

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
556th Meeting

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, October 2, 2008

Work Order No.: NRC-2459

Pages 1-315

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

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

+ + + + +

556TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARD

(ACRS)

+ + + + +

THURSDAY, OCTOBER 2, 2008

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Advisory Committee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. William
J. Shack, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

WILLIAM J. SHACK, Chairman

MARIO V. BONACA, Vice Chairman

DENNIS C. BLEY, Member

SANJOY BANERJEE, Member

JOHN W. STETKAR, Member

J. SAM ARMIJO, Member

DANA A. POWERS, Member

SAID ABDEL-KHALIK, Member

MICHAEL T. RYAN, Member

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 COMMITTEE MEMBERS PRESENT (Continued):

2 OTTO L. MAYNARD, Member

3 CHARLES H. BROWN, JR., Member

4 HAROLD B. RAY, Member

5 MICHAEL CORRADINI, Member

6 GEORGE E. APOSTOLAKIS, Member

7 NRC STAFF PRESENT:

8 BRIAN HOLIAN

9 DONNIE HARRISON

10 MATTHEW DENNY

11 MAURICE HEATH

12 JIM MEDOFF

13 STEPHEN SMITH

14 BILL RUTLAND

15 PAUL KLEIN

16 MATT EWER

17 JOHN LENNING

18 RALPH LANDRY

19 NRC STAFF PRESENT (Continued):

20 HOSSEIN HAMZEHEE

21 MARK CARUSO

22 AMY CUBBAGE

23 MARIE POHIDA

24 ED FULLER

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:

DAVE CORLETT

MIKE HEATH

BILL ROGERS

BARRY SCHNEIDMAN

CHRIS MALLNER

MO DINGLER

STEVE BAJOREK

RICK WACHOWIAK

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

C O N T E N T S

1		
2		<u>PAGE</u>
3	Opening Remarks, Chairman Shack	5
4	License Renewal Application, Shearon Harris	
5	Nuclear Power Plant, Unit 1:	
6	Remarks by Member John Stetkar	7
7	Briefing by NRC Staff and Carolina Power &	
8	Light	8
9	Status of Resolution of GSI-191:	
10	Remarks by Member Sanjoy Banerjee	86
11	Briefing by NRC Staff and PWR Owners	
12	Group	97
13	Selected Chapters of the SER Associated with the	
14	ESBWR Design Certification Application	196
15	Remarks by Subcommittee Chairman	197
16	Briefing by NRC Staff and GE	198
17	Adjourn	
18		
19		
20		
21		
22		
23		
24		
25		

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

P R O C E E D I N G S

(8:29 a.m.)

CHAIRMAN SHACK: The meeting will now come to order.

This is the first day of the 556th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting the Committee will consider the following:

License renewal and final SER for the Shearon Harris Nuclear Plant, Unit 1;

Status of resolution of Generic Safety Issue 191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance";

Selected chapters of the SER associated with the economic simplified boiling water reactor design certification application;

Quality assessment of selected research projects;

Historical perspectives and insights on reactor consequence analyses; and

Preparation of ACRS reports.

A portion of the session selected chapters of the SER associated with the ESBWR design certification application may be closed to protect proprietary information applicable to this matter.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 This meeting is being conducted in
2 accordance with the provisions of the Federal Advisory
3 Committee Act. Mr. Sam Duraiswamy is the Designated
4 Federal Official for the initial portion of the
5 meeting.

6 We have received no written comments or
7 questions nor request for time to make oral statements
8 from members of the public regarding today's session.

9 Mr. Cardell Julian, Region 2, is on the
10 phone bridge line listening to the discussion
11 regarding the Shearon Harris license renewal
12 application. He will answer any questions directed to
13 him during the Shearon Harris license renewal
14 application review.

15 Also Mr. Jack Sieber, ACRS member, who was
16 not able to attend the meeting today due to personal
17 issues, is on the phone bridge line listening to
18 today's discussions.

19 A transcript of portions of the meeting is
20 being kept and it is requested that speakers use one
21 of the microphones, identify themselves, and speak
22 with sufficient clarity and volume so that they may be
23 readily heard.

24 Our first item is the license renewal
25 application for Shearon Harris and Mr. John Stetkar

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 will be leading us through that.

2 John.

3 MEMBER STETKAR: Thank you, Mr. Chairman.

4 We're here for the Shearon Harris license
5 renewal application. We had a subcommittee meeting on
6 May 7th. At the time of the subcommittee meeting
7 there remained one open item on the safety evaluation
8 report, two confirmatory items. So we're anxious to
9 hear how those items were resolved.

10 And at the time of the meeting, we also
11 asked the applicant to be prepared to discuss two or
12 three additional technical issue that came up during
13 our meeting, and to get the process rolling here, I'm
14 just going to turn it over to Mr. Brian Holian,
15 Director of the Division of License Renewal, for
16 introductory remarks.

17 MR. HOLIAN: Good, thank you.

18 My name is Brian Holian, Director of
19 License Renewal, and I'd just like to do a few
20 introductions.

21 To my left is Dave Pelton, Branch Chief in
22 License Renewal, who has responsibility for the Harris
23 plant. Dave replaced Louise Lund, who is right behind
24 you. Louise is in the ICS Candidate Development
25 Program and is still in License Renewal and still

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 assisting us.

2 To my right is Maurice Heath, who is the
3 project manager for the license renewal application
4 and will be doing the majority of the staff's
5 presentation today.

6 I'd just also like to highlight a few of
7 the technical branch chiefs that are in the audience
8 that have helped with the review. We have Jerry
9 Dogier, who is right behind me there, and he's
10 responsible for one of the Technical Audit Branches in
11 License Renewal.

12 We also have Donnie Harrison from Balance
13 of Plant in NRR.

14 And Matt Mitchell from Component
15 Integrity.

16 And Bill Rogers is acting for Raj Auluck,
17 the other Technical Audit Branch.

18 With that, as was mentioned, we did
19 forward the final SER, and both the staff and the
20 applicant will cover the open item and the two
21 confirmatory items and how they were resolved in the
22 time frame from the subcommittee meeting to the final
23 meeting.

24 With that, the applicant will lead off the
25 presentation, and with that I'll turn it over to Mike

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Heath, the Director of License Renewal for the Harris
2 Plant.

3 MR. MIKE HEATH: Thank you, Brian.

4 With me today I've got Dave Corlett, who
5 is the licensing and regulatory program supervisor at
6 the Harris plant.

7 Matt Denny, equipment performance
8 supervisor.

9 Back here in the corner, Chris Mallner,
10 who is our lead mechanical engineer.

11 Next to him is Barry Schneidman, who is
12 handling all of our implementation activities.

13 And Mike Fletcher, who wrote our
14 application for us.

15 They may be answering questions as we move
16 forward.

17 We are going to provide you some general
18 information on the Harris plant, and we were asked to
19 address four topics. The first of those is the water
20 sources for the Harris plant, and Dave will be doing
21 that.

22 Dave will also be discussing the open item
23 on the feedwater regulating valves scoping.

24 I'll be discussing our electric manholes
25 and the cable system associated with that.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 And Matt will be discussing corrosion
2 associated with the containment valve chambers.

3 So with that, I'll turn it over to Dave.

4 MR. CORLETT: Thank you, Mike.

5 Briefly, a little information on the
6 Harris plant located approximately 20 miles south of
7 Raleigh, North Carolina, originally licensed in 1986.

