTHAL: And that would be a new  
11 challenge in a new area.

12 MEMBER WALLIS: This is a new challenge.  
13 I mean, some hydraulic models have been around for a  
14 long time, but putting some hydraulic model  
15 uncertainties into the PRA is a new task, and it seems  
16 to be what you must do because that's where all of the  
17 uncertainty is. Almost all of it is.

18 MR. ROSENTHAL: Well, let me just say that  
19 I think that we recognize this as an issue.

20 MR. BAJOREK: Okay. Let me kind of get  
21 through ESBWR severe accident issues. We've looked at  
22 that. Again, we're looking at this as having many  
23 similarities to existing BWRs.

24 When it comes to doing things with the  
25 MELCOR code, we don't see any tremendous needs here.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Most of these are issues that we can deal with in  
2 terms of licensing.

3 Now, ACR-700, okay, we think is probably  
4 going to require us to do a bit more fundamental work.  
5 This shows just some of the differences between ACR-  
6 700 and other types of CANDUs.

7 The interesting feature is that it's a  
8 light water cooled reactor with a heavy water  
9 moderator within the outer calandria region. It is  
10 not an entirely passive system, but requires  
11 accumulators for high pressure injection and uses  
12 pumps to supply water at low pressure to the headers,  
13 okay, to insure that you have covery of the pressure  
14 tubes during a LOCA or other accident.

15 This shows the pressure tube. Just to  
16 point out, there's something like 43 elements in here.  
17 The central elements are natural uranium with like a  
18 four percent dysprosium poison in them. These are two  
19 percent enriched that's surrounded by a pressure tube  
20 that has an annulus separating it from the calandria  
21 tube and the heavy water moderator in the outer region  
22 of the pressure tubes.

23 When we look at fuel and neutronics types  
24 of questions, we see some fairly complex modeling  
25 types of questions. We have both light water and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 heavy water multiple enrichments with dysprosium,  
2 which is different than what we have normally used in  
3 a code. It's a one type of moderator, a standard,  
4 uniform type enrichment. So we know that we have to  
5 do -- I'm sorry?

6 MEMBER SIEBER: Finish your thought and  
7 then I'll ask my question.

8 MR. BAJOREK: We know we have to do  
9 additional work in order to model this better and, you  
10 know, perhaps a different way than we had in the past.  
11 We're going to have to update libraries.

12 We have some questions on burst and )  
13 blockage of the fuel. Okay? But with regards to the  
14 kinetics issues, we see those as being tractable with  
15 effort to resolve these modeling type differences,  
16 potential for experimental data when it comes to some  
17 of the fuel performance.

18 MEMBER SIEBER: Yeah, I withdraw my  
19 question. You've answered it.

20 MR. BAJOREK: Oh. Okay. Thermal  
21 hydraulic issues, some of us have kind of talked that  
22 maybe the way of getting out of the modeling issues is  
23 to convince AECL to take this thing and stolt  
24 (phonetic) it to 90 degrees because we've kind of  
25 grown up and our codes of matured with this idea that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 refloods go from bottom up or town down in some cases,  
2 but they're along the lines of gravity. It's not  
3 perpendicular to it.

4 So modeling events that will occur  
5 laterally along this pressure tube be it the flow  
6 patterns in an aided bundle and how those patterns  
7 transitioned, what the rewet and the clinch processes  
8 will look like. Okay? If you get a dry patch, how  
9 stable will it be? What will happen when you try to  
10 flood a heated pressure tube from both ends? Will you  
11 get any water into this hot patch?

12 And we get on to the next one. Well, what  
13 happens when that tube starts to sag? And if you  
14 remember from that fuel bundle and that pressure tube  
15 starts to make contact with the calandria tube. We  
16 think there's a whole wealth of thermal hydraulic  
17 issues that we're going to have to deal with in order  
18 to try to model this, in addition to what's the flow  
19 distribution as we go from this bank of tubes from the  
20 header, as we're potentially draining the system and  
21 some tubes at the top are uncovered and they aren't on  
22 the bottom.

