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NUCLEAR REGULATORY COMMISSION

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NUCLEAR REGULATORY COMMISSION

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BRIEFING ON STATUS OF AP600 AND SBWR  
THERMAL HYDRAULIC TESTING

- - - -

PUBLIC MEETING

Nuclear Regulatory Commission  
One White Flint North  
Rockville, Maryland

Monday, September 20, 1993

The Commission met in open session,  
pursuant to notice, at 1:30 p.m., Ivan Selin,  
Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission  
KENNETH C. ROGERS, Commissioner  
FORREST J. REMICK, Commissioner  
E. GAIL de PLANQUE, Commissioner

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STAFF SEATED AT THE COMMISSION TABLE:

WILLIAM C. PARLER, General Counsel

DR. ANDREW BATES, Chief, Operating Branch, Office of  
the Secretary

JAMES TAYLOR, Executive Director for Operations

ERIC BECKJORD, Director, Office of Research

THOMAS MURLEY, Director, NRR

ASHOK THADANI

BRIAN SHERON

LOUIS SHOTKIN

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

1:30 p.m.

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

We're pleased to welcome members of the staff to brief the Commission on the certification schedule and on the status of the AP600 and the small boiling water reactor thermal hydraulic testing for the passive designs.

The advanced passive reactor designs have a number of unique features distinguishing them from both the current generation of light water reactors and the evolutionary LWRs. The thermal hydraulic test program will provide information badly needed for code assessment for evaluating passive system performance independently. The test data are needed for model development, improvements to existing codes and for confirmation of the validity of existing models under the low-flow conditions that you get in these reactors.

While the development of the needed test data and the validation of the thermal hydraulic codes are largely the responsibility of the reactor vendors, some NRC tests are warranted to ensure adequacy of the vendor test data and to provide sufficient independent

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1 data to validate the NRC audit tools. And in today's  
2 tight budget environment, I would say that this is a  
3 major area of expenditures and a major project that we  
4 have going, so it's in both our professional and our  
5 fiduciary responsibilities that we're very interested  
6 in the report today.

7 Today's briefing will cover the  
8 certification and the testing program schedules as  
9 well as the planned schedule for code assessment. The  
10 staff I understand will also discuss issues identified  
11 for each of the passive designs as well as research  
12 results in future plants.

13 Copies of the briefing are available.

14 Commissioners, comments?

15 Mr. Taylor, would you please proceed?

16 MR. TAYLOR: Good afternoon.

17 With me at the table are Lou Shotkin and  
18 Brian Sheron and Eric Beckjord from the Office of  
19 Research, Tom Murley and Ashok Thadani from NRR.

20 CHAIRMAN SELIN: Good afternoon.

21 MR. TAYLOR: This is very important  
22 research with regard to the staff activities and I  
23 think the Commission is aware that it not only will  
24 involve the research we do but it will involve our  
25 review of the work done by the vendors in their

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1 testing as part of the overall effort to be sure that  
2 we have all the thermal hydraulic information we need  
3 with regard to these designs.

4 I'll now ask Eric Beckjord to continue.

5 DOCTOR BECKJORD: Thank you.

6 Mr. Chairman, the purpose of our  
7 presentation is -- and Commissioners, Mr. Chairman and  
8 Commissioners, our purpose is to describe the  
9 confirmatory research activity as it relates to both  
10 the AP600 and the SBWR, to describe the activities  
11 that are underway, where we are now and where we're  
12 going, and also we will discuss it in the relation of  
13 research to review the designs for these plants and  
14 the safety evaluation reports and finally how it  
15 relates to certification.

16 The AP600 and the SBWR are based to a  
17 considerable extent on established technology, but  
18 there are systems and component changes, including  
19 passive safety features in core cooling and  
20 containment cooling, that are important departures.  
21 The purpose of the confirmatory work on both reactor  
22 types is to provide independent confirmation on the  
23 proper functioning of these systems by means of tests  
24 and then to provide thermal hydraulic codes which have  
25 been proven against test results for evaluating system

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1 performance, and we will be making those codes  
2 available to NRR and the other conclusions that we  
3 arrive to for their use.

4 The other point I'd like to make is that  
5 the AP600 tests and code development work is on  
6 schedule and within budget and the work on the SBWR is  
7 getting underway. The test facility for the SBWR at  
8 Purdue will be ready for testing in September of 1994.

9 That completes --

10 DOCTOR MURLEY: I think --

11 DOCTOR BECKJORD: -- Doctor Murley.

12 CHAIRMAN SELIN: That's the briefing. The  
13 rest is just details, right?

14 MR. TAYLOR: That's the opening. Now  
15 Doctor Murley has some --

16 DOCTOR MURLEY: I would like to just  
17 describe and try to reassure the Commission that the  
18 offices of NRR and Research are working very close  
19 together on this program and I'll give some examples  
20 of how that's done, but we could start off for the  
21 AP600 by noting that it was some scoping calculations  
22 that were done at the Idaho National Engineering Lab  
23 for Research that actually highlighted some questions  
24 -- this was about two years ago -- caused the staff to  
25 question some of the basic characteristics of the

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1 safety system performance of the AP600.

2 Then as the NRR staff began to look into  
3 it a little more, we found even more fundamental  
4 questions that we thought early in 1992 needed  
5 integral system testing. In fact, Jim Taylor got the  
6 senior staff from both offices together and we met and  
7 went over what our understandings were and where the  
8 deficiencies were and from that meeting then developed  
9 a users need letter from Research to -- I mean, from  
10 NRR to Research.

11 (Slide) Let's see. Roger, if we could  
12 fire up the machine back there and get the first chart  
13 on, the second chart, it would illustrate  
14 schematically how the design certification review  
15 raises issues that have to be addressed through  
16 testing.

17 Looking at the upper left-hand balloon  
18 where the staff review takes place, it raises a couple  
19 of sorts of questions.

20 One is there are basic phenomena questions  
21 about the plant behavior during accidents: for  
22 example, the flow of emergency cooling water under  
23 conditions of low pressure differentials with multiple  
24 flow paths during a LOCA and with the possible  
25 presence of noncondensable gases. We think there are

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1 some basic phenomena that have to be tested to answer  
2 those kinds of questions.

3 Likewise we have questions about the  
4 adequacy of the models that are in our current codes,  
5 because when these current codes were developed they  
6 were based on what we now call the evolutionary  
7 plants, but for those accidents you always had large  
8 driving pressure differentials and you generally had  
9 pumps with large flow, so their models were developed  
10 under quite different conditions.

11 Then as you get into code development, the  
12 developers themselves frequently raise questions on  
13 models where you need separate effects tests to verify  
14 individual models in the codes.

15 And then the final product, then, of all  
16 this, as Eric said, is a validated systems code that  
17 both we and Research can use and the applicant, for  
18 that matter, to calculate the behavior of the plant  
19 and we would do our own independent calculations. So  
20 that's kind of the logic of how the review fits in  
21 with the testing program.

22 (Slide) If I could have the next chart,  
23 it shows the relationship of the Westinghouse  
24 sponsored tests and the NRC sponsored tests in ROSA to  
25 the design certification review schedules. Here what

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1 we see is that the tests are integrated into the  
2 review schedule.

3 We plan to issue the draft safety  
4 evaluation report for the AP600 in next May, May of  
5 1994. As you can see, some of the tests won't be  
6 completed by then, so we'll -- we've talked with  
7 Westinghouse. We will probably issue a supplement to  
8 the DSER that covers the test results and will cover  
9 any open issues that arise as a result of these tests,  
10 then Westinghouse has some time to respond to those  
11 and then of course we issue our final safety  
12 evaluation report to the Commission in late 1995.

13 COMMISSIONER REMICK: Tom, do we have the  
14 input decks for SPES, ROSA, and Oregon State yet?

15 DOCTOR MURLEY: I doubt it.

16 Do you know?

17 DOCTOR SHOTKIN: We have initial versions  
18 right now. We're trying to go through again and make  
19 them quality assured and make sure that the noting is  
20 consistent between all the input decks for the  
21 facilities and the input deck for the plant.

22 COMMISSIONER REMICK: For all three test  
23 facilities?

24 DOCTOR SHOTKIN: Yes, and for the plant.

25 COMMISSIONER REMICK: Good.

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1 DOCTOR MURLEY: One final point with  
2 regard to the NRC sponsored tests in ROSA. Brian  
3 Sheron will talk about those in more detail, but from  
4 our point of view we viewed these and always have  
5 viewed these as confirmatory tests and they're  
6 confirmatory in the sense that the data from the tests  
7 are not necessary to support the Westinghouse  
8 application. But we in the staff believe they're  
9 necessary to give us the added assurance that our  
10 safety findings are conservative, and to me that is  
11 the distinction between a confirmatory test that the  
12 NRC sponsors and does and the tests that an applicant  
13 needs to support his safety case.

14 That concludes my remarks.

15 CHAIRMAN SELIN: The implication of your  
16 remarks, Doctor Murley, is that if any of those  
17 earlier tests, not the ROSA tests but the vendor  
18 tests, slip, then the whole certification process may  
19 slip.

20 DOCTOR MURLEY: That's exactly right. In  
21 fact --

22 CHAIRMAN SELIN: It's actually a fairly  
23 tight schedule when you look at all these tests that  
24 are going on side by side, so there are five different  
25 sets of tests not so much mutually contingent, but any

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1 one of those delays will ricochet through the  
2 schedule.

3 DOCTOR MURLEY: Yes, that's correct, Mr.  
4 Chairman. And in fact, for a variety of reasons, each  
5 of those tests shown, the Westinghouse tests, have  
6 slipped in the last year. They've slipped from six to  
7 ten months, each of them have, and that has caused us,  
8 as I mentioned, to have to split the draft SER into  
9 two parts.

10 CHAIRMAN SELIN: Already?

11 DOCTOR MURLEY: Already, yes. If it slips  
12 much more, I don't think we can hold these schedules.

13 CHAIRMAN SELIN: So the remarks that I  
14 made to the Advanced Reactor Corporation last week  
15 clearly are supported by this kind of a schedule?

16 DOCTOR MURLEY: Exactly right, yes.

17 COMMISSIONER REMICK: Just a comment. You  
18 mentioned the scoping studies done out at INEL under  
19 Research sponsorship, about two and a quarter years.  
20 I happened to be out there and saw a demonstration of  
21 that on their work station and showing the possibility  
22 of uneven flow out of the various tanks, which made me  
23 feel that it was something far more than nice that we  
24 have work stations in the building to run some of  
25 those codes in-house as well as having it at

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1 contractors. It was quite impressive and convincing  
2 that it was a valuable tool.

3 DOCTOR MURLEY: Yes, we agree.

4 DOCTOR THADANI: We do have that  
5 capability in-house and we can run a number of codes.

6 COMMISSIONER REMICK: I'm very pleased to  
7 see that.

8 MR. TAYLOR: Brian Sheron will continue.

9 MR. SHERON: (Slide) Next slide, please.

10 I'll talk quickly about our background and  
11 objectives for this research. I won't repeat really,  
12 other than what Eric said, and that is that we almost  
13 without a doubt use our computer codes to validate the  
14 performance of these new plant designs.

15 When we first looked into it for the  
16 passive plants, there were three predicted needs that  
17 we could foresee. One was the system performance of  
18 AP600, system performance of the SBWR, and then in  
19 addition stability of the SBWR.

20 In 1989, actually four years ago, we began  
21 to receive sufficient design information from the  
22 vendors on these advanced designs that we could do  
23 some serious planning and start to determine how best  
24 to go about setting up these codes.

25 (Slide) Next slide, please.

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1           What we did is we started at Idaho by  
2 first asking them to do a systematic evaluation of the  
3 RELAP5 code to determine whether there were any models  
4 that were missing to predict the phenomena in these  
5 new designs or whether there were appropriate models  
6 that hadn't been properly validated for the specific  
7 conditions or the geometry of these designs.

8           What we concluded from that study was that  
9 there were no new phenomena that were expected in  
10 these plants, but that the codes and the models in the  
11 codes had not been assessed against either scaled or  
12 prototypic data from systems and components that are  
13 geometrically similar to AP600, which is the plant  
14 which has the most unique design features, and then  
15 also under the low pressure gravity-driven flows  
16 expected during the safety injection.

17           (Slide) Next slide, please.

18           What I'd like to do now is go through the  
19 issues first for AP600, the issues and then the  
20 programs we have to address them, and then I will go  
21 over and discuss the same thing for the SBWR.

22           When we took a look at the AP600, we asked  
23 ourselves what really are the particular new features  
24 for which further assessment was desired. If you  
25 recall, basically the major difference in the AP600 to

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1 the conventional Westinghouse plant is that they  
2 replaced the high-pressure injection with a passive  
3 system, the core make-up tanks and the ADS system, and  
4 then later on there is the passive residual heat  
5 removal system.