8 It's a 900 megawatt, electric, three-loop
9 Westinghouse PWR. The containment structure is a
10 steel-lined reinforced concrete containment, and next
11 I'll talk about the ultimate heat sink.

12 This is an overview of the main reservoir
13 with the main band being right here, if you can follow
14 the pointer, and the plant located approximately here.

15 The auxiliary reservoir is another hold-up right here
16 with a dam right there.

17 And the following is a closer in view of
18 how we use that ultimate heat sink, and the red is the
19 emergency service water. This is the emergency
20 service water pump intake structure here that those
21 pumps can take a suction either from the main
22 reservoir or the auxiliary reservoir. The auxiliary
23 reservoir is a higher elevation at approximately 250
24 feet, and the main reservoir approximately 220 feet of
25 elevation.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 The emergency service water pumps pump
2 directly through the reactor auxiliary building in
3 various heat exchangers and discharge to the auxiliary
4 reservoir. So, for example, if the suction is aligned
5 to the main reservoir, they would pump into the
6 auxiliary reservoir raising that level. There's a
7 small diversion dike right here which causes the
8 discharged water to go through a longer flow path to
9 return back to the auxiliary reservoir suction.

10 The cooling tower is shown here. You can
11 see the plume there. In the dark blue is the normal
12 service water pumps which use the cooling tower basin
13 water and remove heat from the heat exchangers in the
14 reactor auxiliary building and return that back to the
15 cooling tower because the emergency service water
16 pumps are not needed to run during normal operation.

17 And in the light blue are the circulating
18 water flow path, which of course goes through the main
19 conductor back to the cooling tower.

20 MEMBER ABDEL-KHALIK: What's the
21 difference in the service water flow rate if it's
22 pulling from either one of the two sources, given the
23 difference in elevation, 30 foot to first?

24 MR. CORLETT: The flow rate is
25 approximately the same. The emergency service water

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 pumps are not significantly affected by --

2 MEMBER ABDEL-KHALIK: Thirty feet?

3 MR. CORLETT: The way that the auxiliary
4 reservoir feeds the emergency service water pumps,
5 it's a gravity flow from the screening structure here.

6 Gravity flows, and it dumps into the same bay. So
7 the reservoir water flows into that bay with the pump
8 running. So it's not that much. There's some amount
9 of feed of head difference, but it's not dramatic.

10 MEMBER CORRADINI: So just so I understand
11 your arrows, so regardless of auxiliary or main
12 reservoir, the lower right arrow is where the suction
13 is taken for the emergency feedwater, emergency ESW?

14 MR. CORLETT: Yes. That's where the pumps
15 are, and that's where the pay is where the pump is
16 located. So regardless of whether the water is
17 gravity flowing from the auxiliary reservoir into that
18 bay or whether the valve is open for the main, that's
19 where the pumps are located.

20 MEMBER MAYNARD: Which one is considered
21 your safety related supply there? Is that both the
22 main dam and the auxiliary or --

23 MR. CORLETT: The auxiliary.

24 MEMBER MAYNARD: Okay. For automatic
25 line-up, does it automatically line up to the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 auxiliary reservoir then?

2 MR. CORLETT: Would normally line up to
3 the auxiliary reservoir. Those suction valves do not
4 automatically reposition, however.

5 MEMBER MAYNARD: Okay.

6 MR. CORLETT: It's just a normal line-up.

7 MEMBER MAYNARD: So it would be a manual
8 action to switch to the main if you needed to for some
9 reason there?

10 MR. CORLETT: Yes, it's manual action,
11 manually operated valves.

12 With that, I'll move into the open item
13 discussion on the feed regulating valves. The open
14 item was related to the scoping, and the resolution is
15 that the feed regulating valves, or feed reg. valves,
16 are scoped for (a)(2).

17 I want to talk a little bit about where
18 these are located. The feed reg. valves, feed reg.
19 bypass valves, are in the non-safety related turbine
20 building. It's an open turbine building, and as the
21 feed lines progress through to the steam generators,
22 they go through the reactor auxiliary building, and
23 the check valve there that you see and the feedwater
24 isolation valve in green are safety related in the
25 safety related reactor auxiliary building before they

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 go into the steam generators.

2 To start with an overview of the licensing
3 basis discussion, and then I'll move into safety
4 considerations after this slide, they are non-safety
5 related, and the safety function of isolating
6 feedwater is accomplished by the feedwater isolation
7 valves in the reactor auxiliary building. The feed
8 reg. valves are a backup to that, and our design is
9 consistent with applicable NRC guidance.

10 MEMBER BANERJEE: I guess I'm missing
11 something. Why is this an issue with the license
12 renewal and not an ongoing issue?

13 MR. CORLETT: Mike can you help us?

14 MEMBER BANERJEE: I don't have any
15 background. I didn't attend the subcommittee meeting.

16 MR. MIKE HEATH: Well, during the license
17 renewal review process, we originally scoped these
18 valves then as non-safety related, as (a)(2). They're
19 equipment that supports the safety function.

20 The question was raised during the review
21 process, well, if they support the safety function
22 and, in fact, provide isolation, shouldn't they --
23 they had a safety intended function -- shouldn't they,
24 in fact, be considered safety related.

25 From a license renewal standpoint and from

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 our current licensing basis standpoint of view,
2 they're not safety related. Therefore, they're not
3 (a)(1). So we scoped them in as (a)(2), and that was
4 the question that was raised.

5 MEMBER BANERJEE: So you're dealing with a
6 specific issue which relates to the renewal or is it
7 always a problem?

8 MR. MIKE HEATH: Well, it relates to the
9 license renewal in the sense that our current
10 licensing basis has these as non-safety related
11 valves, where in the license renewal space, the
12 question was, well, shouldn't they be considered to be
13 safety related, and that was the issue that we had to
14 resolve.

15 MEMBER BANERJEE: That's what you're
16 telling us now.

17 MR. MIKE HEATH: Yes, and we're explaining
18 why they're safety related, why they're not safety
19 related, and why that's true.

20 (Laughter.)

21 VICE CHAIRMAN BONACA: They were always in
22 scope, right?

23 MR. MIKE HEATH: They were always in
24 scope.

25 VICE CHAIRMAN BONACA: Thank you.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Everything else is okay, like corrosion
2 and all of these things related to that?

3 MR. MIKE HEATH: Yes.

4 MR. CORLETT: Well, I'll move on to the
5 safety implications, which was a discussion requested
6 from the subcommittee meeting as well. The feed reg.
7 valves and feed reg. bypass valves do close on a main
8 feedwater isolation signal. That signal is derived
9 from a safety injection signal and the permissive P-14
10 high steam generator water level.

11 The valves also close upon a loss of the
12 instrument air system and loss of DC power.

13 They are designed and maintained to high
14 standards, and that's all I have prepared to say about
15 the safety implications of these valves.

16 MEMBER BROWN: Well, they're non-safety
17 related. So they just operate under the same auspices
18 that isolation valves do.

19 MR. CORLETT: Yes.

20 MEMBER BROWN: If they don't -- I wasn't
21 at the meeting. That was before my time. So it
22 sounds like nobody cares. I mean, is that -- am I
23 getting that wrong?

24 That's the wrong way to phrase it. It's
25 just like they were never part of the current

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 licensing basis relative to safety functions, and
2 you're just reiterating and reaffirming that they are
3 not for a specific reason. Is that --

4 MEMBER STETKAR: The issue, if I can jump
5 in here a little bit, and back me up; the issue,
6 Charlie, is that in the current licensing basis under
7 steam line break inside the containment, Chapter 15,
8 FSAR accident analyses, take credit for the feedwater
9 reg. valves and the bypass valves as a backup
10 isolation function because it's only one single safety
11 related, active valve, single feedwater isolation
12 valve.