23 There's a lot of thermal hydraulic issues  
24 that we are identifying and we think are going to have  
25 real modeling needs and real needs for experimental

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 data.

2 I think I covered this one already talking  
3 about the heat transfer between this pressure tube and  
4 the calandria tube as the bundle heats up an this tube  
5 sags and begins to make contact with this or  
6 potentially fails the calandria tube, and I'll let the  
7 kinetics people worry about what happens when you mix  
8 the light water and the heavy water and you have to  
9 worry about reactivity insertions.

10 MEMBER SIEBER: Maybe I'll go back to my  
11 older question.

12 MR. BAJOREK: Ut-oh. I haven't answered  
13 it, I guess.

14 MEMBER SIEBER: When you manufacture  
15 something like this combination of pressure tube and  
16 calandria tube, I would guess that unless you only  
17 made one of them that they wouldn't be concentric  
18 necessarily, and because that gas annulus is so  
19 narrow, I would think that that variability would have  
20 a big effect on what the heat transfer characteristics  
21 are, and in addition, in an accident condition, it's  
22 changing over time.

23 MR. BAJOREK: Yeah.

24 MEMBER SIEBER: How do you deal with  
25 something like that?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. BAJOREK: You don't know right now.  
2 That's one of the things that we're going to have to  
3 deal with, and it's clear from some of the things that  
4 we've seen from AECL that that has been a problem in  
5 their --

6 MEMBER SIEBER: It's an issue.

7 MR. BAJOREK: It's an issue because where  
8 do they put the spacers, and there's been a lot of  
9 work on that.

10 MEMBER SIEBER: I would think that  
11 depending on what that geometry really is would  
12 determine what the heat output and the temperature of  
13 the fuel assembly would be, and that would have a  
14 fairly good uncertainty unless you have a lot of  
15 margin.

16 And it's not clear to me how you would  
17 model that.

18 MR. BAJOREK: We agree. I think there's  
19 a lot of questions, and with the ACR-700, we don't  
20 have any documentation on that yet. It hasn't been  
21 submitted as part of the design certification. This  
22 is based on workshop and handouts. We're trying to  
23 formulate where we're at and where we're going to go.

24 MEMBER WALLIS: It seems to me --

25 MEMBER SIEBER: Did they not have a

1 damaged fuel assembly in one of those reactors at one  
2 time where they might have observed what the behavior  
3 was?

4 MR. BAJOREK: I thought they had, but I'm  
5 -- I'm reaching because I remember cracking has been  
6 a problem on these.

7 MEMBER SIEBER: Well, that was a different  
8 problem. This was earlier than that. Well, my memory  
9 isn't that great.

10 MEMBER WALLIS: Well, there are so many  
11 questions with this ACR-700 which you're not prepared  
12 that it seems to me that you may simply have to say we  
13 can't make decisions about it, and therefore, we won't  
14 accept applications because we're burdened with all  
15 of this other work on these other reactors. It would  
16 take too long, too much effort to come up to speed on  
17 all of these questions that you've raised here. So we  
18 won't ever consider it.

19 MR. BAJOREK: Right now we have with we  
20 have, and I think as far as decisions on how to  
21 proceed at this point, it's going to have to be up to  
22 the management.

23 MR. FLACK: Yeah, I think it's important  
24 to realize that we are in the space of just trying to  
25 be proactive and trying to understand what's coming.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 It hasn't come yet and so we're really -- we don't  
2 know how significant these things will play out until  
3 we learn more about the plant, but again, we haven't  
4 really entered into pre-application review. Hopefully  
5 we'll get a lot of these answers as we move along.

6 MR. BAJOREK: I guess our point is  
7 compared to ESBWR or AP1000 things, we think there are  
8 a lot of significant questions and a lot of work  
9 that's still going to have to be entertained.