6 But the features that we felt we needed  
7 further assessment on were the core make-up tank, the  
8 automatic depressurization system performance, and the  
9 direct vessel injection performance. In this plant,  
10 the ECC water is injected directly in the vessel in  
11 the downcomer whereas in a conventional plant it's  
12 injected in the cold leg.

13 And finally, as Tom said, we wanted to see  
14 the integral behavior of these systems looking for  
15 possible system interactions and their performance  
16 under these very low flow natural circulation type  
17 conditions.

18 (Slide) Next slide, please.

19 Let me run through quickly the vendor test  
20 programs that are ongoing.

21 Westinghouse is running separate effects  
22 tests for their core makeup tanks. These I believe  
23 are not quite yet started. I think they're imminent,  
24 though. These are being run at Westinghouse.

25 The passive residual heat removal system

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1 separate effects tests, these are completed. These  
2 are also run at Westinghouse.

3 And the automatic depressurization system  
4 tests are ongoing right now and they're being run at  
5 Italy.

6 SPES, which I think you're familiar with,  
7 is also being run in Italy in Piachenza at the CF  
8 facility and those tests I believe now are expected to  
9 start in mid-October.

10 And then also, Westinghouse is running a  
11 smaller scale, or actually I should say a differently  
12 scaled facility. It's a lower pressure facility at  
13 Oregon State and those tests are expected to start in  
14 the mid-November time frame.

15 With regard to these vendor tests, both  
16 Research and NRR have developed jointly a vendor  
17 testing monitoring program. What this means is that  
18 the staff, both NRR and Research staffs, as well as  
19 our contractors, will be physically present on site  
20 when the vendors are running these tests so we can  
21 better understand them, understand how they're  
22 collection data, how they're qualifying the data and  
23 so forth. This is also very useful for our code  
24 developers because it's very hard to develop a code  
25 and a code model when you don't actually see the

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1 facility and basically get hands-on, so it serves a  
2 dual purpose.

3 COMMISSIONER REMICK: Brian, I have a  
4 question. It doesn't relate necessarily to the vendor  
5 facility, but it's a question I asked before but I  
6 don't recall that I got an answer.

7 I had heard that the Japanese had run a  
8 separate effects test on the core makeup tanks in  
9 Japan. I don't know if that's true and, if it is  
10 true, have we done anything of code assessment based  
11 on that data? Has it been provided to us if they  
12 performed the test?

13 DOCTOR SHOTKIN: Yes. On their own they  
14 ran a test. They modified their facility and their  
15 test results confirmed what we had previously  
16 predicted, the recirculation phase of the CMT, so  
17 we're not planning to do anything more than just pat  
18 them on the back and say, "Thanks for the test and it  
19 confirmed what we had already seen in our codes."

20 COMMISSIONER REMICK: I see. But we do  
21 have the data?

22 DOCTOR SHOTKIN: Yes.

23 COMMISSIONER REMICK: Okay. Good.

24 MR. SHERON: Okay. Now I'll talk about  
25 the NRC programs that we have for AP600.

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1           The first thing we did is we met with NRR  
2           and evaluated the vendor's testing programs and from  
3           that decided what confirmatory testing was appropriate  
4           for the Office of Research to conduct. What we  
5           concluded was that the vendor-sponsored separate  
6           effects tests, which I just described, were in fact  
7           sufficient and that there were no confirmatory  
8           separate effects testing needed to be conducted by the  
9           NRC staff.

10           COMMISSIONER REMICK: That was an area  
11           where I believe ACRS differed with the staff. Is that  
12           anything that your code review consultants have looked  
13           at to see if they agree?

14           MR. SHERON: The code consultants have not  
15           identified any additional areas where they thought  
16           testing was needed and we never really got a clear  
17           indication from the ACRS on specifically what further  
18           separate effects tests they thought were needed.

19           COMMISSIONER REMICK: I see. Okay.

20           MR. SHERON: We did determine, as you  
21           know, that for AP600, full height, full pressure  
22           integral system tests were required from the vendor  
23           and that's being satisfied by the SPES facility. In  
24           addition, both NRR and Research decided that also  
25           confirmatory testing in a full pressure, full height

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1 facility was desirable.

2 Now, the reason we were so concerned about  
3 having the high pressure testing and the full height  
4 was basically for three scenarios in which the passive  
5 safety systems in AP600 would be expected to operate  
6 while the system was still at high pressure. Let me  
7 just remind you that the original facility -- the only  
8 facility that Westinghouse was proposing was Oregon  
9 State, which is a low pressure facility. The question  
10 was is that sufficient. When we took a look at the  
11 accidents that are normally analyzed and evaluated,  
12 there were three that occurred at high pressure. This  
13 is the small break LOCA, the steam generator tube  
14 rupture and the steam line break. All of these will  
15 occur and will produce an actuation of these passive  
16 safety systems while the plant is at high pressure.

17 COMMISSIONER REMICK: Do you plan to run  
18 any large break LOCA tests at all on the AP600?

19 MR. SHERON: No, because the passive  
20 safety features basically don't come into play during  
21 the large break. The accumulators come on very  
22 quickly and they'll basically shut off the CMT until  
23 the system is at very low pressure.

24 Westinghouse, as you know, is using the  
25 SPES facility. The staff proposed to use the ROSA-V

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1 facility which when scaled to AP600 scales out at  
2 about 1/30th volume scale. Just for reference, LOFT,  
3 which was our biggest facility previously, was 1/50th  
4 scale. So, this is actually even larger than that.

5 The Oregon State University facility,  
6 which is 1/200th scale, will provide mostly data on  
7 long-term cooling. It won't do the short-term part of  
8 the transients.

9 Based on, I guess, my experience and I  
10 guess others here, doing testing in three facilities  
11 like that at three different locations with three  
12 different group of testing engineers at three  
13 different scaling rationales will provide us with  
14 probably one of the most comprehensive sets of thermal  
15 hydraulic data that we've ever had on a plant that  
16 we're proposing to license. As you know, we asked and  
17 the Commission approved for Research to contract to go  
18 forward with the ROSA-V facility on August 11th last  
19 year.

20 Next slide, please.

21 COMMISSIONER ROGERS: Just one thought on  
22 that. Because there will be such a comprehensive  
23 collection of data, will any of that data be made  
24 available in the future for, for instance, university  
25 programs to work with? If you've got such a wide

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1 range now, it would seem to me that that would be --  
2 I can see a lot of Ph.D. theses in that database if  
3 people could get their hands on it. Would it be  
4 relatively easy for them to access that?

5 MR. SHERON: The data we get from the ROSA  
6 facility is publicly available. Westinghouse data,  
7 I'm sure they would declare it proprietary and would  
8 not be available.

9 COMMISSIONER ROGERS: Oregon State, what  
10 about that?

11 MR. SHERON: The Oregon State, my guess is  
12 the Westinghouse data would be proprietary. You'll  
13 see later in the slides that we are looking into the  
14 possibility of doing some of our testing there once  
15 Westinghouse finishes. Obviously we'll have to talk  
16 with Westinghouse with regard to whether there's any  
17 aspects of the facility that they consider  
18 proprietary. But if we can overcome that, then that  
19 data would also be made available to the public.

20 (Slide) Next slide, please.

21 The status of the ROSA-V, right now we've  
22 awarded the contract to Sumitomo Heavy Industries for  
23 \$6.73 million to fabricate and install the  
24 modifications to ROSA-V. There have been some minor  
25 additions that are pending right now to reflect some

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1 recent AP600 design changes and one of our thermal  
2 hydraulic consultants provided us with a comment  
3 regarding the structural integrity of one of the  
4 baffle walls in the IRWST, which we had to put some  
5 additional support in there.

6 But basically we're on our original  
7 schedule. We expect shakedown testing around January  
8 of '94 and hopefully we'll obtain our first test data  
9 in early spring of '94. We do have a resident NRC  
10 representative. It is a gentleman from EG&G Idaho who  
11 is on-site, living there.

12 COMMISSIONER REMICK: What will be his  
13 function while there, just to observe or will he  
14 actually do any calculations or run any --

15 MR. SHERON: Well, mostly I think it's  
16 going to be to observe to provide us with status, any  
17 problems. He's been observing the manufacture of the  
18 components right now at Sumitomo, making sure that  
19 they're on schedule, being delivered, installed  
20 properly and so forth.

21 Lou, is there anything else that we would  
22 expect of --

23 DOCTOR SHOTKIN: Yes. He actually, I  
24 think, is going to be doing some calculations while  
25 he's there.

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1 COMMISSIONER REMICK: I see. Good.

2 COMMISSIONER ROGERS: Before you leave  
3 this, towards the end of your presentation here on  
4 page 28 or slide 28, I don't know what it is, there  
5 are some changes that you mention there for the AP600,  
6 a larger valve size in the fourth stage ADS, the  
7 possibility of a steam diffuser in the core makeup  
8 tank. Are those relevant to the ROSA-IV? In other  
9 words, would they represent some changes in ROSA-IV?

10 MR. SHERON: Well, yes. The answer is  
11 yes. The fourth stage ADS valve, this was identified  
12 early on. As a matter of fact, Doctor Murley  
13 mentioned it. These were the calculations done at  
14 Idaho. What was happening was that the system  
15 pressure did not have enough relieving capacity and  
16 what you were winding up with was periods of time  
17 during a small break in which there was no ECC  
18 injection going in. When this was brought to  
19 Westinghouse's attention, they acknowledged it and the  
20 next thing we knew they went from an eight inch valve  
21 to a 12 inch valve.

22 So, this design change had already been  
23 made and that's being incorporated in ROSA as part of  
24 the original design.

25 The diffuser that they're putting in the

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1 CMT is something recent. Okay? That is to prevent  
2 some of these shock condensation loads that they were  
3 afraid might occur during certain range of breaks, the  
4 intermediate breaks. We are right now -- we have  
5 asked Sumitomo to look at how much it would cost to  
6 install this diffuser. I think the answer is coming  
7 out to about \$18,000.00 and it still keeps us under  
8 the \$10 million cap.

9 COMMISSIONER ROGERS: So you think that  
10 will probably be in there then?

11 MR. SHERON: Yes.

12 COMMISSIONER ROGERS: Good. Thank you.

13 MR. SHERON: (Slide) The next several  
14 slides, you may get a better picture if you look at  
15 the monitor. These are the photographs of the  
16 components that are going to go into AP600. I mean  
17 I'm sorry, into the ROSA facility being fabricated at  
18 Sumitomo. The first one is the pressurizer and in the  
19 background you'll see the two core makeup tanks.

20 (Slide) The next one is the -- this is  
21 the pressurizer at the flanged section and in the back  
22 also is the --

23 COMMISSIONER ROGERS: I think they're out  
24 of phase with your slides up there.

25 MR. SHERON: Oh, I'm sorry. Let's see.

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1 They're one up ahead.

2 (Slide) This is the pressurizer heater  
3 bundle that you're looking at there. We can get  
4 copies of these photographs for you.

5 (Slide) The next one is the passive RHR  
6 system tubes. This is the U-bend shape.

7 (Slide) The next slide shows the in-  
8 containment refueling water storage tank and this has  
9 the two ports shown for insertion of the RHR tubes.  
10 So, you can see, this is not a small facility that  
11 we're putting together over there.

12 (Slide) The next slide is the two catch  
13 tanks for collecting the flows from the fourth stage  
14 ADS system. This is the one where I said they  
15 increased the valve size from eight to 12 inches.

16 (Slide) The next slide now I'll go to is  
17 the talk about the status of the analytical programs  
18 for the AP600. We've selected RELAP5/MOD3 as our  
19 audit code for the small break LOCA, the steam line  
20 break and the steam generator tube rupture analyses  
21 for AP600. We'll do the large break LOCA analysis  
22 using TRAC/PWR code. The reason is because TRAC has  
23 been extensively accessed for the large break LOCA  
24 and, as I said before, the passive features do not  
25 affect the large break LOCA analysis for AP600 and

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1 therefore there's no need right now to go off and  
2 assess TRAC/PRW for the large break any further than  
3 it's already been assessed.

4 Now, there's been a question raised about  
5 the intermediate size breaks and this is, for example,  
6 the 6.8 inch direct vessel injection line and the cold  
7 leg pressure balance line. We will use TRAC/PRW if  
8 multidimensional processes are found to be important.  
9 For example, a cross flow in a down comer because  
10 there are certain simplifying assumptions made in the  
11 RELAP code which may not be appropriate if the  
12 momentum terms are too large, in which case then we go  
13 to the TRAC code. If that's the case, then we may  
14 have to do some limited assessment of TRAC against  
15 intermediate line break tests.

16 The models that are in RELAP we're  
17 currently updating and modifying them to simulate the  
18 AP600 and the SBWR geometries as well as any expected  
19 phenomena. I guess the question you had asked before,  
20 we plan to provide a quality assured plant deck to NRR  
21 by October the 15th, which is in less than a month.

22 (Slide) Next slide.