13 MEMBER BROWN: Got you.

14 CHAIRMAN SHACK: To isolate the feedwater
15 line. So if that fails, the actual licensing basis,
16 current licensing basis for the plant takes credit for
17 these non-safety related valves to perform that safety
18 related feedwater isolation function, and there's a
19 long history of why that particular function has been
20 allowed in licensing space to be performed by non-
21 safety related pieces of equipment, and that's the
22 whole basis for this issue.

23 Because it's kind of a gray area for these
24 particular valves. In the current licensing basis,
25 they are non-safety related, but the Chapter 15

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 accident analyses and in the current licensing basis
2 take credit for them to perform that safety related
3 function.

4 MEMBER CORRADINI: So since you brought
5 that up, the implication really is as a matter of
6 periodic testing and QA for these valves going
7 forward?

8 MEMBER STETKAR: And perhaps for people
9 who are less familiar with this, either the applicant
10 or perhaps the staff could explain in 30 seconds or a
11 minute the functional differences between the (a)(1)
12 requirements and the (a)(2) requirements, because
13 that's the real crux of this issue.

14 MEMBER CORRADINI: Right.

15 MEMBER STETKAR: Is what type of
16 performance monitoring requirements are assigned to
17 these valves, if they were classified as safety
18 related or required for a safety related function
19 versus non-safety related pieces of equipment.

20 MEMBER BROWN: The reason I asked the
21 question, they can answer that, but the flavor I got
22 was this is the way it had always been, and now
23 somebody was looking. Should we consider that in the
24 status?

25 Is that the point?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: That's it.

2 MEMBER BROWN: All right. So a change in
3 the licensing basis fundamentally.

4 MEMBER STETKAR: Right.

5 MEMBER BROWN: Okay.

6 MEMBER STETKAR: It's my understanding
7 there is not necessarily the desire to formally
8 reclassify them as safety related pieces of equipment.
9 That hasn't been an issue. It's whether the
10 performance monitoring programs for safety related
11 equipment should be applied to these valves. So it's
12 not necessarily reclassify -- it's a de facto
13 reclassification, but not a formal, legal
14 reclassification of the equipment.

15 Do we need a quick primer on the
16 difference between (a)(1) and (a)(2)? I'd try it, but
17 I'd mess it up.

18 MR. ROGERS: Yeah, hi. I'm Bill Rogers.
19 I work in the Division of License Renewal, and I was
20 involved with this issue, and as far as the process
21 goes between (a)(1) and (a)(2), it really has to do
22 with the way the surrounding environment is reviewed.

23 So as was stated, these valves were always
24 in scope with the scope of license renewal, and they
25 were in scope for (a)(2). When the technical staff

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 reviewed these valves, there were some questions
2 related to their reliance during an accident scenario,
3 and that was more of a technical discussion.

4 The difference between the (a)(1) and
5 (a)(2) categorization would be that if they were in
6 scope for (a)(1), there would have to be a review of
7 the surrounding non-safety related environment to see
8 if that could impact the safety functions of an (a)(1)
9 classified component.

10 When they're in scope for (a)(2), the
11 review of the surrounding area is not required. So
12 what it ultimately would result in is if they're in
13 scope for (a)(2), there wouldn't be additional
14 equipment brought into scope which could affect the
15 performance of their safety function. That's the
16 regulatory distinction between the two.

17 MEMBER CORRADINI: So just one
18 clarification. So that means that if this was in
19 scope for (a)(1), you'd have to look in the room and
20 the surroundings about any sort of malfunction that
21 would affect their safety function.

22 MR. ROGERS: That's correct. That's the
23 total difference.

24 VICE CHAIRMAN BONACA: Capture additional
25 equipment.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: Right, right, and then,
2 therefore, you bring in additional equipment that you
3 have to worry about, yes.

4 MEMBER APOSTOLAKIS: Are (a)(1) and (a)(2)
5 safety related?

6 PARTICIPANTS: No.

7 MEMBER APOSTOLAKIS: (a)(2) is not?

8 MEMBER STETKAR: (a)(2) is not.

9 MEMBER ABDEL-KHALIK: Have you ever had an
10 LER related to the operability of either the feedwater
11 reg. valves or the bypass valves?

12 VICE CHAIRMAN BONACA: Say that again.
13 Sorry?

14 MEMBER ABDEL-KHALIK: I'm asking them if
15 they --

16 VICE CHAIRMAN BONACA: I missed the
17 question.

18 MEMBER ABDEL-KHALIK: -- licensee report
19 related to the operability of either of these valves,
20 either the reg. valves or the bypass valves.

21 MR. CORLETT: We haven't had any failure
22 of the feed reg. valves to close. An LER, upon our
23 unit trip, we would initiate an LER, and early in our
24 operating years, dating back to 1987, we had unit
25 trips related to the feedwater system. So I recall

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 one time when we had lost instrument air system
2 pressure, and the feed reg. valves closed, and the
3 unit tripped, and that would have been a LER.

4 So we haven't had any LERs related to the
5 failure to close. However, I don't have in front of
6 me any feedwater related LERs, if that answers the
7 question.

8 MEMBER ABDEL-KHALIK: I guess it has to
9 do, since I'm not sure if you have access to that
10 information -- is there any way you can find out and
11 let us know as to the history of these valves?

12 MR. CORLETT: We looked at the history of
13 the failure to close, and we have no history of that.

14 MEMBER ABDEL-KHALIK: Okay.

15 MR. CORLETT: So there may be history of
16 them closing and causing a transient. I remember one
17 of those.

18 VICE CHAIRMAN BONACA: It was told to
19 close in that circumstances.

20 MR. CORLETT: Right.

21 VICE CHAIRMAN BONACA: It didn't close on
22 its own. It was told by the instrument --

23 MR. CORLETT: Right, right. It was a
24 reaction to the loss of instrument air. So we have
25 looked at the history. We have no history of them

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 failing to close on demand.

2 MEMBER ABDEL-KHALIK: But history of
3 incidence of failing to fully close?

4 MR. CORLETT: From my memory, I'm not
5 aware of any binding or failure to go full stroke. I
6 don't believe that they are leak tested.

7 Mike, do you know of any leak testing
8 requirements?

9 Are you talking about leak-by or failure
10 to fully close?

11 MEMBER ABDEL-KHALIK: Both. I guess the
12 check valves are leak tested, but I'm not sure if
13 these two valves are leak tested.

14 MR. MIKE HEATH: I don't think we have an
15 answer on that.

16 MR. CORLETT: I don't have information on
17 the leak test. I'm not aware of any failures to fully
18 close. We did replace the trim and actuator in 2000
19 with a more reliable design that was designed to make
20 the valves more reliable from an operation -- from an
21 erosion type standpoint, but not as a reaction to
22 failure to close.

23 MEMBER MAYNARD: Do you have a manual
24 isolation valve for your feed reg. valves?

25 MR. CORLETT: Yes.

NEAL R. GROSS

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

1 MEMBER MAYNARD: I don't know about you,
2 but at most Westinghouse plants, typically part of the
3 procedure once you shut down or you trip anything that
4 closes the feedwater reg. valves, that you then go out
5 and manually shut that. I don't know what Shearon
6 Harris does.