10 MEMBER WALLIS: But the assumption seems  
11 to be made at the beginning that you're going to do  
12 enough research to be able to answer all of the  
13 questions about all of these reactors coming along,  
14 and it probably will turn out that you can't do that.

15 MR. FLACK: Well, not us as an agency, but  
16 I think us as relying on the bigger picture of all the  
17 work that's going on, and we're still trying to figure  
18 out where all of that lies.

19 So there will be a trip to Chalk River  
20 coming up in December. We'll be looking at what has  
21 been done, and certainly we want to get the answers to  
22 the questions, but the burden is always on the  
23 licensee, the applicant, to come forth, and then it's  
24 up to us look at that and see what other questions we  
25 have.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But we're still at a very preliminary  
2 stage, and we're again trying to be proactive, think  
3 ahead, put in where we are today, and as Steve  
4 mentioned, we haven't really looked at the plant  
5 itself yet.

6           So at this point there is uncertainty.

7           MR. BAJOREK: We see some of that with the  
8 thermal hydraulics. I mean, a number of issues and  
9 problems.

10           When it comes to severe accidents, the  
11 situation or the issues may actually even become more  
12 difficult because our initial read of the database,  
13 the modeling that has been gone on previously is that  
14 there hasn't been a tremendous amount of that due to  
15 the way that this reactor has been regulated in  
16 Canada.

17           And we would, again, anticipate a  
18 relatively robust need to address severe accident  
19 issues, such as the pressure tube/calandria tube  
20 failure, how you get fuel failure and melt progression  
21 in a horizontal core as opposed to a vertically  
22 oriented core, how you fail this calandria in the  
23 outer shield tank.

24           We don't see a whole lot of information.  
25 We see very little in the way of test data available

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1 even to the designers at this point. We think at this  
2 point it's prudent for us to say that if we're going  
3 to be the ones to be relied upon to come up with  
4 credible auditing tools, we have a difficult task  
5 ahead of us.

6 I think I basically said that.

7 MEMBER RANSOM: Steve do you know if AECL  
8 has any severe accident codes for modeling CANDU?

9 MR. BAJOREK: I've talked to a few people  
10 on that, and I think their general consensus is no.

11 MR. SNELL: Yeah, I'd like to correct  
12 that. We have adapted the map code for severe  
13 accidents.

14 Oh, sorry. Identify yourself. Victor  
15 Snell for ACL.

16 We have adapted the map code for CANDU.  
17 It's been copied with the Canadian utilities, and  
18 that's our severe accident tool with them.

19 MR. BAJOREK: I just want to summarize  
20 some of the work that has been ongoing to try to look  
21 at these two reactors in addition to some of the  
22 others. As John has noted, there's been work to try  
23 to develop advanced research plans for ESBWR and for  
24 the ACR-700.

25 We haven't started work on the SWR-1000 or

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 IRIS at this point, but would anticipate that would be  
2 done some time in the future.

3 The work that's ongoing that gives us a  
4 little bit of a head start on some of these, as  
5 Shanlai pointed out, and I think I hope I emphasized  
6 earlier, we see a very tight coupling between what  
7 goes on in the ESBWR containment and what goes on  
8 within the primary vessel.

9 We've recently coupled TRAC-M and the  
10 contain code to give us a tool that will be able to  
11 exercise and try to look at uncertainties, how  
12 uncertainties in containment affect the vessel and  
13 vice versa.

14 In our developmental assessment, we've  
15 given all of the BWR related assessments a higher  
16 priority now. We've sort of shifted what we're doing,  
17 and it started things like the ROSA III, the GIST, the  
18 FIST, a number of component assessments in order to  
19 try to get TRAC-M qualified for BWR applications,  
20 maybe a little bit ahead of where we would want to be  
21 for PWRs.