23 Let me run through quickly now the SBWRs  
24 using programs that we have in place. The new passive  
25 safety features for which data for code assessment was

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1 desired are the tall chimney region above the core.  
2 This core sets a lot deeper in the vessel than a  
3 conventional BWR. The gravity driven cooling system,  
4 the isolation condenser system and the passive  
5 containment cooling system.

6 In the SBWR we found that the containment  
7 acts very closely with the vessel injection systems,  
8 beginning early in the transient and therefore the  
9 data for the code assessment must cover these expected  
10 interactions over an adequate period of time.

11 COMMISSIONER REMICK: What do you mean by  
12 "acts closely?" In other words, the pressure  
13 increases?

14 MR. SHERON: There's an interaction  
15 between the pressure in the containment and then the  
16 primary system performance because the containment  
17 provides a back pressure.

18 COMMISSIONER REMICK: Back pressure.  
19 Okay.

20 MR. SHERON: (Slide) The vendor programs  
21 that are in place to address some of issues, GIST is  
22 a GE program that was carried out out in California,  
23 I guess in Sunnyvale or San Jose, I'm sorry. That's  
24 to look at the GDCS and the integral performance and  
25 these tests have been completed.

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1           The GIRAFFE facility in Japan looks at  
2           long-term PCCS integral performance. That's a 1/400th  
3           volume scale facility and those tests are completed.

4           PANTHERS, that's a test program to look at  
5           the PCCS and the isolation condensers separate effects  
6           testing. That's a full height, full pressure  
7           facility. I was fortunate enough to see it when I was  
8           over there.

9           COMMISSIONER REMICK: Over where?

10          MR. SHERON: That's also being done right  
11          next door to where they're doing the Westinghouse SPES  
12          facility. They're in the same physical building.

13          COMMISSIONER REMICK: I see.

14          MR. SHERON: And that's expected to start  
15          in calendar year '94.

16          The PANDA facility, which is in  
17          Switzerland, is also a long-term PCCS integral  
18          performance facility. It's rather large, 1/25th  
19          volume scale, and that testing is expected to start in  
20          mid-calendar year '94.

21          COMMISSIONER REMICK: Have we received  
22          data from any of these, looked at the data or not like  
23          the GIST facility?

24          MR. SHERON: Yes. We've got GIST data,  
25          haven't we? You want to talk a little bit about the

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1 data?

2 DOCTOR SHOTKIN: Well, I don't know.  
3 Maybe NRR should. We've looked at the data and we  
4 found that there really wasn't as much there as we  
5 thought there might be and NRR is getting involved in  
6 that now.

7 DOCTOR MURLEY: Ashok, do you want to  
8 mention that?

9 DOCTOR THADANI: Yes. We have received  
10 some of the data certainly for tests that have been  
11 completed and the one that Lou and Brian were  
12 referring to in terms of the GIST facility. We have  
13 a number of questions as to the quality of the data  
14 and also some of the considerations that went into the  
15 testing and how well were various controlling  
16 parameters considered in the tests themselves. So, we  
17 have, in fact, today a number of significant questions  
18 on the data that was developed from GIST testing. We  
19 intend to meet with General Electric to discuss these  
20 issues. They could have very significant impact.

21 COMMISSIONER REMICK: How about the  
22 GIRAFFE data, data from the GIRAFFE facility?

23 DOCTOR THADANI: We have seen some of the  
24 GIRAFFE data and GIRAFFE and PANDA together basically  
25 would form, in our view, the basis for our

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1 conclusions. GIRAFFE actually answers some questions  
2 we may have on some separate effects test. So, in  
3 total, GIRAFFE would be just a piece of the total  
4 picture, so to speak.

5 COMMISSIONER REMICK: But we will be  
6 receiving data from all these tests and looking at  
7 them?

8 DOCTOR THADANI: Yes. We would -- what we  
9 have also done is to ask that we get what we call  
10 quick look reports because, as you saw, the schedule  
11 and the timing is so short. What we're asking them to  
12 do is the following. After critical tests, tests we  
13 think are very important, we'd like to see quick look  
14 reports which define the objective of the test and  
15 describe to what extent those objectives were  
16 satisfied. Give us all the important data,  
17 significant plots, et cetera, and also tell us what  
18 conclusions they are drawing from the tests and the  
19 results of the test so that we can quickly assess and  
20 get ourselves up to speed as to what's going on.  
21 That's our plan.

22 COMMISSIONER REMICK: Good. How long have  
23 we had the data from GIST?

24 DOCTOR THADANI: The issue developed for  
25 us in spring of this year and we conducted an

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1 inspection not too long ago. It was about three weeks  
2 ago, I think it was.

3 COMMISSIONER REMICK: Is that when we got  
4 the data, in the spring from GE?

5 DOCTOR THADANI: I think we at NRR got  
6 some information from actually a contractor that  
7 Research had and we followed up on that.

8 COMMISSIONER REMICK: But in the spring,  
9 is that when we got it?

10 DOCTOR THADANI: Spring is when we became  
11 aware.

12 MR. SHERON: (Slide) Okay. I'll continue  
13 now and I'm on -- let's see. Next slide, which is 22.  
14 I'll talk about the NRC programs that we have for the  
15 SBWR.

16 Similar to AP600, we felt that  
17 confirmatory tests from a small scale facility would  
18 provide the staff with an ability to obtain  
19 independent data on a range of conditions, mostly  
20 beyond what we normally would ask a vendor to provide.  
21 We're not looking to duplicate in this case what the  
22 vendor is providing, but we felt that having our own  
23 facility which we could run tests perhaps beyond  
24 design base to look at margins and so forth would be  
25 very useful.

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1           So, to accomplish this, we prepared a  
2 competitive proposal to design, construct and operate  
3 a small scale loop that would simulate the SBWR  
4 design. This is -- our decision to do this was pretty  
5 much based on our positive experience we had  
6 previously at the University of Maryland in which we  
7 built a small scale loop that simulated the B&W  
8 design. There was a question when we first did that  
9 as to whether the scaling would be compromised too  
10 much to produce useful data, but we did a fair amount  
11 of comprehensive analysis on the Maryland loop and  
12 convinced ourselves that the scale was acceptable and  
13 one could get useful data from these small loops.

14           (Slide) As a result of the competitive  
15 contract, Purdue was selected on July 26th of this  
16 year, just about a month or so ago. The selection of  
17 Purdue was actually made -- we had six universities  
18 that submitted proposals to construct this. The award  
19 was for three years and the cost was \$2.5 million.  
20 That's fairly comparable to, I think, our experience  
21 at Maryland.

22           The principal investigators are Professors  
23 Ishii and Ransom, which I'm sure some of you have  
24 heard of, both well known in the thermal hydraulic  
25 area. Subsequent to awarding the contract, there was

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1 a kickoff meeting between the staff. Both Research  
2 and NRR attended at Purdue on August 17th.

3 We expect that the construction will start  
4 probably in like February of this year, in about maybe  
5 five to six months. And we would expect testing  
6 probably in about a year, year and a half's time.

7 (Slide) The analytical programs for SBWR,  
8 we have also selected the RELAP5/MOD3 code to analyze  
9 the SBWR for the steam line break and the small break  
10 LOCA. General Electric is using the TRACG code which  
11 is basically the TRAC/BWR -- it's their version of  
12 TRAC/BWR code.

13 The reason we selected RELAP rather than  
14 TRAC was two reasons. One is that we felt if we used  
15 our own TRAC code we would be using almost the  
16 identical code that General Electric was using and  
17 therefore we would lose some independence. So, by  
18 using RELAP we were using a code that was developed  
19 separate and independently from the TRAC code. Also,  
20 because of limited staff resources in terms of our in-  
21 house analysis capability, we felt that having the  
22 staff only use one code to analyze both AP600 and SBWR  
23 was a much more efficient use of resources. Because  
24 these codes are so large and difficult to learn, we  
25 felt that the staff could do a much better job if they

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1 just learned on one code and focused all their  
2 resources on that.

3 For the stability analyses, we will be  
4 using the RAMONA code, which is at Brookhaven. This  
5 has the 3-D kinetics in it and so forth needed for the  
6 stability analysis.

7 COMMISSIONER REMICK: Brian, you mention  
8 in the report that the TRAC/BWR code will continue to  
9 be used. There was no mention of whether you would  
10 benchmark it or validate it against the SBWR tests.  
11 It seemed like it would be an optimum time to keep  
12 that code up to date also. I can understand why you  
13 wanted to use the RAMONA to be different and so forth,  
14 but if we truly are going to keep track of BWR, is  
15 there any reason why we should not benchmark it with  
16 this data so it's kept up to date?

17 MR. SHERON: I'm not aware of any except  
18 in terms of looking at overall resources. But I think  
19 it would be worthwhile that we did at least a limited  
20 benchmarking to make sure that we were convinced that  
21 it was performing well for the SBWR.

22 Lou, do you have any --

23 DOCTOR SHOTKIN: Yes, that's correct.  
24 We're doing it in sort of an informal way. We're not  
25 counting on it, but we're giving the people at Penn

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1 State the data and they will be looking at things very  
2 informally.

3 COMMISSIONER REMICK: Fine.

4 MR. SHERON: (Slide) Our plant deck for  
5 the SBWR, at least the QA'd version we would call it,  
6 is not yet complete. One of the reasons is we're  
7 awaiting design information from GE. NRR has arranged  
8 a meeting with GE with us in order to obtain this  
9 data. However, we will have a plant deck for NRR to  
10 use to by November 30th of the SBWR.

11 (Slide) Now, our analytical programs --  
12 and let me talk about both AP600 and the SBWR before  
13 I talk about the program separately. We plan to  
14 assess our code or codes against both the vendor's  
15 separate effects data and the integral data as they  
16 become available. Keep in mind that we just -- you  
17 know, the data has really not been coming forth.  
18 We've only just started getting it.

19 We will assess our codes against ROSA-V  
20 and the Purdue SBWR loop data when it becomes  
21 available. We also plan to conduct a structured  
22 uncertainty analysis of the RELAP5 code using a  
23 modification of the method that was used for the large  
24 break LOCA uncertainty analysis, called the code  
25 scalability applicability and uncertainty method, or

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1 CSAU. We had used that to support the ECCS rule  
2 change in 1988. So, we will do a structured  
3 evaluation of the uncertainties in the code.

4 The thermal hydraulic consultants which  
5 are now on board are reviewing this planned approach  
6 and they're providing us valuable feedback on the  
7 overall program.

8 The Commission had asked the ACRS to  
9 review the ROSA test matrix. We have a meeting  
10 scheduled on October 28th to present to them the test  
11 matrix and we will also go through the instrumentation  
12 and related subjects on the ROSA testing.

13 (Slide) Next slide, please.

14 As Ashok said before, both Research and  
15 NRR have developed an in-house analysis capability.  
16 I'll speak to Research right now. We've been running  
17 AP600 calculations in-house. You may want to ask what  
18 are some of the things we do with these analyses.

19 One of the most important is one we've  
20 just done to determine the impact of containment  
21 pressure on primary system behavior. As you know, as  
22 you have a break and you discharge steam and energy  
23 into the containment, that provides a back-pressure  
24 which in fact prohibits the depressurization of the  
25 primary system. The question is, do we need to

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1 simulate that in our analyses, this interaction  
2 between the containment and the primary system, so one  
3 of our staff members did a number of calculations  
4 parametrically looking at this and from those we  
5 concluded that, yes, it was something that we should  
6 do.

7 As a result of that, we've decided to  
8 couple the RELAP5 code, which is the systems code,  
9 with our containment code, which is the CONTAIN code.  
10 So as you run through the calculation in RELAP, it  
11 will also in parallel calculate the containment  
12 pressure in the CONTAIN code and it will feedback data  
13 to each code.

14 COMMISSIONER REMICK: This is being done  
15 for both SBWR and AP600?

16 MR. SHERON: Yes.

17 COMMISSIONER REMICK: In both cases?

18 MR. SHERON: Yes.

19 We are currently installing four work  
20 stations. Actually, I think we have two of them  
21 already installed and two are coming in, and we are  
22 currently capable of running the RELAP code, MELCOR,  
23 and the CONTAIN code.

24 COMMISSIONER REMICK: I wrote a the side  
25 of that when I saw that, "hurray."

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1 MR. SHERON: Research and NRR staffs meet  
2 periodically through a work stations users group and  
3 what they do is basically the staff that are doing the  
4 analyses sit down in an informal way and trade  
5 information, experiences with the codes and just  
6 information in terms of what they're doing and I think  
7 they get some benefit synergism in there.

8 COMMISSIONER REMICK: Do you know when you  
9 might expect the input deck for the SBWR? You  
10 mentioned October for AP600.

11 MR. SHERON: Yes. We said we'll have an  
12 SBWR deck available November 30th. It won't be QAed  
13 to the level we would like because we don't have all  
14 the data. We would expect that to come in the early  
15 spring.

16 COMMISSIONER REMICK: Spring.

17 MR. SHERON: (Slide) The next slide is  
18 just a -- we put this in here just to show you that we  
19 actually do calculations in-house. This is one that  
20 one of our staff did.