7 MR. CORLETT: For that function we have
8 motor operator valves, but we also have manual valves
9 in the turbine building.

10 MEMBER ABDEL-KHALIK: Thank you.

11 MR. CORLETT: That's all for the feed reg.
12 valves discussion. I'll turn it over to Mike.

13 MR. MIKE HEATH: If there are no further
14 questions on that open item, I'll discuss the electric
15 manholes and discuss them in the context of the
16 cabling system that runs through them. The reason
17 this was asked to be addressed is associated with
18 water that we get in those manholes.

19 We've had two failures of our 6.9 kV
20 cabling system out in the yard over the last several
21 years. The first occurred in 2002. The second
22 occurred in 2006. In both of these cases the failure
23 mechanism was water permeating into the insulation
24 system ultimately resulting in failure.

25 In the failure in 2002, we could find no

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 mechanical reason for that. There was no scarring.
2 There was no damage caused by installation that we
3 could find.

4 In the second case, we found that, in
5 fact, when it was installed, we installed it with a
6 minimum bend radius that exceeded the allowable, and
7 we found that the failure occurred at the minimum bend
8 radius. That was a failure of one phase of three.
9 The other two phases were installed correctly and we
10 tested those and those were good.

11 MEMBER STETKAR: Mike, if I could
12 interrupt you just a second here, for the benefit of
13 the members who were not at the subcommittee meeting,
14 you kind of jumped into answering our concerns without
15 the context for some of the other members.

16 The concern came up that Harris has, I
17 think, if I remember, 180 manholes that provide access
18 to underground cables, cable vaults, cable channels
19 and things like that. There has been some evidence, a
20 history of water accumulation in those manholes, and
21 in some manholes to a depth where they found the
22 cables submerged a few times.

23 So we raised a question about what has
24 been the operating history relative to any actual
25 failures of those cables, and we asked for a little

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 bit more information about also the history of
2 inspections of those manholes, any efforts to control
3 water levels and things like that.

4 That's just a little general context for
5 the other folks who weren't at the subcommittee
6 meeting.

7 MEMBER BROWN: Are these safety related
8 cable issues?

9 MEMBER STETKAR: They will discuss that, I
10 think.

11 MEMBER BROWN: Oh, okay.

12 MR. MIKE HEATH: These two cables, the
13 first went to an NCC at our intake structure and the
14 second went to the make-up pump for the cooling tower,
15 and neither were associated with safety related
16 equipment.

17 However, all of our cables, all of our 6.9
18 kV cables were the same material. So any failure in
19 that environment has implications for all the other
20 cables.

21 Following the failure in 2002, we did a
22 baseline inspection of all of our manholes. We pulled
23 the lids off of them, took a look at them, and that
24 was as much to look to see if we had water in the
25 manholes as to see what kind of structure damage might

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have occurred.

2 We then established a 90-day frequency for
3 pumping out the manholes with the exception of one
4 manhole that has a 45-day frequency, and that
5 obviously is a shorter frequency because we have water
6 problems in that particular manhole.

7 We do trend that. We do, in fact, find
8 some occasions when we have water over the cables in
9 those manholes.

10 MEMBER STETKAR: Mike, I had some notes
11 from the subcommittee meeting, and I think during the
12 subcommittee meeting we're told that manholes that
13 contain energized cables were inspected and, if
14 necessary pumped down every 45 days, and manholes that
15 contain normally de-energized cables were inspected
16 very 90 days.

17 This slide seems to indicate something
18 different.

19 MR. MIKE HEATH: We do, in fact, pump down
20 manholes every 90 days regardless of whether they have
21 energized cables in them or not.

22 MEMBER STETKAR: So the normal inspection
23 frequency is once every 90 days?

24 MR. MIKE HEATH: Every 90 days.

25 MEMBER STETKAR: With the exception of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 this one.

2 MR. MIKE HEATH: That's a pump-down
3 frequency. With the exception of that one. This one
4 is every 45 days.

5 MEMBER STETKAR: When you say "pump-down
6 frequency," does that mean also the frequencies which
7 people pull the manhole cover off and look down in the
8 hole?

9 MR. MIKE HEATH: No.

10 MEMBER STETKAR: How frequently do people
11 do that?

12 MR. MIKE HEATH: That is a nine-year
13 frequency. We actually do the inspection. Now, we
14 check water level before we pump it out, but we don't
15 pull off the manhole cover.

16 MEMBER STETKAR: The water level, do you
17 have lever indicators?

18 MR. MIKE HEATH: I think they use a dip
19 stick.

20 MEMBER STETKAR: Huh?

21 MR. MIKE HEATH: They use a dip stick.

22 MEMBER STETKAR: A dip stick? Okay.

23 MR. MIKE HEATH: Yeah. What we're trying
24 to establish now is this program is relatively new,
25 and what we're trying to establish as we go into this

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 program is where the cables are in the manholes and
2 whether or not water gets up over the cables and
3 adjust our frequency based on that information.

4 As I was saying, we do know that we do
5 have some cases where water gets up over our cables

6 MEMBER ABDEL-KHALIK: Now, this trending
7 that's being done is based on this 90-day frequency?

8 MR. MIKE HEATH: It's based on the 90-day
9 frequency.

10 CHAIRMAN SHACK: But your implication is
11 that you will change that frequency if necessary, if
12 you find water over the cables?

13 MR. MIKE HEATH: Yes. And what we have
14 found is that we've got some of the manholes where we
15 find inches of water in there each time. So we're not
16 going to continue to do those on a 90-day frequency.

17 We have this one manhole in particular
18 that we're doing on a 45-day frequency. The last two
19 times we've checked it we've had more than six feet of
20 water in there. Prior to that, we were getting about
21 two or three feet of water in there. So we're going
22 to be looking at increasing the frequency on that
23 while we decrease the frequency on some of the
24 others.

25 This picture gives you an idea of what

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 these manholes look like. They're essentially just
2 large cable vaults, concrete vaults. The cable would
3 come in one side, exit another, often changing
4 directions or changing elevations as they go through.

5 The openings you see at both sides there
6 are actually we have a set of conduit that come in
7 there. For this particular manhole and for most of
8 our manholes, those conduits are not sealed. We do,
9 in fact, have at least one manhole in which we have
10 sealed those conduits, but typically the typical
11 arrangement is not to seal them.

12 MEMBER BROWN: So they communicate water
13 from one manhole to the other through those conduits?

14 MR. MIKE HEATH: They could or you could
15 have water getting into the conduits in between the
16 manholes.

17 MEMBER BROWN: And then it would go either
18 way?

19 MR. MIKE HEATH: Well, we would assume it
20 goes either way. You may, in fact, have a low spot
21 there where it accumulates.

22 MEMBER RYAN: Is the source of the water
23 all surface water running down or is there any
24 groundwater coming up?

25 MR. MIKE HEATH: It could be either.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER RYAN: Or both?

2 MR. MIKE HEATH: It could be either. We
3 do see a direct correlation between rain events and
4 water in the manholes.

5 MEMBER RYAN: The surface going down might
6 be the driver.

7 MR. MIKE HEATH: We think that is the
8 driver.

9 MEMBER MAYNARD: I was going to ask about
10 that because just putting it on a number of 45 days or
11 90 days may not be the right answer. You may have to
12 consider what's causing it, and it may have to be
13 pumped down after a certain amount of rain or after
14 whatever other event might be causing it there. So it
15 may not be just so many days.