22 With respect to the ACR-700, we're in the  
23 process of resurrecting and identifying work that has  
24 been done previously by the staff, more so in the case  
25 of the CANDU. There was some work done by INEEL that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 identified what models they would recommend changing  
2 in TRAC-M, what was the database that was acceptable  
3 back then for some of these processes, some of which  
4 are the same.

5 They've identified code changes. We also  
6 have a partnership with some of the Korean  
7 organizations who have also looked at or have been  
8 analyzing the CANDU reactors. So we've had some  
9 preliminary discussions with them on looking at some  
10 of their work that might be useful to assessing the  
11 ACR-700.

12 To summarize, I think it's pretty safe to  
13 say that there's been a lot of renewed activity now in  
14 these advanced light water reactors. As John pointed  
15 out, we don't have all of the documentation yet.  
16 We're still waiting for a great bulk of that, but our  
17 goal is to try to look at the physical processes,  
18 where we're at in our ability to model and assess  
19 those things which are going to have the highest  
20 uncertainties, and start to formulate plans that will  
21 lead eventually to code modifications or possibly to  
22 experimental programs.

23 Thanks.

24 MR. FLACK: Okay. We're just about on  
25 schedule.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE, N.W.  
WASHINGTON, D.C. 20005-3701

1           There's two more viewgraphs actually to go  
2 through. This one is to just go quickly over what  
3 we're planning to do in '03, and that was an  
4 attachment. It's actually an attachment to the paper,  
5 and basically there's three things we're trying to  
6 achieve.

7           One is to expand our current capability.  
8 That's pretty much in the codes, the TRAC that you've  
9 heard about and MELCOR and also establish cooperative  
10 agreements in various areas, primarily in the fuels  
11 analysis area, where it's very costly to do this work  
12 ourselves, and as well in the materials area, analysis  
13 area, where we're looking at the codes and standards  
14 that are out there and reviewing them and revising  
15 them and also seeking cooperative agreements.

16           Framework we talked about and PRA, as far  
17 as PRA and its application to advanced designs,  
18 looking for data and experience is out there that we  
19 can use to better be able to quantify risk for those  
20 types of plants.

21           And in the structural analysis area, we're  
22 also looking at codes. The seismic -- updating  
23 seismic curves and looking at what we can gain from  
24 cooperative agreements with Japan is one area that has  
25 done some work on modular concepts and designs.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 So were there any other questions on that?

2 Yes.

3 CO-CHAIRMAN FORD: In your Attachment 4,  
4 you give lots of subsets for these framework analysis,  
5 et cetera. Were those subsets derived by the formal  
6 PIRT activity that you outline in the infrastructure  
7 assessment plan?

8 MR. FLACK: I would say most of the  
9 subset, the actual subsets come from further  
10 development of our infrastructure and asking questions  
11 and trying to understand what's out there and  
12 capitalizing, leveraging on what else is going on in  
13 the world today.

14 It's not so much comparing one against the  
15 other, but recognizing the domain, the spectrum of  
16 areas that need to be worked, and from that, again,  
17 trying to not actually jump inside doing work in one  
18 area, but trying to capitalize on what work has  
19 already been done in these areas. So --

20 CO-CHAIRMAN FORD: But you're capitalizing  
21 on the low cost tasks.

22 MR. FLACK: That's basically it, trying to  
23 take advantage, trying to understand what the status  
24 and advances that have been made and where do we need  
25 to go from there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So I would say this fiscal year, again, is  
2 still trying to establish a vision and building on  
3 what already has been done.

4           CO-CHAIRMAN FORD: But you're no longer  
5 confined to the statement about fiscal year '03 to  
6 '06. It's no longer a five year plan.

7           MR. FLACK: No. It's pretty much this  
8 document will be revisited again in the next year and  
9 revised based on what we know and what we need to  
10 know, and so it's a living document, and it projects  
11 as far out as we can in that regards.

12           CO-CHAIRMAN FORD: So it's a rolling plan  
13 with input of the technical challenges as given in the  
14 infrastructure assessment, and it's a rolling plan as  
15 to how you implement that.