21 COMMISSIONER REMICK: I noticed that's for  
22 collapsed liquid. Do you have any for two-phase?

23 DOCTOR SHOTKIN: Yes. We thought this  
24 would be easier to understand, the collapsed liquid,  
25 than the --

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1 COMMISSIONER REMICK: No, I was just  
2 curious if you do have them.

3 DOCTOR SHOTKIN: Yes, we have them.

4 COMMISSIONER REMICK: Okay.

5 MR. SHERON: Okay. Let me talk about the  
6 results that we've had so far with the Research  
7 program. Most of the findings have been for the  
8 AP600. We have not really uncovered anything major  
9 for the SBWR.

10 As I said before, one of the first things  
11 we came up with was the four stage ADS valve. We  
12 noted that with the eight inch valve there were  
13 periods in which the ECCS was not injecting and when  
14 we brought it to the attention of Westinghouse the  
15 valve size was increased to 12 inches in order to  
16 get --

17 COMMISSIONER ROGERS: When did you pick  
18 that up?

19 MR. SHERON: Golly. That was about 1990,  
20 was it?

21 DOCTOR SHOTKIN: Yes, about two years ago.

22 COMMISSIONER ROGERS: About two years ago.

23 MR. SHERON: One of the other questions  
24 that everybody really had was on the CMT performance  
25 and one of the things that was of concern was this

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1 tank during normal operations sits there full of  
2 basically cold water that's at the containment  
3 temperature. There was a concern that when you  
4 activate the system and you expose this tank full of  
5 cold water to, for example, the steam from the  
6 pressurizer, that you would get very rapid  
7 condensation in there and a lot of strange type of  
8 phenomena.

9 Based on our calculations, what we saw was  
10 that the CMT tank when the valve is open will start to  
11 inject, but it is replaced, that the water in the tank  
12 is replaced with warm water from the cold leg. And so  
13 by the time you actually get the ADS system operating  
14 and so forth and you get the equalization line so the  
15 CMT sees the steam, it is not full of this cold water.  
16 It is full of cold leg water and you don't get or see  
17 this rapid condensation. We think that was a very  
18 interesting finding, because I know some of the ACRS  
19 members had been originally concerned about that and  
20 I think this --

21 COMMISSIONER REMICK: I believe this was  
22 a concern, yes.

23 MR. SHERON: And then also, for break  
24 sizes larger than three inches, we saw the possibility  
25 of large condensation pulses exist within the CMT

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1 during the initial part of the injection phase.  
2 Westinghouse is, as I think I mentioned before,  
3 proposing to modify the design to include a steam  
4 diffuser at the top of the CMT to help alleviate this  
5 and this is something we're going to try and -- if  
6 they put it in their design, we will be putting it in  
7 ROSA.

8 Now how are all these test results going  
9 to be used?

10 First, they help us in independently  
11 reviewing the vendor test programs. We are assisting  
12 NRR in reviewing all the vendor test programs that are  
13 ongoing. We're reviewing them from the standpoint of  
14 the instrumentation. Is it adequate? Is it in the  
15 right locations? Is there enough of it? Looking at  
16 the test matrix, are they running the right tests in  
17 order to validate the phenomena of interest? Is the  
18 scaling rationale for these tests appropriate? All of  
19 our analyses and research that we're doing are helping  
20 us in terms of this evaluation and giving this  
21 information to the NRR people.

22 Independent test data to confirm the  
23 applicability and scalability of vendors results.  
24 When we run the tests, one of the things we're doing  
25 in ROSA is we've made sure that we have in the test

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1 matrix counterpart tests for both SPES, ROSA, and OSU,  
2 so we'll be running almost the identical tests in all  
3 three facilities so we can do a type of comparison and  
4 see whether there's anything strange going on that's  
5 strictly a result of scale.

6 And then finally, we have our assessed  
7 computer codes which the staff then can use to audit  
8 the vendor submittals to see if we can reach  
9 independently the same conclusions that the vendors  
10 did.

11 I won't go through the AP600 schedule  
12 because Doctor Murley talked about that in his first  
13 slide.

14 This is the SBWR schedule. What we're  
15 most interested in is to make sure that our research  
16 program is compatible with the regulatory needs and  
17 provides data on the scale that they do. You will see  
18 the thing they're called, NRC confirmatory testing as  
19 well as the code improvement and assessment, and you  
20 can see where those milestones fit into the overall  
21 regulatory review schedule. If everything goes well,  
22 we will be providing them with the tools they need in  
23 advance of when they have to make the decisions, so  
24 they will have assessed codes in which to do audit  
25 calculations prior to writing the SERs.

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1 DOCTOR MURLEY: Brian?

2 MR. SHERON: Yes?

3 DOCTOR MURLEY: Could I add a bit on the  
4 SBWR testing just to make sure that the Commission is  
5 aware of some problems?

6 The GIST tests that were done by GE were  
7 done in 1988, so they're very old tests. They were  
8 done as developmental tests. We were not involved at  
9 that time because, well, we just didn't know what  
10 their plans or anything were with regard to submitting  
11 an application to us. As a result of some contacts  
12 that Research and their contractors had, there arose  
13 some apparent problems in the quality of the data from  
14 those tests.

15 We've sent a team inspection out this  
16 summer that had vendor inspection people, reactor  
17 systems people and thermal hydraulics experts from our  
18 contractors, and our preliminary conclusions from  
19 that -- I must say that we have not yet sent these to  
20 GE, so in a way this is, I suppose, a little unfair to  
21 them. We need to talk to them and make sure they get  
22 our conclusions, but I think the Commission should  
23 know our preliminary conclusions are that there are  
24 serious inadequacies in the technical quality of the  
25 data from those tests.

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1 Right now staff believes that there's  
2 going to have to be some more tests done to support  
3 design certification of the SBWR. If that's the case,  
4 then there may be some interactions and some schedular  
5 impacts. Clearly, we're going to have to have a lot  
6 of discussions with GE. The staff is not -- we don't  
7 have our heels dug in yet on this, but there's a lot  
8 of information available to us that indicates there  
9 are problems here.

10 COMMISSIONER REMICK: That's why I was  
11 asking when we got the data, because it was my  
12 understanding that the tests were done before I became  
13 a Commissioner because when I went out there shortly  
14 thereafter those tests had been conducted, so that's  
15 why I was curious about when did we first get the data  
16 from GE. Figured it was sometime before late '89 that  
17 the tests had been conducted.

18 DOCTOR MURLEY: The tests had been done,  
19 yes. But again, as I said, the NRC was not really  
20 involved at that time.

21 DOCTOR SHOTKIN: They really only  
22 submitted a very -- like a short report that didn't  
23 have the data, the data that we needed for our code  
24 modeling. We went out I think it was last December  
25 with a team of people and rummaged through their boxes

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1 that they had and that's where we started to find out  
2 that there wasn't as much there as we thought there  
3 should be.

4 COMMISSIONER REMICK: Incidentally, I must  
5 say honestly I'm not at all meaning any blame on the  
6 NRC, but it was a fact that I did go out there early  
7 on as a Commissioner to Westinghouse and GE and saw  
8 the amount of work that had been done on these designs  
9 and got concerned that the NRC was not being involved  
10 getting information, getting feedback and so forth at  
11 that stage.

12 I'm not being critical of the NRC  
13 necessarily, but things were kind of being done  
14 separately and led to some of my comments about  
15 industry apparently have the perception you just send  
16 in an application and three months later it comes back  
17 stamped "approved" and in-house the idea was when we  
18 get an application we'll review it, and I thought both  
19 had lost an appreciation for the fact that both have  
20 to be involved over a long period of time. There has  
21 to be a lot of arms length interaction. That was the  
22 basis for some of my early concerns about us not being  
23 fully aware of these activities.

24 MR. SHERON: (Slide) Let me just talk  
25 about future plans now.

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1                   With our facilities, and once we start to  
2                   run the ROSA tests in hopefully early next year, and  
3                   my guess is after we run the first couple my feeling  
4                   is that usually it's the first couple tests you get  
5                   the most information from, we will then begin to  
6                   examine the need to run testing beyond phase I. If  
7                   you remember, phase I was going to be a first set of  
8                   tests looking at some of the fundamental questions  
9                   that we had.

10                   We will be sitting down with NRR and  
11                   deciding whether we feel that there's additional  
12                   testing we would need to run and then we would have to  
13                   start negotiating with the GERI people to put that in  
14                   their schedule for a phase II testing.

15                   Phase II testing, if needed, would  
16                   probably run, we think, from late calendar year '94  
17                   into calendar year '95 and this would most likely be  
18                   beyond design basis type events, looking at margins  
19                   beyond a design basis.

20                   We are also looking into the possibility  
21                   of contracting with Oregon State, once Westinghouse  
22                   has completed their testing, to run some NRC specified  
23                   tests. Again, these would be tests that were beyond  
24                   design base, looking at margins and so forth. As a  
25                   matter of fact, Doctor Shotkin is going to leave this

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1 evening to fly out there and have discussions with  
2 them.

3 COMMISSIONER REMICK: How about the Purdue  
4 facility? Do you foresee that we would keep that  
5 available for some period of time, even after  
6 potential certification?

7 MR. SHERON: Yes, provided that the  
8 contractors did good work on it and so forth. I would  
9 very much be interested in keeping that facility  
10 available. As a matter of fact, our plan would be  
11 that we have a facility for most of the major reactor  
12 types in the country. We will have the OSU facility,  
13 which would be the AP600. The Purdue facility would  
14 basically give us data on most GE designs, on a BWR  
15 design. We have the Maryland loop, which is the B&W  
16 design and there's a loop right now at North Carolina  
17 State which uses freon, but it is a one-ninth linear  
18 scale of the Prairie Island plant. That would provide  
19 us with at least qualitative data on Westinghouse and  
20 CE designs.

21 So, in terms of a larger plan, we'd like  
22 to keep these small facilities running around the  
23 country.

24 COMMISSIONER REMICK: Good.

25 MR. SHERON: (Slide) With regard to our

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1 codes, we intend to maintain development activities in  
2 order to utilize data from the various advanced  
3 reactor test facilities. The thermal hydraulic  
4 consultants have been asked to review the models and  
5 will continue to be asked to review the models that  
6 are being developed as a result of these tests and we  
7 will also be asking them to give us their advice on  
8 whether any additional tests or what additional tests  
9 might be needed in these facilities. They're also  
10 helping us on this code uncertainty assessment program  
11 in terms of looking at the PERT, which is sort of a --  
12 it's a ranking table of the importance of certain  
13 phenomena.

14 Consistent with the Commission's  
15 direction, we will be asking them to comment on the  
16 long-term thermal hydraulic research plans that we  
17 have.

18 COMMISSIONER ROGERS: Are there any open  
19 questions with that group on scalability, of  
20 scalability questions on any of the -- with respect to  
21 any of the facilities that we're using?

22 MR. SHERON: None have been raised in the  
23 meetings we've had with them in terms of the  
24 scalability of these facilities. But in the same  
25 sense, I would say that they have not really focused,

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1 I think in real depth, on that question. I think  
2 mostly because they felt that this is something that's  
3 already been pretty much studied by various groups.

4 DOCTOR THADANI: Brian, if I may add to  
5 that, Commissioner Rogers.

6 We do have some questions on scalability  
7 at the some of the facilities that the vendors are  
8 using. So, there are questions particularly on PANDA,  
9 for example, that we have asked and we're waiting for  
10 responses to those questions.

11 MR. SHERON: I would just add too that a  
12 lot of times once you run the facility a lot of  
13 scalability questions show up. For example, I know on  
14 SPES there's questions about the heat loss question.  
15 That remains to be seen once they run the test and if  
16 they can do proper heat balances and so forth.

17 (Slide) On summary, we think that the  
18 research program is closely integrated with the NRR  
19 review program in terms of getting them the needed  
20 research products on the schedule that they need them.

21 Our experimental facilities are being  
22 constructed on schedule and within the planned  
23 budgets. We expect to have testing commence on  
24 schedule for both ROSA-V and then an SBWR facility at  
25 Purdue.

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1           Our code evaluation program was started  
2           about as early as we could, when we first got the  
3           information back in '89 and as such we think it's  
4           fairly well along. As a matter of fact, the gentleman  
5           who told me from Westinghouse is not here, but he told  
6           me at one time, he says, "You people have done more  
7           work on it than we have."

8           CHAIRMAN SELIN: I can see why he's not  
9           here.

10          MR. SHERON: But I think he was right. We  
11          had actually done more analyses on the AP600 than  
12          Westinghouse had done at a certain point in time. So,  
13          I think we were actually ahead of them.

14          As I said, we'll be providing assessed  
15          codes for NRR use on the schedules consistent with the  
16          FDA and the certification.

17          (Slide) With regard to the thermal  
18          hydraulic consultants, they've been very useful and  
19          helpful to us in our deliberations. We plan to  
20          continue using them and we will continue to report the  
21          results of our meetings with them to the Commission.  
22          Our next meeting is scheduled in early November, I  
23          believe, with the consultants.