16 MR. MIKE HEATH: A rain event may be
17 implicated. We will be looking as we go forward if
18 this is a problem and continues to be a problem
19 putting in putting systems. You know, whatever is
20 easiest for us to do, we're going to do it. The idea
21 is, of course, you really don't want to have a wet-
22 dry-wet-dry situation with these cables. That's
23 probably the worst possible scenario.

24 A wet scenario is bad. Wet-dry-wet-dry is
25 probably worse, and dry is what you're looking for.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER RYAN: Have you ever tried that
2 correlation with rain events or rainfall rates?

3 MR. MIKE HEATH: We have not. We're too
4 early into it.

5 MEMBER RYAN: Okay.

6 MR. MIKE HEATH: And essentially since we
7 started this we've been in drought until recently.

8 (Laughter.)

9 MR. MIKE HEATH: Fortunately we've had a
10 lot of rain events. The cables don't appreciate that,
11 but everybody else does.

12 As a result of these failures and looking
13 at how we do, corporate-wide basis, how we do cable
14 testing, we went out and we looked at all of the
15 different testing capabilities out there, and we
16 decided from a corporate standpoint you have shielded
17 medium voltage weighted cables that we test using the
18 high voltage, very low frequency, tan delta testing.

19 We've done significant testing at our
20 Brunswick plant, and we've done some testing at
21 Harris, and we find it to be very effective. We do
22 believe it gives very good answers. It shows us where
23 we have degraded cables but not failed cables. It
24 gives us time. In some cases we just monitor those
25 more frequently. In other cases we have replacement

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 work tickets out.

2 For the Harris plant, we have a total of
3 17 cables that we're looking at. Those are safety,
4 non-safety, and they may just be going to out-
5 buildings. We've currently tested four cables, one of
6 the normal service water pumps, one of the emergency
7 service water pumps, one of the circulating water
8 pumps, and those have all tested okay.

9 We did a test on one of our maintenance
10 shop feeders. We tested it because we were having
11 ground faults associated with it and found that it
12 wasn't okay. That cable is still in service. It's
13 still in operation. We have a work ticket out there
14 to replace it at the earliest possible moment, and
15 once we pull it out, we'll take a look at it and see
16 what the issue is there.

17 The bottom line for us is that we have had
18 cable failures. We've gone out and taken a look at
19 all of our manholes. We have an inspection frequency
20 for the manholes, a pump-down frequency for them, and
21 a testing program for all of our cables that are
22 important to us in the system.

23 More questions?

24 MEMBER STETKAR: I think it came up in a
25 subcommittee meeting. Do you have, do you know or

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have an estimate you can share with us about the
2 number? Is 180 the correct number for the --

3 MR. MIKE HEATH: For manholes?

4 MEMBER STETKAR: For manholes.

5 MR. MIKE HEATH: The manholes that we
6 actually care about are about 50.

7 MEMBER STETKAR: Okay.

8 MR. MIKE HEATH: It's not 180. I'm not
9 sure where that 180 came from.

10 MEMBER STETKAR: I had it written down in
11 notes. So it could have been an anecdotal comment
12 during the subcommittee meeting. So let's say it's 50
13 if the population is 50.

14 Do you have any estimate from that
15 population how many contain safety related cables?

16 MR. MIKE HEATH: Yes. Actually I've got
17 the number in my briefcase. It's ten or 12, something
18 on that order.

19 MEMBER STETKAR: You said safety related.
20 Insulation, safety and non-safety cables have the
21 same insulation?

22 MR. MIKE HEATH: Same insulation. It's an
23 Anaconda unit shield.

24 Yes, sir?

25 MEMBER MAYNARD: Do I understand you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 correctly? A while ago you said you linked the one
2 vault that typically had two or three feet but the
3 last few times you've been finding six to eight feet
4 of water or something like that?

5 MR. MIKE HEATH: Yes.

6 MEMBER MAYNARD: Does that get entered
7 into your corrective action? Do you start looking for
8 why that's occurring or do you know why that's
9 changed?

10 MR. MIKE HEATH: We don't. There were
11 large rain events in each of those cases. The system
12 engineer maintains a spreadsheet of all the work
13 orders. So he goes and collects the work orders,
14 takes it in the spreadsheet and analyzes that, and
15 then he's going to be making adjustments to his
16 frequencies based on that.

17 MEMBER MAYNARD: Okay. So that can be
18 attributed to the recent rain and --

19 MR. MIKE HEATH: Yes, sir. He notes that
20 on there, you know. If there has been a rain event,
21 he is noting it only there. Where he knows where the
22 level of the cable is, he's noting that the water is
23 over it or under it. So he's keeping up with all of
24 those things.

25 Yes, sir.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BROWN: I remember you said there
2 were ten or 12 safety cables in this.

3 MR. MIKE HEATH: There were a total of 17
4 cables.

5 MEMBER BROWN: Okay, and it was some
6 number of relative -- I mean, I think John asked about
7 how many of those were safety related or whatever, and
8 I thought you gave a number of some kind.

9 MR. MIKE HEATH: I did not. There's a
10 total of 50 manholes, but in the license renewal aging
11 management program for this, there are four pumps that
12 are in that system. Two other safety related feeders
13 are to the emergency diesel generators. We also look
14 at those manholes, and we're looking at those cables.

15 Essentially, we look at all of our 6.9 kV
16 cables in the yard. We're looking at all of manholes
17 that those go through, and we're looking and we're
18 testing all of those cables whether safe related or
19 non-safety related.

20 MEMBER BROWN: Okay. I guess what I was
21 looking for, and I didn't phrase it right, if there
22 are safety related cables in these manholes that are
23 getting filled up, is it a potential for a manhole
24 filling to compromise the separation or independence
25 of some cables that are running to some other safety

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 related, where you need to maintain an independence
2 such that, for instance, you mentioned communication
3 from one manhole to some other cluster of manholes,
4 and then you said stuff comes in and out.

5 Do they merge? Do they not merge? Do you
6 always --

7 MR. MIKE HEATH: My understanding --

8 MEMBER BROWN: -- maintain a separate
9 train of manholes like you have a separate train of
10 controls or what?

11 MR. MIKE HEATH: My understanding is --

12 MEMBER BROWN: My point is could one
13 flooding or two floodings take out the cables?

14 MR. MIKE HEATH: But you'll have like an
15 alpha train and a bravo train of manholes.

16 MEMBER BROWN: You maintain separation of
17 trains of manholes.

18 MR. MIKE HEATH: Yes. However, you would
19 expect the same environment in both trains.

20 MEMBER BROWN: But you didn't see the same
21 amount of water in all levels.

22 MR. MIKE HEATH: That's true. That's
23 okay.

24 MEMBER BROWN: So my point being, my
25 question -- I think you've answered it -- is that for

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 safety related cables you maintain a separation
2 manhole-wise as well as -- I mean, it gives you
3 physical, but there's no communication between those
4 sets of manholes, and you don't mix cables.

5 MR. MIKE HEATH: We don't mix cables.

6 MEMBER BROWN: Or allow communication from
7 manhole train to manhole train?

8 MR. MIKE HEATH: No.

9 MEMBER BROWN: Okay, all right. Thank
10 you.

11 MR. MIKE HEATH: Other questions on this?

12 Okay. Matt will discuss our valve
13 chambers.

14 MR. DENNY: Thanks.

15 I'm Matt Denny. I'm one of the engineer
16 supervisors at the Harris plant, and during the
17 subcommittee discussion there was a lot of discussion
18 about the external and some internal corrosion that
19 we've detected on the valve chambers, and we were
20 asked to come back and provide some follow-up.