16           MR. FLACK: Yeah, the plan is the broader  
17 picture, and that involves resources and where you're  
18 going to put them and prioritize them. The  
19 infrastructure assessment is really an assessment of  
20 our needs, where the issues are, technical challenges,  
21 what's out there and where we need to go.

22           So there's these two parts of it, and the  
23 one, the piece about what we actually will be doing is  
24 the prioritization process, and that plays out against  
25 other things that are going on in the office.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So it's not in the sense of, you know,  
2 here's what we need over the next five years and we'll  
3 do this in fiscal year '02, '03, '04, '05, and '06.  
4 It's to continuously revisit this based on new  
5 information as information becomes available, and  
6 prioritizing the work as we see it against other work  
7 that's going on.

8           CO-CHAIRMAN FORD: So it's very unlike a  
9 structured program that you'd have in many other  
10 organizations.

11           MR. FLACK: I think because it's so far  
12 reaching it's difficult to just establish and know all  
13 that needs to be known to write something down that's  
14 very structured. It's more flexibility there in  
15 making decisions as we go and as needs arise and as we  
16 can capitalize on things.

17           And, again, in the sense of infrastructure  
18 is one thing, and then how we apply that to a  
19 particular plant will depend on how much is available  
20 from the applicant. So the more that we can  
21 understand and gain from the applicant, the less we'll  
22 need to do, but the more that we see that we have  
23 outstanding questions that that time will require us  
24 to do more.

25           So it's not clear exactly where that line

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C. 20005-3701

1 is drawn at this point. There's always a gray area  
2 when it comes down to --

3 CO-CHAIRMAN FORD: I'm trying to struggle  
4 to get away from the uncomfortable feeling that this  
5 whole PIRT program is driven entirely by resources,  
6 dollars and manpower, as opposed to safety.

7 Now, is that an unfair statement?

8 MR. FLACK: Well, I think as far as the  
9 PIRT is concerned, the issue is safety, and it's how  
10 you prioritize your work. The phenomena that's  
11 important will depend on its implication with respect  
12 to safety. So within the PIRT process, I think it's  
13 intrinsic to the process that safety is foremost.

14 MR. ELTAWILA: Can I? I really think  
15 there is a confusion here about the PIRT. The PIRT  
16 process applies only to certain phenomena. A thermal  
17 hydraulic code, try to identify the phenomena, and  
18 among these phenomena say which is the most important  
19 one that drive the risk or influence the behavior of  
20 the plant, and from that you try to develop your data  
21 and analysis tool.

22 So that's related to the structure of our  
23 database and our codes and things like that, and  
24 that's the only use of the PIRT.

25 The way we project is we use the -- I

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 forgot the acronym PPM, PM something, you know, but  
2 you look at they are measured against the performance  
3 goal of the agency, and the performance goal of the  
4 agency, the first one of them is maintaining safety.

5 So you try to look for each of these  
6 activities. The work that we are doing for ESPWR or  
7 ACR-700, how is it used to address these four  
8 performance goals: maintaining security (phonetic),  
9 reducing unnecessary burden, and all this stuff?

10 And that's how we come up with the  
11 prioritization to allocate the money.

12 In addition to that, there is another  
13 layer built on that, is the long lead time, you know.  
14 For example, you know that your fuel testing is going  
15 to take ten years before you get results. So after  
16 even you go through all of these processes, you will  
17 go further and say do I need this work in a year or  
18 two years or five years, and this or that I will look  
19 at the resources.

20 CO-CHAIRMAN FORD: So that comes into the  
21 thought process.

22 MR. ELTAWILA: That's correct.

23 CO-CHAIRMAN FORD: So if I look at this  
24 list here that Graham and myself were looking at and  
25 trying to work out where it fitted into what we've

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 heard today, it will all be done in fiscal year '03.