24          With regard to in-house analysis  
25          capability, as I said, we've greatly improved our

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1 staff ability to analyze not only the advanced designs  
2 but I would guess the current designs as well and we  
3 have the work stations installed and I think -- I  
4 know, Commissioner Rogers, you were talking about  
5 coming over and seeing the installation.

6 I guess I would close by saying that I  
7 know there was a concern about the thermal hydraulic  
8 research program and I think that the program we have  
9 in place right now is designed to maintain it on the  
10 forefront of the international community with regard  
11 to its technical excellence. I continue to be amazed  
12 that we must get about two or three requests a week  
13 for our codes. There's something probably on the  
14 order of -- how many domestic requests have we had for  
15 RELAP and foreign?

16 DOCTOR SHOTKIN: Probably 200 or so.

17 MR. SHERON: So, it is obviously the code  
18 of choice of the international community.

19 COMMISSIONER REMICK: Certainly everywhere  
20 you go internationally people bring up an appreciation  
21 for the fact those codes are made available to them or  
22 have an interest in them.

23 MR. SHERON: So, anyway, that completes my  
24 presentation. So, if there are any questions.

25 CHAIRMAN SELIN: Commissioner Rogers?

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1 COMMISSIONER ROGERS: No, I don't have any  
2 specific questions, but I really did find this  
3 briefing very illuminating, very helpful to see the  
4 entire scope of the program, how the code development  
5 or maintenance and updating fits with the research  
6 facilities, the testing facilities. So, I want to  
7 thank you all very much for an excellent presentation.

8 COMMISSIONER REMICK: Just a couple  
9 questions. I've asked about input about almost  
10 everything except the ABWR and System 80+. Do we have  
11 those yet?

12 MR. SHERON: No, unless NRR has them.

13 DOCTOR THADANI: Currently we do not have  
14 System 80+ and ABWR DACs, but we are expecting to have  
15 them in the near future. I just don't have the dates  
16 in front of me.

17 COMMISSIONER REMICK: Are the vendors  
18 going to supply those?

19 DOCTOR THADANI: I'm sorry.

20 COMMISSIONER REMICK: Are the vendors  
21 going to supply those or are we going to develop  
22 them --

23 DOCTOR THADANI: Well, we're going to  
24 develop them with information from the vendors, of  
25 course.

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1 COMMISSIONER REMICK: Yes. Yes. Okay.

2 I guess one doesn't know, but it's  
3 possible that CANDU III might be the next applicant  
4 for design certification and the Commission in an SRM  
5 asked Research to evaluate, if that was the case, what  
6 additional resources would the agency need. Certainly  
7 I assume the code area to take resources, when can we  
8 expect response on that SRM?

9 DOCTOR SHOTKIN: We will answer that later  
10 this fall.

11 COMMISSIONER REMICK: Okay.

12 Also, last week we met with the Advanced  
13 Reactor Corporation and several of the Commissioners  
14 asked about the possibility of having access to the  
15 data that was being developed under that program and  
16 the industry expects, I guess, to get back to us and  
17 answer that question. I hope that wherever  
18 appropriate within the agency one will follow that and  
19 if that data is going to be made available and it's  
20 something that we need to utilize that we have the  
21 resources to be able to access that data.

22 MR. SHERON: Is this the data that is  
23 being developed by DOE?

24 COMMISSIONER REMICK: First-of-a-kind  
25 engineering. It's under the first-of-a-kind

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1 engineering effort.

2 I think, Commissioner Rogers, you might  
3 have asked those questions.

4 COMMISSIONER ROGERS: Well, I don't know  
5 how much -- I wouldn't exactly call it data. I mean  
6 data sort of implies research results, but they're  
7 engineering design results that are to be provided in  
8 a kind of system neutral format so that one could  
9 access them by different computer systems so that they  
10 aren't specific to one particular proprietary system  
11 of some sort. I asked them if they could supply them  
12 to our staff and they were going to look into that and  
13 see to what extent that could be --

14 DOCTOR MURLEY: We had several discussions  
15 with NUMARC and ARC on that. I would say we're not  
16 yet at an agreement. They tend to view first-of-a-  
17 kind engineering as merely filling in the details of  
18 what's approved in the design certification and they  
19 have not yet seen the need for NRC to be involved in  
20 any of that. So, we're still having discussions.

21 COMMISSIONER REMICK: No. I must admit a  
22 question of whether it's something applicable to  
23 design certification or if it's something beyond. But  
24 in the event they do offer it in the event that it  
25 might be useful to the staff, I would just ask that

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1 you be alert to evaluate it and see that we have  
2 access to it.

3 COMMISSIONER ROGERS: Excuse me.

4 COMMISSIONER REMICK: Go ahead.

5 COMMISSIONER ROGERS: Just to see that we  
6 have the hardware software systems available to be  
7 able to access it.

8 COMMISSIONER REMICK: Right.

9 DOCTOR MURLEY: Yes. I don't want to get  
10 off on a tangent here, but I think there's a more  
11 practical reason why we should follow what's going on  
12 is that they could actually waste a great deal of  
13 money and time using models to fill in the details  
14 that we wouldn't agree with, like on seismic and  
15 structural design. It would be better if they knew  
16 that now than five years from now.

17 COMMISSIONER ROGERS: Yes, clearly.

18 COMMISSIONER REMICK: We just addressed  
19 the fact that international cooperation in the code  
20 development and so forth has been extremely important.  
21 But with the new designs we'll be validating and  
22 benchmarking our codes to new data. Is there any  
23 thought about when one releases the validated code  
24 updates to foreign entities that might have commercial  
25 interest in mind? Do we ever address that when we

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1 make updated validated codes for new designs available  
2 on the international market? Have the vendors brought  
3 this up at all?

4 MR. SHERON: Well, one of the vendors, at  
5 least one individual in the vendors has sort of raised  
6 the concern. But the intent right now is that the  
7 codes, even though they would be validated against the  
8 data that we're getting, would not be considered  
9 proprietary and there would be nothing in them that  
10 would lead somebody to have access, say, for example,  
11 to proprietary data. All we're doing is demonstrating  
12 the ability of the models in the code to predict  
13 certain features, design features and their  
14 performance of these plants.

15 So, right now there's nothing that  
16 indicates that by giving the codes to foreign entities  
17 that there would be some unfair advantage being  
18 provided to them. In other words, I don't know that  
19 they could go off and say, "Now we can design and  
20 build an advanced plant."

21 COMMISSIONER REMICK: They don't get the  
22 input decks on the design.

23 MR. SHERON: Correct.

24 COMMISSIONER REMICK: Have we received a  
25 copy of the French CTAR code?

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1 DOCTOR SHOTKIN: No.

2 COMMISSIONER REMICK: No. Have we asked  
3 for it?

4 MR. SHERON: Yes.

5 COMMISSIONER REMICK: Are we going to get  
6 it?

7 MR. SHERON: It doesn't look like we'll  
8 get it anytime soon through any official channels. We  
9 might get it unofficially, but I don't think that  
10 counts. We're not getting it officially.

11 COMMISSIONER REMICK: Okay. One item that  
12 I think is not new to you, I have been concerned about  
13 our maintenance of some of our existing programs and  
14 in the report you talk about maintaining the codes,  
15 which I think is good. Are you developing any kind of  
16 a maintenance program? I think it's referred to in  
17 there. Do you have a program for maintaining these  
18 various codes that we've talked about over a period of  
19 time?

20 MR. SHERON: Yes. Actually prior to the  
21 advanced designs really coming into their own here, we  
22 had put together a maintenance program because we felt  
23 following the ECCS rule that most of the major  
24 research had been completed on the codes. We went  
25 through a process, we sat down with NRR and first got

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1 agreement with them on what codes needed to be  
2 maintained by the agency for regulatory use. Once we  
3 established that, then we went and we talked to the  
4 laboratories that were responsible for those codes to  
5 determine what was the necessary level of resources to  
6 keep a cadre of experts together to keep the codes  
7 in -- not just maintaining them in the sense of having  
8 them there so that somebody could run a calculation.  
9 But what we found is that if you don't have the  
10 researchers have exciting information to deal with in  
11 terms of code development and developing models, they  
12 will very quickly leave to other programs.

13 COMMISSIONER REMICK: Absolutely, yes.

14 MR. SHERON: So, what we need to do for  
15 maintenance is to basically keep a moderate level of  
16 development going with the codes to keep the experts  
17 there. So, that has been our strategy right now.  
18 We're fortunate in the sense that right now with the  
19 advanced designs the model development and the  
20 challenges are certainly keeping enough experts there  
21 and, of course, there's no Star Wars to lure them  
22 away. So, we've been fortunate. But then again,  
23 we're looking towards beyond AP600 and SBWR when we  
24 finished the certification and how we will structure  
25 our maintenance program at that time to maintain the

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1 expertise and the leadership of our codes.

2 COMMISSIONER REMICK: Yes. The thing I  
3 was hearing about a year ago, and this was not from  
4 one source but a number of sources, that the amount of  
5 resources going into maintenance they felt were not  
6 adequate to keep up with the basically approved  
7 changes that people thought should be made. I agree  
8 with these new designs and so forth. There's a lot of  
9 effort going in now to the codes.

10 Is there a written plan or one being  
11 developed for maintenance?

12 MR. SHERON: Well, we are putting together  
13 research plans right now in each of our subject areas,  
14 for example thermal hydraulics. What was sent to you  
15 was actually a condensed version of that plan.

16 COMMISSIONER REMICK: I see.

17 MR. SHERON: And we will be updating that  
18 every year. We are -- right now, one of the things  
19 we'll be looking at to our consultants to help us with  
20 is that real question of where should the thermal  
21 hydraulic research program go in the future.

22 COMMISSIONER REMICK: Yes.

23 MR. SHERON: What are these levels? I  
24 could tell you from experience that no matter who you  
25 talk to you'll get a different answer on what the

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1 appropriate level is of maintenance.

2 COMMISSIONER REMICK: No, I'm sure of  
3 that. Yes. But it is an important item.

4 MR. SHERON: Yes, I agree.

5 Just last -- I really want to say I am  
6 pleased with the program that you've outlined in this  
7 report. As discussed today, I think we've come a long  
8 way over what I perceived we were a year or two ago.  
9 I think it's no surprise that I'd like to see a few  
10 more of these test facilities in the United States,  
11 but I agree if we maintain some of the ones we're  
12 going to have at Oregon and Purdue and Maryland and  
13 North Carolina we're going to at least have some  
14 facilities in the United States. I guess I would like  
15 to see some of those full height, full pressure type  
16 of facilities available also. But I really am  
17 impressed with the program that you've outlined.

18 Also, I'm very pleased with staff response  
19 in building up our analytical capability, both in the  
20 hardware manipulating the software, and I understand  
21 both in Research and NRR you've added some very  
22 topnotch young analysts. I hope they're here because  
23 from what I hear they're doing a very good job and  
24 making a contribution. I think that's important to  
25 the long-term of the agency to have this type of

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1 talent. Although I certainly have been interested in  
2 making sure that we have this -- maintain this  
3 traditional capability in the agency, I also know that  
4 there are other areas of the agency like materials and  
5 instruments and instrumentation and control and  
6 seismic and criticality and others that i haven't  
7 mentioned that are extremely important to us too. So,  
8 we can't sit back on our laurels perhaps in this area  
9 and relax in the importance of our expertise in other  
10 areas.

11 But all in all, I just want to say that  
12 I'm very pleased with what you're doing in this area  
13 and what you've done. I thank you very much. It's  
14 been a very good presentation, Brian.

15 MR. SHERON: Thank you.

16 COMMISSIONER de PLANQUE: I think  
17 Commissioner Remick handled all the tough questions,  
18 so I just have one item.

19 It's certainly commendable that you're on  
20 schedule and within budget on the NRC testing,  
21 especially ROSA. I hate to even ask this question,  
22 but considering that the schedules are so tight, if  
23 they slip at all, are we assured that that facility  
24 would be available to us under a longer time frame if  
25 needed?

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1 DOCTOR SHOTKIN: The ROSA facility?

2 COMMISSIONER de PLANQUE: Yes.

3 DOCTOR SHOTKIN: Yes, I believe so.

4 COMMISSIONER de PLANQUE: Okay. That's  
5 it. I appreciate the briefing.

6 CHAIRMAN SELIN: Thank you very much.

7 (Whereupon, at 2:50 p.m., the above-  
8 entitled matter was concluded.)