21 Was that a summary?

22 MEMBER STETKAR: Indeed it is, and for the
23 benefit of the people who were not at the subcommittee
24 meeting, could you just briefly explain what the valve
25 chambers are and why the issue came up?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. DENNY: I'd love to do that. That's
2 actually my first two slides.

3 MEMBER STETKAR: Oh, okay. Good.

4 MR. DENNY: I started off with that.

5 PARTICIPANT: What a team.

6 MEMBER STETKAR: I'm a good straight man.

7 MR. DENNY: All right. On the monitors
8 you'll see a picture of a typical containment valve
9 chamber. This one happens to be for a containment
10 spray. Visually you're seeing approximately one-third
11 of the valve chamber. The other two-thirds is
12 imbedded into the concrete, and the only way to access
13 these valve chambers is from the access hatch on the
14 top of them.

15 During power operations, they are normally
16 closed. It's considered a containment environment.
17 So it's closed.

18 MEMBER STETKAR: It's important for
19 members who aren't really familiar with this
20 particular -- it's kind of a feature of a few plants
21 around. If you go back to -- well, this is good, too,
22 right?

23 MR. DENNY: Right.

24 MEMBER STETKAR: That thing that you saw,
25 although it's in the auxiliary building, indeed, is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the containment.

2 MR. DENNY: Correct.

3 MEMBER STETKAR: That's considered the
4 containment boundary.

5 MEMBER CORRADINI: The atmospheric
6 pressure or the atmospheric containment goes to that
7 steel liner.

8 MEMBER STETKAR: That is the containment
9 pressure boundary. It is physically inside the
10 auxiliary building.

11 MEMBER CORRADINI: It kind of bulges out a
12 bit.

13 MEMBER STETKAR: It bulges out.

14 MEMBER BROWN: So if you look, that is the
15 auxiliary building on the left-hand side of that?

16 MR. DENNY: Yes.

17 MEMBER BROWN: What looks like the
18 structure, concrete, poured concrete, whatever in the
19 heck it is?

20 MR. DENNY: Let me explain this a little
21 bit and I think I'll answer a lot of these questions.

22 On top of the picture I'm showing is the containment
23 sump. So this is the basement of containment. And
24 this is basically a liner imbedded in the concrete
25 substructure. This is in the reactor aux. building,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and this is open to containment.

2 This is a penetration. It is welded seal
3 or seal welded. So there's no communication with the
4 containment atmosphere. Okay? So it's basically its
5 own atmosphere inside. Once we open it and close it
6 during an outage, it's its own atmosphere.

7 The process pipe, either RHR or
8 containment spray, is internal to the valve chamber
9 taking the suction off of the containment sump.

10 The elevation on this, normal ground
11 elevation is --

12 MEMBER BROWN: Is that filled with water?

13 MR. DENNY: No.

14 MEMBER STETKAR: Hopefully not.

15 (Laughter.)

16 MEMBER BROWN: The suction for the --

17 MR. DENNY: Containment sump.

18 MEMBER BROWN: Okay. Where the reactor is
19 located.

20 MR. DENNY: Right. The reactor is up top.

21 MEMBER BROWN: Okay, all right.

22 MR. DENNY: The normal ground elevation is
23 261. The elevation of the containment sump is 216.
24 The actual elevation of the containment valve chamber
25 is 190.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BROWN: So the auxiliary building
2 is not part of the containment.

3 MR. DENNY: That's correct.

4 MEMBER BROWN: Okay, okay. I thought
5 somebody said it was though.

6 MR. DENNY: No, the reactor aux. building
7 is not part of the containment.

8 MEMBER STETKAR: That thing bulges into
9 the aux. building and that --

10 MEMBER BROWN: That boundary in the
11 chamber. Okay. All right.

12 MR. DENNY: If you're on the 190 elevation
13 of the reactor aux. building, this is the concrete
14 wall that you're going to see at that elevation, and
15 you'll see the structure sticking out of there.

16 MEMBER BROWN: Okay.

17 MEMBER STETKAR: A photographs shows that.

18 MR. DENNY: Yeah, I can go back and show
19 you. So right now we're standing in the reactor aux.
20 building, 190 elevation, looking at the wall, which
21 happens to be not quite underneath containment, but
22 it's --

23 MEMBER BROWN: Okay. I've got it now.

24 MR. DENNY: All right. What we have is
25 talking about the groundwater and how it comes into

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the reactor aux. building. Since the early '80s we've
2 detected water coming into the reactor aux. building.

3 We tried through the late '80s, early '90s to
4 pressure grout, to seal or somehow prevent the water
5 from getting in there.

6 In 1996 time frame, we implemented the
7 water in-leakage plan where we've started diverting
8 the water to collect it and put it where we can remove
9 it correctly out of the building.

10 MEMBER CORRADINI: And it's coming in from
11 seepage from the outside, I assume.

12 MR. DENNY: Correct. It's seeping through
13 the concrete, the seams of the concrete and coming in.

14 MEMBER CORRADINI: Like a basement.

15 MR. DENNY: Correct.

16 MEMBER CORRADINI: Somebody's basement.

17 MR. DENNY: And we're continuing to
18 monitor where it's coming in. We've made locations
19 and we monitor where it's coming in.

20 Okay. So what I'm going to go on to now
21 is the external, the external surfaces. So now we're
22 talking about the reactor aux. building side of this.

23 MEMBER ABDEL-KHALIK: But before you do
24 that.

25 MR. DENNY: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER ABDEL-KHALIK: Internal surfaces,
2 do any of the valves have a history of leakage?

3 MR. DENNY: Internal surfaces?

4 MEMBER ABDEL-KHALIK: Right.

5 MR. DENNY: I was talking to the system
6 engineer, the coding system engineer, who happens to
7 be the structure system engineer also. So it's kind
8 of a two for one deal. He's the one that basically
9 goes into the internals of these and does the
10 inspections, and he says he's never gone in there and
11 seen leakage or seen it wet on the internals.

12 So to answer that question, they might
13 have minor leakage of the valve packing. I wouldn't
14 expect it because it only has the water head in the
15 containment sump, but there hasn't been any.

16 MEMBER ABDEL-KHALIK: Okay.

17 MR. DENNY: What?

18 MEMBER STETKAR: There's not normally
19 water in the containment sump.

20 MR. DENNY: Yeah, we maintain the water
21 level in the containment sump.

22 MR. CORLETT: In the pipe.

23 MR. DENNY: In the pipe. I'm sorry, yeah.

24 MR. CORLETT: So there's water in the pipe
25 but not in the sump.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BROWN: One clarification for me.
2 It's dry.

3 MR. DENNY: Correct.

4 MEMBER BROWN: If water accumulates in the
5 sump, you pump it out. Is it recirc? Is that the
6 purpose? What's the purpose of the containment
7 isolation?

8 MEMBER STETKAR: These are the safety
9 related containment sump spray RHR re-spray --

10 MEMBER BROWN: Recirculation back and
11 spray down. Okay. I just wanted to know where it was
12 system-wise.

13 MR. DENNY: And, again, you wouldn't get
14 the water. When the water is in the sump here, this
15 is a sealed penetration. So it goes internal to the
16 process, which is internal to the containment valve
17 chambers.