2 MR. FLACK: Well, no, I don't think it's  
3 to say that it'll all be done. At least it will be  
4 initiated.

5 CO-CHAIRMAN FORD: Oh, okay. All right.  
6 It will all be initiated in '03.

7 MR. FLACK: Yes, right. That is correct.

8 MEMBER WALLIS: Now, I asked a question  
9 earlier about why was Steve presenting to us.

10 MR. ELTAWILA: We know that you think the  
11 thermal hydraulic is the center of the universe.

12 MEMBER WALLIS: No, no, no.

13 MR. ELTAWILA: So we try to please you.

14 (Laughter.)

15 MEMBER WALLIS: No, no. That's not the  
16 case. I mean, I'm trying the various hypotheses I  
17 have. One is that --

18 MR. FLACK: It's the area that needs the  
19 most work.

20 MEMBER WALLIS: Yes. Steve is the only  
21 person who has really thought about what needs to be  
22 done, and in these other areas it hasn't been done, or  
23 the other one is that these other areas are in such  
24 tremendously great shape, and Steve is the one who  
25 needs some help from us. So you put him in front of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D C 20005-3701

1 them.

2 (Laughter.)

3 MEMBER WALLIS: Is it true that if we had  
4 heard something from the fuels analysis people, like  
5 what Steve presented, it would have been something  
6 very close to the kind of presentation he gave?

7 MR. ELTAWILA: Well, there are no new fuel  
8 issues for ESPWR and ACR-700.

9 MEMBER WALLIS: Yeah, but there are for  
10 the --

11 MR. ELTAWILA: Because we can identify --

12 MEMBER WALLIS: But it is all fuel.

13 MR. FLACK: Right. We came down I guess  
14 it was in July and we spent a day with the  
15 subcommittee to talk about the different areas. Of  
16 course, fuel was one of them that we discussed, but  
17 you know, within that time frame. We spent a number  
18 of hours I think while Stu was given that  
19 presentation, and then also as one on materials.

20 Materials is also equally important, and  
21 there is a piece on ACR-700 that's in the plan on  
22 materials. So there are areas in there which we just  
23 don't have the time to cover today, which could easily  
24 be covered -- well, it wouldn't easily be covered, but  
25 could be covered in subcommittees at the very --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   MEMBER WALLIS: Do you think Steve was  
2 being typical of the status in these other areas? I  
3 mean, of course, the problems are different, and  
4 they're for different reactors, but should you take  
5 him as being typical of what's going on?

6                   I found that personally what he presented  
7 helped me a great deal as opposed to what I read. I  
8 mean, it helped me a great deal as a supplement to  
9 what I had read.

10                  MEMBER BONACA: It was very good.

11                  MEMBER WALLIS: And probably if I had  
12 heard more about materials today, that would have  
13 helped me a great deal as a supplement to what I have  
14 read.

15                  MR. FLACK: Yes. When you see the  
16 attachments, of course, what Steve had covered was  
17 most of what's in the Attachments 2 and 3. The other  
18 parts are somewhat generic.

19                  There is, again -- I apologize. If we had  
20 some time; in fact, if we would like to hear about the  
21 materials for ACR-700, there's a discussion of that,  
22 but primarily the information that's in the  
23 Attachments 2 and 3 right now from how far we can go  
24 with them at this stage is primarily the issues that  
25 Steve had covered, which is the thermal hydraulics and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the severe accidents in the nuclear part of it.

2 So he covered 90 percent. For SBWR it was  
3 pretty much what's in there now.

4 MEMBER BONACA: It seems to me for all of  
5 these plants, the I&C, I mean, digital I&C is also.

6 MR. FLACK: Yeah. I mean, it's more  
7 generic. It's ongoing. I think the systems analysis  
8 piece though is very important in not only developing  
9 codes for application, but as you develop these codes,  
10 you understand the plant better. You understand what  
11 the success criteria means.

12 So you grow with that, and you become  
13 aware of the plant, which we sometimes forget that  
14 this is how we understand the plant. So that's why  
15 it's a critical piece in all of this.