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DATE OF MEETING: SEPTEMBER 20, 1993

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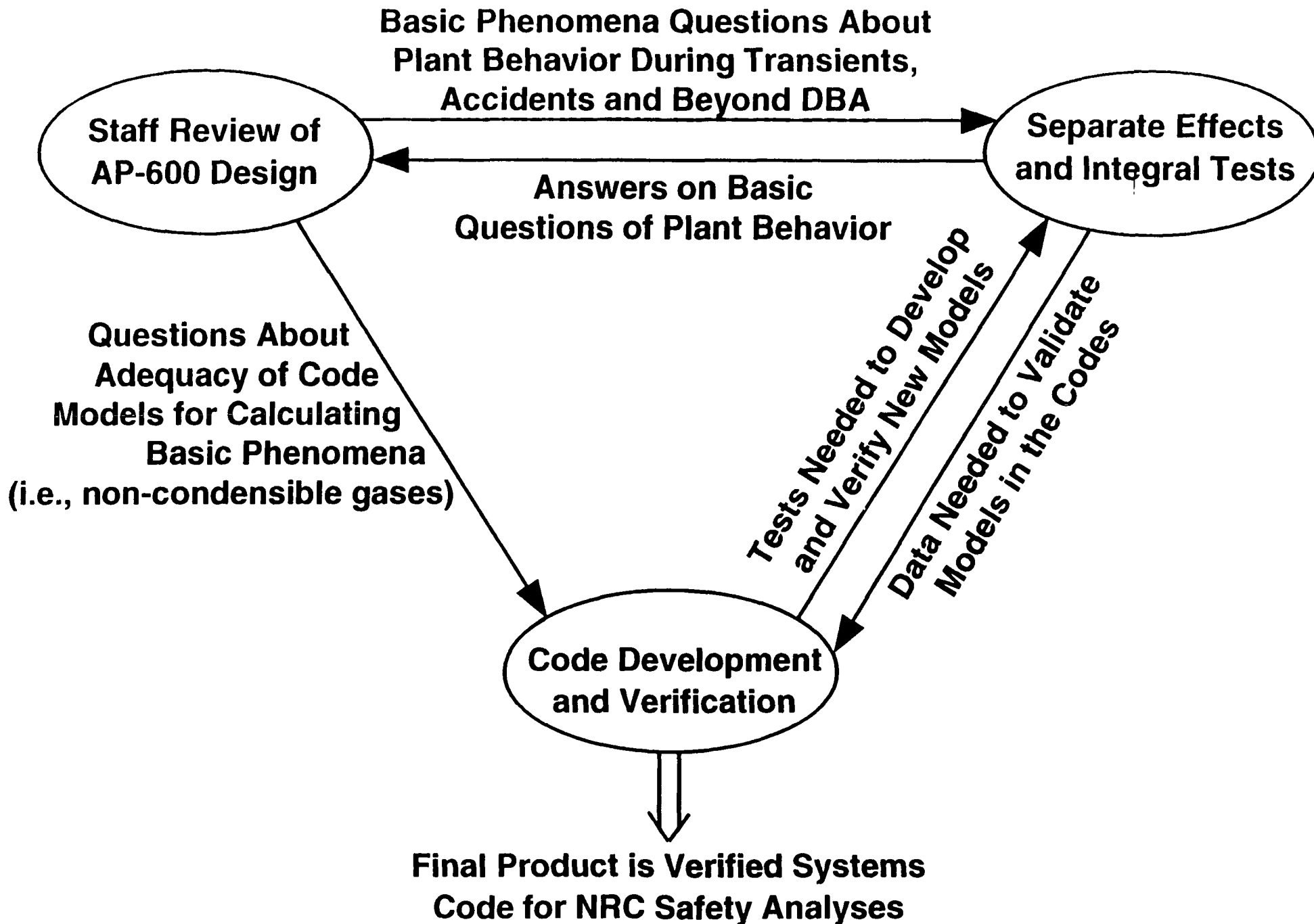
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Presented by B. W. Sheron

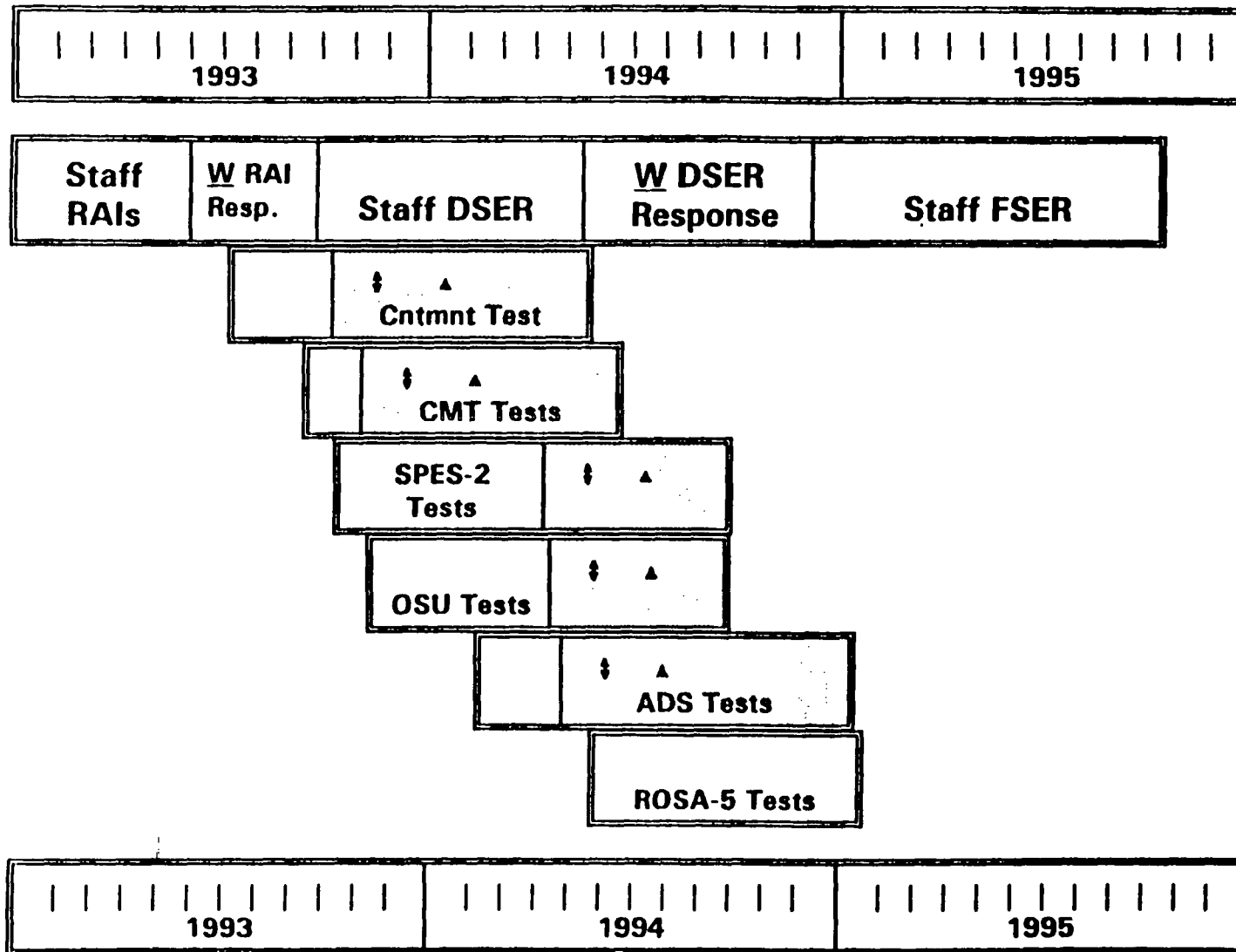
Director, DSR, RES

September 20, 1993

- NRR OVERVIEW AND CERTIFICATION AND TESTING SCHEDULES
- RES PRESENTATION
  1. Background and Objectives
  2. AP600: Issues and Programs
  3. SBWR: Issues and Programs
  4. NRC Analytical Program Applicable to both AP600 and SBWR
  5. Research Results
  6. Utilization of Results
  7. Future Plans
  8. Summary



# AP600 CERTIFICATION AND TEST SCHEDULE



SER schedule reflects SECY-93-097

↑ = Denotes submittal of Quick Look reports

▲ = Denotes beginning of submittal of processed data to the NRC

Shaded Areas = Denote time from test completion to final report to the NRC

## 1. BACKGROUND AND OBJECTIVES

- A major regulatory need for review of new plant designs is for assessed, thermal hydraulic system performance codes capable of independently evaluating passive system performance
- three major predictive needs were foreseen:
  - system performance of AP600
  - system performance of SBWR
  - stability of SBWR
- In 1989, staff began to receive sufficient design information on the advanced LWRs that utilized passive safety systems (AP600 and SBWR) to begin planning advanced reactor research

## 1. BACKGROUND AND OBJECTIVES - CONTINUED

- In 1989, due to availability of sufficient AP600 design information, RES started a systematic examination of the RELAP5 code to determine its ability to predict passive system performance
- Conclusion was that no new phenomena were expected, but code and models in codes had not been assessed against either scaled or prototypic data from (1) systems and components geometrically similar to AP600 and (2) under the low-pressure gravity driven flows expected during safety injection.

## 2. AP600: ISSUES AND PROGRAMS

- Particular features of AP600 which further assessment was desired included:
  - Core Makeup Tank (CMT) performance
  - Automatic Depressurization System (ADS) performance
  - Direct Vessel Injection (DVI) performance
  - Integral system behavior, including possible system interactions under natural circulation conditions

## 2. AP600 PROGRAMS

### A. VENDOR FACILITIES

- CMT separate effects tests
- PRHR separate effects tests
- ADS tests
- SPES testing expected to start in mid-October
- Oregon State University (OSU) testing expected to start in mid-November
- RES and NRR have developed a vendor testing monitoring program
  - staff and/or contractors have been on site during selected tests



## B. NRC PROGRAMS FOR AP600

### Background

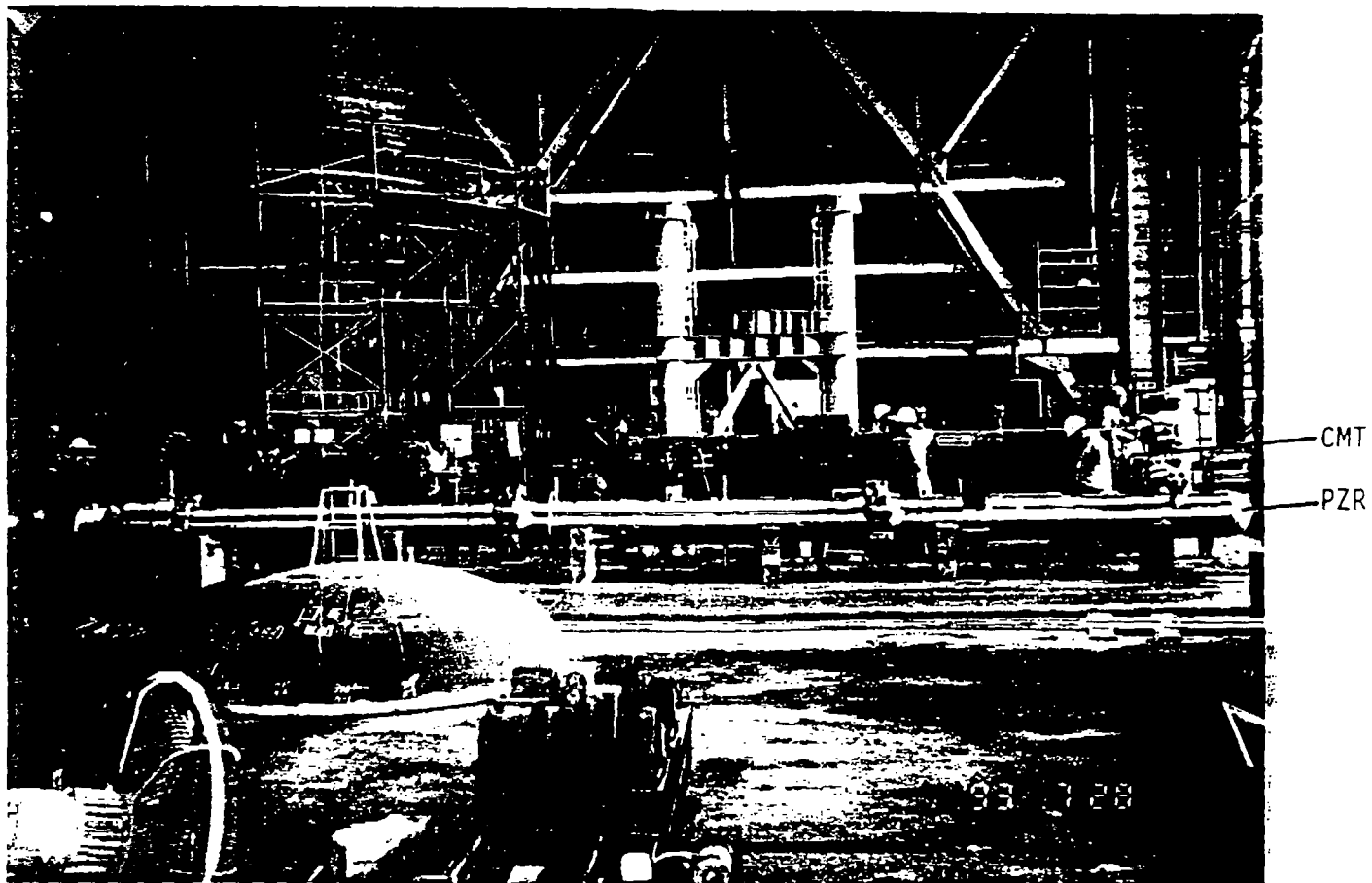
- For AP600 as well as SBWR, RES, in conjunction with NRR, evaluated vendor's proposed testing programs and decided on what confirmatory testing should be conducted by RES
  - vendor-sponsored separate effects tests were concluded sufficient and no confirmatory separate effects tests needed