18 MEMBER BROWN: You just lost me. If it's
19 sealed, how do you take a suction on it?

20 MR. DENNY: This is open, open up top,
21 sealed to the liner.

22 MEMBER BROWN: Oh, okay. I've got you.

23 MEMBER MAYNARD: The chamber is basically
24 an encapsulation for the pipe and the valves.

25 MEMBER BLEY: Charlie, the dashed line is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the pipe.

2 MR. DENNY: The pipe, and there's a
3 penetration on top which seals the internal --

4 MEMBER BROWN: Okay. I've got it. All
5 right.

6 MR. DENNY: Okay?

7 MEMBER BROWN: I never perceived dashed
8 lines as being a pipe.

9 MEMBER STETKAR: Think of this as a funny
10 looking containment penetration.

11 MEMBER BROWN: I've never seen a pipe
12 being shown as a dashed line as opposed to a pipe. So
13 it's a pipe within the chamber.

14 MR. DENNY: That's correct.

15 MEMBER BROWN: Okay. Boy, that really
16 helps a lot.

17 MR. DENNY: All right. Moving on, we
18 talked about the structures from the external. Our
19 engineering staff looks at them. Approximately every
20 six years these surfaces are looked at. This is
21 considered part of containment. It is part of the IWE
22 program, which is looked at approximately every two
23 outages. It's every three and a third year, which
24 turns out every two outages.

25 Well, when we do find evidence of coatings

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 damage, which is what we're going to see on an
2 external surface, it is removed. Examination is
3 performed to determine the extent on the base metal,
4 which would be the valve chambers, and recoated.

5 To date we haven't found any metal loss.
6 You know, we find corrosion, surface corrosion, no
7 appreciable metal loss.

8 Going on to the internal, since 2000 we've
9 been doing some internal inspections. QC goes in.
10 Part of the IWE program, we do a visual inspection.
11 We've seen some blistering approximately a 16th inch
12 in diameter, very small. We've attributed it to
13 condensation being the concrete is imbedded -- I mean,
14 I'm sorry, the steel is imbedded in concrete with its
15 own atmosphere, and some degraded coatings to go with
16 that is what's causing the blister on the coatings.

17 We remove the coating to perform UT
18 thickness measurements; haven't seen anything below
19 nominal thickness yet, which is above a half inch
20 thick in addition. So this is pretty thick itself.
21 In all cases, we always replace the coatings.

22 Since 2004 we haven't seen further
23 blistering on the interior surfaces. We did have to
24 repair some damage to the coatings that occurred when
25 we were gaining access to the inside surfaces to one

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 of our valve chambers. So that was repaired and some
2 new coatings were put on.

3 In addition, I talked about QC doing the
4 internal inspections every two outages.

5 VICE CHAIRMAN BONACA: The program
6 foresees changing the frequency of inspection, that
7 isn't what you find? I would expect that you have
8 some of that element in it.

9 MR. DENNY: That's correct, and being in
10 the IWE program, it's an ASME Section 11 type program.

11 When you find degradation that you have to evaluate,
12 you have to increase the frequency or put it into
13 another category which would require like an augmented
14 category, they call it, which would require a
15 different type frequency of inspections.

16 VICE CHAIRMAN BONACA: And currently
17 frequency of inspection is every four years?

18 MR. DENNY: Right. If it went into the
19 augmented category, it would be every outage. We
20 would have to be doing UT on it, but sine we're not
21 finding the degradation, it hasn't made it there yet.

22 MEMBER ARMIJO: How many of these chambers
23 do you have?

24 MR. DENNY: There are four of them.

25 MEMBER ARMIJO: Four of them?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. DENNY: Two for RHR and two for
2 containment spray.

3 MEMBER ARMIJO: And all of them get the
4 same level of inspection?

5 MR. DENNY: That's correct.

6 MEMBER BLEY: Did you find the corrosion
7 in all of them?

8 MR. DENNY: There has been corrosion found
9 in all of them. It's like one year we find it in one.
10 The next year we find it in another. That's why I
11 didn't get into all of that, because you go to alpha
12 containment spray and bravo RHR. It gets kind of
13 confusing, but there has been corrosion found in all
14 of them.

15 I say corrosion at surface. What we're
16 really finding is the blistering on the coatings.

17 MEMBER ABDEL-KHALIK: Are the manholes in
18 these chambers part of the containment leak test?

19 MR. DENNY: Yes, they are. That's why we
20 don't open them on line, because we do an LRT on them
21 when we start up, and then we leave it closed.

22 MEMBER CORRADINI: And this is just
23 background since I can't remember. Do you an LRT
24 every ten years?

25 MR. DENNY: No, local leak rate tests.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 We're still Option -- I believe it's Option A, which
2 is review at every outage.

3 MEMBER CORRADINI: Some sort of leak rate
4 test?

5 MR. DENNY: We haven't gone to the
6 performance based leak rate test, but we perform that
7 every outage.

8 MEMBER CORRADINI: Thank you.

9 VICE CHAIRMAN BONACA: Would you expect
10 any corrosion between the concrete and the metal? I
11 mean they're on the outside surface of it?

12 MR. DENNY: The exterior surfaces were all
13 coated, and they were imbedded in concrete, and the
14 corrosion rates of the steel in concrete is much
15 lower. So while we do expect it, it is a lot. I
16 would expect it to be a much lower rate than I see
17 visually.

18 MEMBER BLEY: You don't have any way to
19 look at that.

20 MR. DENNY: No, the only way we could, if
21 we were suspecting it, we could be doing UT on the ID
22 to see what the OD is showing. If we were suspecting
23 that, that's probably what we would go to.

24 CHAIRMAN SHACK: But you have full access
25 to almost the whole surface in there.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. DENNY: That's correct.

2 PARTICIPANT: But in a leak you wouldn't
3 expect it.

4 MR. DENNY: Not with the pipe going up.

5 CHAIRMAN SHACK: It would surprise me,
6 yes.

7 VICE CHAIRMAN BONACA: But at times you
8 get surprised.

9 MR. DENNY: So our conclusion, although we
10 do have -- I'm sorry? -- although we do have water
11 coming in the RAB, we tried to mitigate it with early
12 grouting and pressure sealant, pressure grouting and
13 sealing what's on the grout. We channeled it to where
14 we can control it, and we do routine inspections,
15 which is maintaining the integrity of the valve
16 chambers.

17 MEMBER CORRADINI: I guess maybe this was
18 asked and I just didn't hear your answer. So the
19 moisture inside the blistering, I assume moisture grew
20 in blistering on the inside of your valve chamber.
21 The source of that is this humidity build-up from
22 leakage?

23 MR. DENNY: Yeah, it's kind of --

24 MEMBER CORRADINI: I shouldn't say
25 leakage, but from communication from the rest of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 containment.

2 MR. DENNY: Well, we're attributing it to
3 the cold concrete. When we start up, it's still warm
4 in there. So we have a cold and you put a steel
5 structure in the ground and you get cold condensation
6 with some initial contaminants underneath the
7 coatings, which is causing the blistering.

8 CHAIRMAN SHACK: But there's no
9 communication to the atmosphere, right? This thing is
10 sealed on --

11 MR. DENNY: Its own atmosphere, that's
12 correct.

13 CHAIRMAN SHACK: Yeah, it's just a big--

14 MEMBER CORRADINI: It's sealed on both
15 sides.

16 MR. DENNY: It's the reactor aux. building
17 atmosphere until we start up. Then it's its own
18 atmosphere.

19 MEMBER BROWN: Well, that's when you seal
20 it.

21 MR. DENNY: Correct.

22 MEMBER BROWN: So it is open. You're
23 exchanging air at least in that point, and if it's
24 warm and humid, then it's trapped in there, and then
25 when you start up it's cold. It condenses.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. DENNY: That's correct.