16 CO-CHAIRMAN FORD: Just one final thing.  
17 I asked the question whether all of these activities  
18 will be started in fiscal year '03, and you said yes.

19 MR. FLACK: Yes.

20 CO-CHAIRMAN FORD: You mentioned two  
21 others, the ones we heard about AP1000. Is the reason  
22 why they're not on this list -- this is the NRR  
23 usually -- the reason they're not on this, is it --

24 MR. FLACK: Yeah, I guess they were  
25 already ongoing, and these were more for things that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we were initiating. So, yeah, I think it would be  
2 safe to say that the AP1000 could have been added to  
3 this list if we were trying to be complete on this.

4 CO-CHAIRMAN FORD: So these are starts.

5 MR. FLACK: These are more, yeah, in the  
6 context of initiating work.

7 MR. ELTAWILA: The other reason, John,  
8 that some of the AP1000 especially in the severe  
9 accident issue is done by the staff here internally.  
10 So that just may be reflecting that these are the  
11 contract work that is going out, you know. So maybe  
12 that's why it was not mentioned.

13 CO-CHAIRMAN FORD: Well, thank you very  
14 much.

15 MEMBER RANSOM: Peter, I'd like to make  
16 one final comment.

17 CO-CHAIRMAN FORD: Yes, of course.

18 MEMBER RANSOM: Which has to do with  
19 uncertainty again, and you've presented research tasks  
20 that are primarily driven by lack of knowledge, you  
21 know, that we understand.

22 But there is another approach, and I'm  
23 hoping that the NRC eventually will adopt something  
24 along these lines that the Europeans are using now in  
25 which they call self-assessment built into a code.

1 It's not actually self-assessment, but it's like self-  
2 sensitivity to the uncertainties that are known and  
3 the various models in the code.

4 And so when they go through the 59 runs  
5 that Professor Wallis has identified as necessary to  
6 get the 9595 assurance, they can actually tell how  
7 much sensitivity to this model, that model, the other  
8 models.

9 It would be nice to see a research driven  
10 by the sensitivity, you know, of these calculations to  
11 those various models. Are they the most sensitive?

12 MR. BAJOREK: We're heading in that  
13 direction. I think our first goal is to try to get  
14 TRAC-M consolidated and assessed at this point because  
15 the uncertainties won't mean anything unless we have  
16 some basic confidence.

17 But we have been working with Ally Mosely  
18 and Mohammed Mudaris at University of Maryland to  
19 start to put together an uncertainty methodology where  
20 we would apply it to the code results.

21 We started earlier in the summer. We're  
22 thinking about using AP1000 as a preliminary tool, but  
23 the idea here if you could come up with an uncertainty  
24 methodology that we could use at least with TRAC-M and  
25 start to use that to address some of your questions.

1 MEMBER RANSOM: Well, the reason I bring  
2 it up is some of these methods have to be built into  
3 the code, and since you're developing TRAC-M now, now  
4 would be the time to actually build this kind of  
5 capability in.

6 MR. FLACK: Yeah, certainly sensitivities  
7 runs -- to understand the significance of the  
8 uncertainties is certainly an important part of the  
9 code development, I would think. So we'll take your  
10 comment certainly into serious consideration during  
11 the development of the codes.

12 CO-CHAIRMAN FORD: I'll be asking the  
13 members for their comments on specifically the NRC,  
14 the NRR and the contributions of this morning. I'll  
15 be asking for that later on today.

16 So thank you very much, indeed, John.

17 MR. FLACK: Okay

18 CO-CHAIRMAN FORD: I hope you will be here  
19 for this afternoon.

20 MR. FLACK: Just the one more conclusion  
21 slide to mention that, just the two bottom bullets.  
22 I think the rest we have already discussed.

23 CO-CHAIRMAN FORD: All right.

24 MR. FLACK: The two papers that are going  
25 forward.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701