## B. NRC PROGRAMS FOR AP600 - CONTINUED

- Staff determined that for AP600, full-height, full-pressure integral system tests were required from the vendor. In addition, NRR and RES decided full-height, full-pressure confirmatory tests sponsored by NRC were desirable.
- Basis was that passive safety features would operate under three high pressure accident scenarios
  - small break LOCA (SBLOCA)
  - steam generator tube rupture (SGTR)
  - steam line break (SBL)

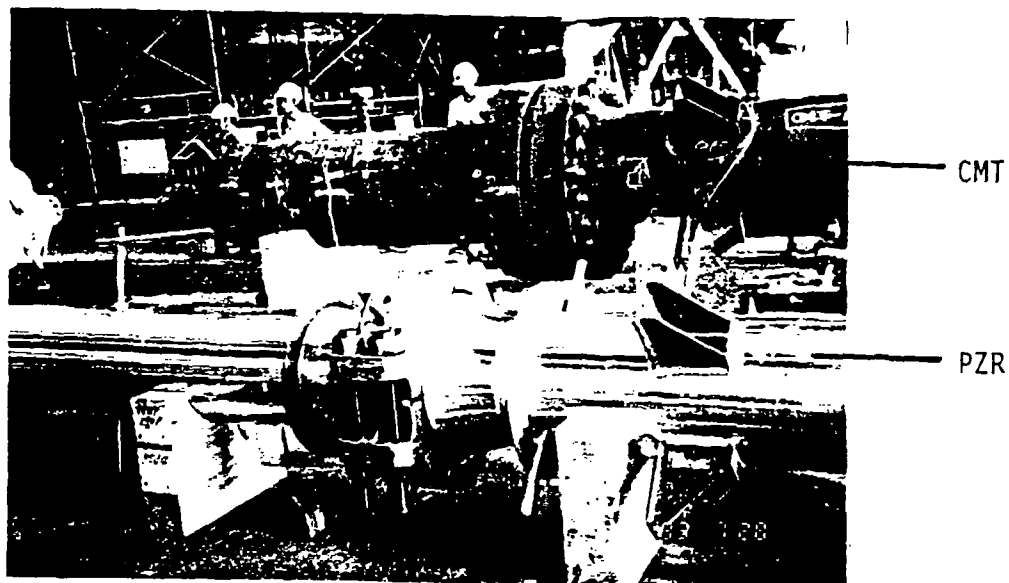
- Westinghouse proposed to use the SPES facility (1/400 volume scale)
- Staff proposed to use ROSA-V facility (1/30 volume scale)
- OSU facility (1/200 scale) will provide data on long-term cooling
- Testing in 3 facilities (ROSA-V, SPES, OSU) will provide staff with most comprehensive thermal-hydraulic systems data base of any reactor type.
- Commission approved contract to modify ROSA-V facility on August 11, 1992.

- STATUS OF ROSA-V FOR AP600 TESTING
  - Contract awarded to Sumitomo Heavy Industries (SHI) for \$6.73M to fabricate and install modifications to ROSA-V for AP600 simulation
  - Minor additions are pending to reflect recent AP600 design changes and thermal-hydraulic consultant comment
  - In accordance with original schedule, expect to begin shakedown testing around January 1994, and obtain first test data in early spring 1994
  - Resident NRC representative (from EG&G, Idaho) on site



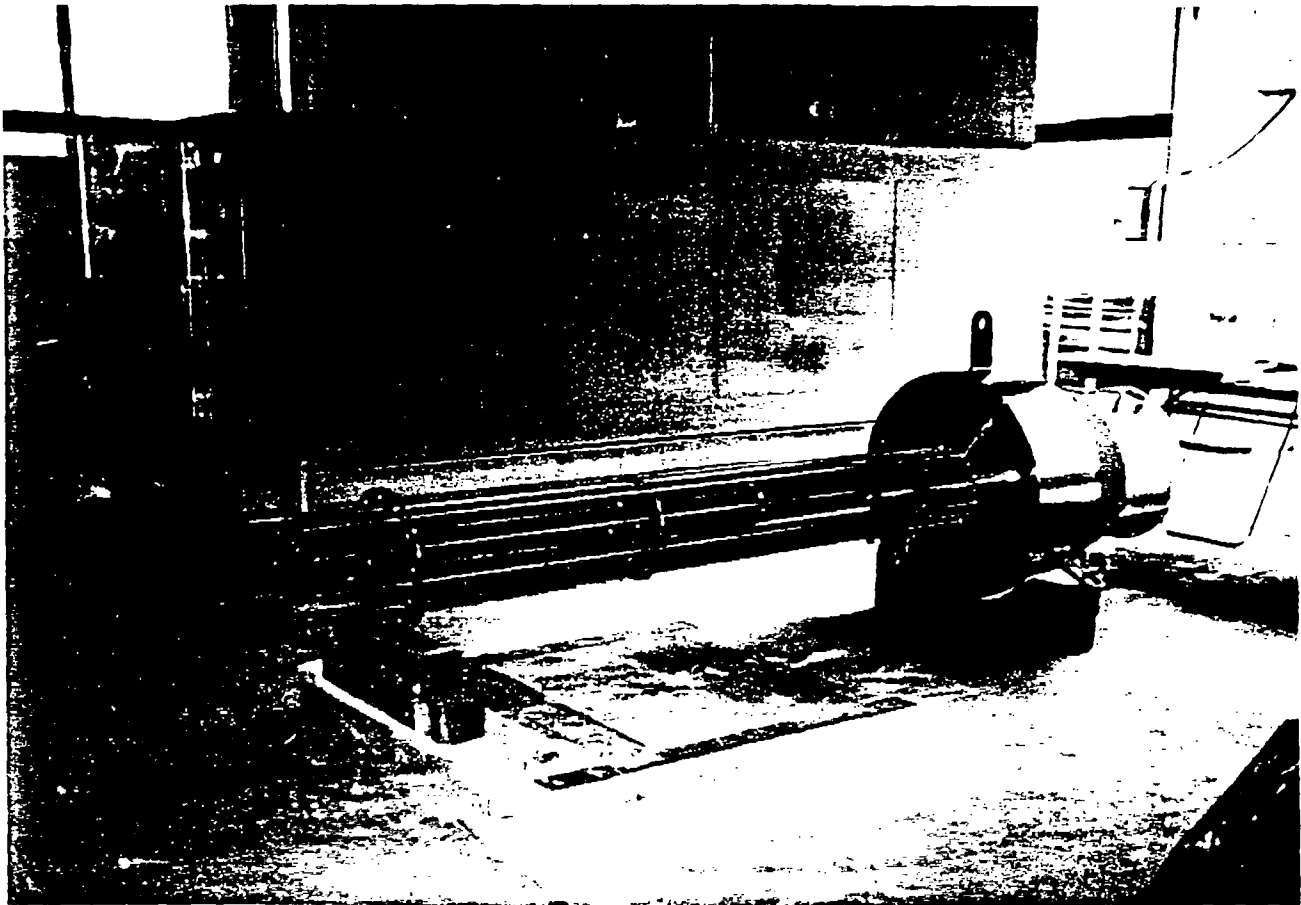
FOREGROUND: PRESSURIZER (PZR)

BACKGROUND: TWO CORE MAKE-UP TANKS (CMTs)



FOREGROUND: CLOSE-UP VIEW OF PRESSURIZER AT A FLANGED SECTION

BACKGROUND: CLOSE-UP VIEW OF CORE MAKE-UP TANK (CMT) FOR THE LOWER HALF  
PORTION



PRESSURIZER HEATER



PASSIVE RESIDUAL HEAT REMOVAL (PRHR)

SYSTEM TUBES ( U SHAPE)





IN-CONTAINMENT REFUELING WATER STORAGE TANK (IRWST) WITH TWO  
PORTS SHOWN FOR INSERTION OF RESIDUAL HEAT REMOVAL (PRHR)  
SYSTEM TUBES



TWO CATCH TANKS FOR COLLECTING FLOWS FROM THE FOURTH STAGE OF THE  
AUTOMATIC DEPRESSURIZATION SYSTEM (ADS)

## STATUS OF NRC ANALYTICAL PROGRAMS FOR AP600

- Staff has selected RELAP5/MOD3 as audit code for SBLOCA, SLB, and SGTR analysis of AP600
- Staff will perform LBLOCA audit analysis of AP600 using TRAC/PWR
  - TRAC/PWR is extensively assessed for LBLOCA
  - Passive features do not affect AP600 LBLOCA
  - For intermediate size breaks in the 6.8" direct vessel injection line and cold-leg pressure balance line, TRAC-PWR will be used if multi-dimensional processes are found to be important.
- RELAP models are currently being updated/modified to simulate AP600 and SBWR geometry and expected phenomena
- AP-600 QA'd plant deck will be provided to NRR by October 15, 1993.

### 3. SBWR: ISSUES AND PROGRAMS

- For SBWR, new passive safety features which data for code assessment was desired include:
  - Tall chimney region above the core
  - Gravity driven cooling system (GDCS)
  - Isolation condensor system
  - Passive containment cooling system

For SBWR, the containment acts closely with the vessel injection systems beginning early in the transient. Data for code assessment must cover these expected interactions over an adequate time period of the expected transients.

- SBWR VENDOR PROGRAMS
  - •GIST, California
    - GDCS integral performance
    - completed
  - •GIRAFFE, Japan
    - long-term PCCS integral performance, 1/400 volume scale
    - completed
  - •PANTHERS testing
    - PCCS and IC separate effects testing
    - expected to start early CY94
  - •PANDA, Switzerland
    - long-term PCCS integral performance, 1/25 volume scale
    - testing expected to start in mid-CY94

## B. NRC PROGRAMS FOR SBWR

- Confirmatory tests from a small scale facility would provide staff with ability to obtain independent data for a range of conditions beyond what is normally required of an applicant and for time periods which provide adequate overlap with applicant data.
- For SBWR, staff prepared competitive proposal to design, construct, and operate a small scale loop simulating SBWR.
- Purdue University was selected on July 26, 1993.

- STATUS OF SBWR LOOP
  - Contract awarded to Purdue University to design, build, and operate a small scale SBWR loop on July 26, 1993
  - Purdue selected from 6 universities. Contract is for 3 years at cost of \$2.5M
  - Principal investigators are Professors M. Ishii and V. Ransom
  - Kickoff meeting between staff (RES & NRR) and Purdue on August 17, 1993

## STATUS OF NRC ANALYTICAL PROGRAMS FOR SBWR

- Staff has also selected RELAP5/MOD3 to analyze SBWR, SLB, and SBLOCA
  - GE is using TRACG to analyze SBWR. Use of TRAC/BWR by staff would reduce independence of audit
  - Use of one code by staff for both designs would minimize resources
- Staff will use RAMONA to analyze SBWR stability and ATWS

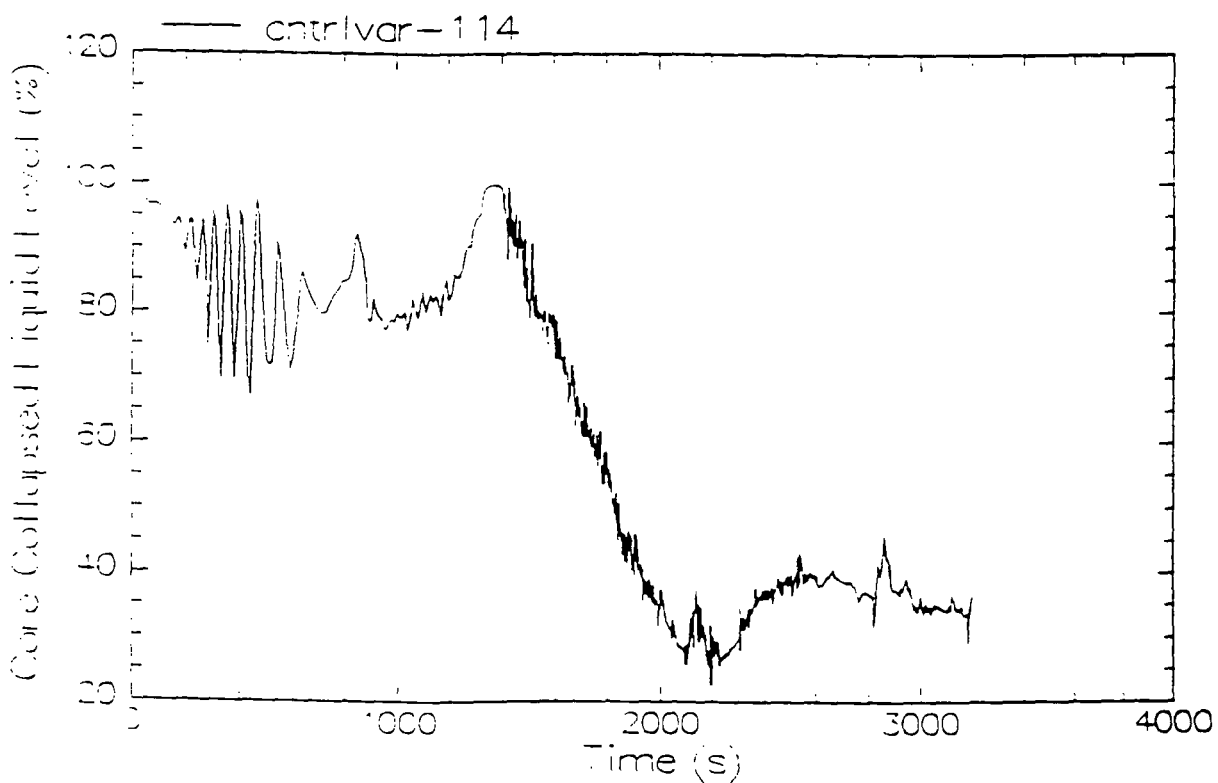
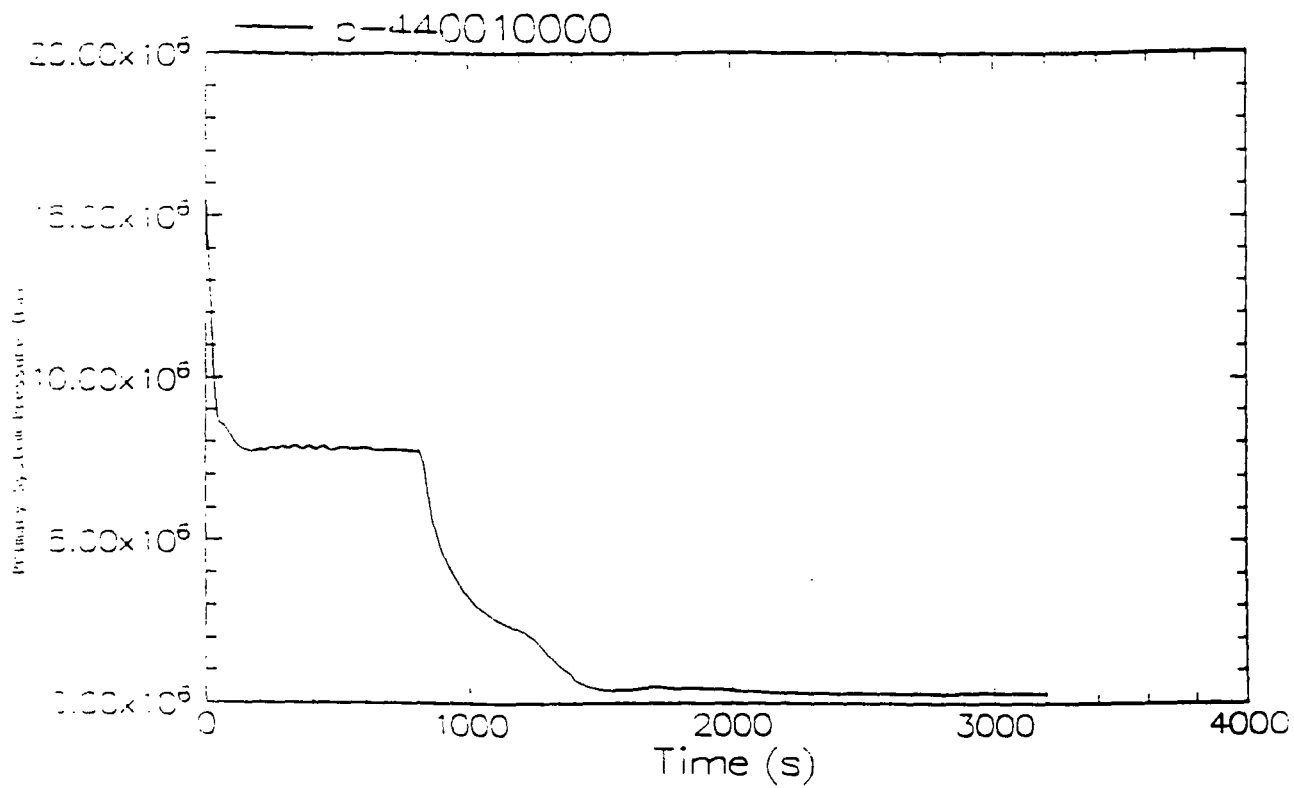


## STATUS OF NRC ANALYTICAL PROGRAMS FOR SBWR - CONTINUED

- SBWR QA'd plant deck not yet complete. Awaiting design information from GE.
- Meeting with GE arranged by NRR to obtain needed data.
- Plan to provide SBWR input deck to NRR by November 30, 1993.

4. NRC ANALYTICAL PROGRAMS APPLICABLE TO BOTH AP600 AND SBWR
- Staff plans to assess code against vendor separate effects data and integral data when it becomes available later in CY93 and early CY94
  - Staff will assess code against ROSA-V and Purdue SBWR loop data when it becomes available
  - Structured uncertainty analysis of RELAP5, using modification of method used for LBLOCA uncertainty analysis (CSAU) to support ECCS rule change of 1988 (10 CFR 50.46 and Appendix K), will be performed
  - thermal hydraulic consultants are reviewing planned approach and providing valuable feedback
  - ACRS thermal hydraulic phenomena subcommittee meeting scheduled October 28 to discuss ROSA-V test matrix

- Both RES and NRR have developed in-house analysis capability
- RES staff has run AP600 calculations to determine impact of containment pressure on primary system behavior
- Calculations led to decision to couple RELAP5 (primary system) code with CONTAIN (containment) code to do integral calculations with proper system feedback
- RES is currently installing four workstations. We are currently capable of running RELAP5, MELCOR, CONTAIN
- RES and NRR staffs meet periodically through a workstation users group to discuss in-house analyses, problems, observations, etc.



IN HOUSE CALCULATIONS OF AP-600  
SMALL BREAK LOCA PERFORMANCE

## 5. RESEARCH RESULTS

- ALL SIGNIFICANT RESEARCH FINDINGS TO DATE HAVE BEEN FOR AP-600; THERE ARE NONE YET FOR SBWR
1. The valve size of the 4th stage ADS was too small to allow sufficient primary depressurization for steady IRWST injection. W subsequently increased the valve size by 33%.
  2. An initial CMT recirculation phase exists for break sizes up to 3 inches. This serves to heat up the CMT and minimize any condensation during the injection phase.

## 5. RESEARCH RESULTS - CONTINUED

3. For break sizes larger than 3 inches, the possibility of large condensation pulses exists within the CMT during the initial part of the injection phase. W may modify the AP600 design to include a steam diffuser at the top of the CMT. They are including this device on their SPES and OSU test facilities and recommended that NRC also include it in the ROSA facility. The staff is currently obtaining cost estimates from SHI to add a diffuser in ROSA.

## 6. UTILIZATION OF RESULTS (AP600 and SBWR)

- Independent review of vendor test programs
  - instrumentation
  - test matrix
  - scaling rationale
- Independent test data to confirm applicability and scalability of vendor's test results
- Assessed computer codes for staff use in auditing vendor submittals

SBWR

APPLICANT TESTING:

- GIST (completed)
- UCB (late 1993)
- MIT (completed)
- GIRAFFE (completed)
- PANTHERS (late 1994)
- PANDA (mid-1995)

NRC CONFIRMATORY  
TESTING

CODE IMPROVEMENT AND  
ASSESSMENT

REGULATORY REVIEW

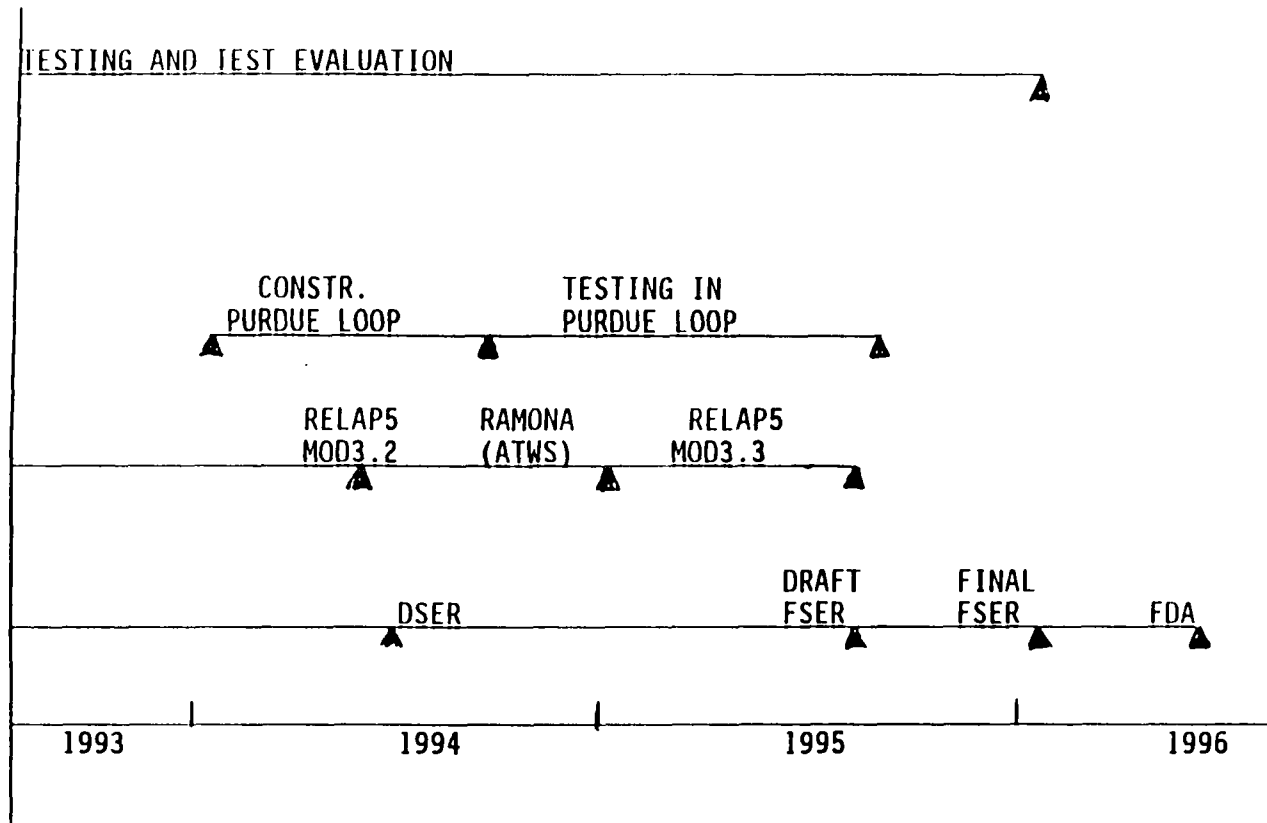


Figure 2



## 7. FUTURE PLANS

- Experimental Facilities
  - Following completion of first few ROSA-V tests, staff will begin examining need to run tests beyond phase I
  - Phase II testing, if needed, would probably run from late CY94 into CY95. It would include testing of beyond-DBA transients.
  - Staff plans to look into possibility of contracting with OSU once W testing is completed to run NRC-specified tests (most likely beyond design basis)

## 7. FUTURE PLANS - CONTINUED

- Codes
  - Staff will maintain development activities in order to utilize data from various advanced reactor test facilities
  - Thermal hydraulic consultants will be asked to review models being developed, test facility results and need for additional tests, and code uncertainty assessment program
  - Consultants will also be asked to comment on long term thermal hydraulic research plans, per Commission SRM.

## 8. SUMMARY

- The research program is closely integrated with the NRR review program
- Staff experimental facilities are being constructed on schedule and within planned budgets
- Testing is expected to commence on schedule for ROSA-V and the Purdue loop
- Code evaluation was started early for advanced reactors. As such, code development activities for advanced reactors are well along
- RES will provide assessed codes for NRR use on a schedule consistent with FDA and certification schedules

## 8. SUMMARY - CONTINUED

- Thermal hydraulic consultants have been very useful and helpful to the staff. We plan to continue our association with them and will report the results of our meetings with them on a periodic basis to the Commission
- In-house analysis capability has improved staff ability to analyze and evaluate advanced reactor design
- Advanced reactor thermal-hydraulic research program is maintaining the NRC on the forefront of thermal-hydraulic research