2 Questions on that topic?

3 MR. MIKE HEATH: Well, that concludes our
4 presentations. Any other questions concerning Harris
5 license renewal that we can answer for you?

6 (No response.)

7 MR. MIKE HEATH: Thank you very much.

8 MEMBER STETKAR: Thanks very much.

9 (Pause in proceedings.)

10 MEMBER STETKAR: Now I guess we'll hear
11 from the staff about resolution of the open items.
12 There were two confirmatory items that we didn't go
13 over in the presentation from the applicant because of
14 time considerations. We wanted to go over and make
15 sure we had enough time to discuss all of the
16 technical issues both on the open SER item and the
17 issues that came up during the subcommittee meeting.
18 So we didn't discuss the two confirmatory items, but
19 they are more or less administratively taken care of.

20 So with that, Maurice, it's yours.

21 MR. MAURICE HEATH: Thank you.

22 And good morning. Again, my name is
23 Maurice Heath, and I'm the project manager for Shearon
24 Harris license renewal application.

25 Today we have, as stated earlier, we have

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 our staff in the audience and also Mr. Cardell Julian
2 is on the phone from Region 2, who was our lead
3 inspector, and he's there to answer any questions as
4 well.

5 All right. What we're going to do now,
6 let me just step through what we're going to cover.
7 We're going to have a brief overview. We're going to
8 discuss the resolution of open item 2.2, as well as
9 the resolutions for confirmatory item 3.4-1 and 4.3.

10 As the applicant mentioned, I will just
11 briefly go through this. LRA was submitted November
12 2006 as a single unit, Westinghouse three-loop PWR,
13 2900 megawatt thermal and 900 megawatt electric, and
14 the operating license expires October 2026, and the
15 plant is 20 miles southwest of Raleigh, North
16 Carolina.

17 At the subcommittee meeting, we presented
18 the results from the safety evaluation report with
19 open items that was issued in March of 2008, and it
20 contained one open item and two confirmatory items.

21 During our process, we had 346 audit
22 questions asked, 75 RAIs issued, and the end result,
23 we ended up with 35 commitments in the SER with open
24 items.

25 Now, since the subcommittee meeting, we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have issued our final SER in August 2008, and we have
2 the resolution of open item 2.2 and the two
3 confirmatory items, and we also have two additional
4 commitments that were added as a result, and those two
5 commitments came from the resolution of the
6 confirmatory items.

7 One open item came from Section 2.2, plant
8 level scoping. What I want to do is kind of give you
9 a little background information and then discuss the
10 resolution of that. So the Harris FSAR credits that
11 feed regulating and bypass valves for redundant
12 isolation function following main steam line break.

13 However, the feedwater isolation is not
14 listed as a function of the feedwater system in the
15 license renewal application, and the LRA states that
16 the feedwater regulating and bypass valves are non-
17 safety related per the current licensing basis and are
18 in scope per 54.4(a)(2).

19 In addressing this open item, staff
20 identified the follow. Fifty-four, four (a)(1)
21 specifies that the following safety related SSCs
22 should be included in scope if they meet
23 54.4(a)(1)(i), (ii) or (iii). The criterion
24 54.4(a)(1) agrees with the definition of safety
25 related specified in 50.2.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Now, if the applicant's definition of
2 safety related differs from 54.4(a)(1), the
3 methodology the applicant used was based off NEI 95-
4 10, and that states that the applicant should use a
5 criterion 54.4(a)(1) to determine that the SSC is to
6 be included in scope.

7 And if the applicant has CLB documentation
8 indicating that the NRC has approved specific SSCs to
9 be classified as safety related, which would otherwise
10 meet the applicant's definition of safety related for
11 the 54.4(a)(1) criteria, that these structures,
12 systems, and components are not identified to be
13 within scope in accordance with 54.4(a)(1).

14 Now, if these SSCs are classified as non-
15 safety related in accordance with the CLB but have
16 potential to affect the functions described in
17 54.4(a), they should be included in the scope in
18 accordance with 54.4(a)(2), non-safety related
19 affecting safety related.

20 Now, the resolution of this one item in LR
21 Amendment 8, that was dated May 30th, 2008. The
22 applicant revised Section 2.3.4.6 to add feedwater
23 isolation as an intended function in the feedwater
24 system.

25 The applicant also has documentation, CLB

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 documentation indicating that NRC has approved
2 classifying these valves as non-safety related.

3 So LR Amendment 8, also the applicant took
4 exception to the scoping methodology in NEI 95-10 and
5 used the current licensing basis and the scoping
6 definition in 54.4 to determine these valves are in
7 scope per 54.4(a)(2).

8 So the staff has come to the conclusion
9 that this position is consistent with the current
10 licensing basis and the scoping definition in 54.4.

11 MEMBER MAYNARD: I'm kind of wondering why
12 this came up with Shearon Harris. What's unique about
13 it? Because this configuration isn't, I don't think,
14 all that unusual for other Westinghouse plants.

15 MR. MAURICE HEATH: Correct.

16 MEMBER MAYNARD: So did it come up on
17 other plants, too, and get resolved somehow? What's
18 unique about Shearon Harris, I guess?

19 MR. MAURICE HEATH: Well, other
20 applications, some applicants have already put it in
21 scope for (a)(1), but Donnie, do you want to?

22 MR. HARRISON: This is Donnie Harrison,
23 Branch Chief for balance of plant, at least during
24 this review.

25 (Laughter.)

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 PARTICIPANT: You're in transition.

2 MR. HARRISON: That's right. That's
3 right.

4 But Maurice has got it right. In the past
5 we've asked questions of licensees on this area, and
6 the licensee has put it in scope for (a)(1) and
7 treated it as (a)(1), and this licensee actually tried
8 to address the RAIs, push back and address the RAIs
9 directly and, again, took exception to the NEI
10 guidance that we were reading as driving you to put it
11 into (a)(1), and they reverted back to the actual rule
12 and the rule language to establish the position.

13 MEMBER STETKAR: So this is the first one?
14 You know, having been on the Committee for only a
15 year and only seen a few of these, is this the first
16 instance where the applicant has, indeed, taken
17 exception and pushed?

18 MR. HARRISON: Yes.

19 MEMBER STETKAR: I want to make sure the
20 rest of the Committee is aware of that because we're
21 going to set a precedent here.

22 MEMBER BROWN: So the rest of the license
23 renewals that come in are going to do the same thing,
24 say, push back on it?

25 MEMBER MAYNARD: They may or may not.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: They may or may not, but
2 just be aware of that fact this is (pause) --

3 MR. HOLIAN: Yes, this is Brian Holian.

4 Just to add to that, I mean, the Committee
5 who was here last month, you know, faced an issue with
6 station blackout scoping in the switchyard for Wolf
7 Creek. It's not exactly similar to that, but I guess
8 from a license renewal perspective, you're on the
9 edges of how a plant is either scoping an item in in
10 their CLB or not, and in one reality this might have
11 been able to be resolved by either a legal
12 interpretation or, you know, even prior to the
13 subcommittee.

14 However, it wasn't. One perspective, it's
15 refreshing that we look at the rule on each plant and
16 a technical reviewer and review both the license
17 renewal application and, of course, the CLB
18 application.

19 So I guess from my perspective, I mean,
20 it's refreshing that the questions still come up and
21 that we're looking at it with new eyes, and you are
22 right. We want a certain percent or certain degree of
23 uniformity, but that's the positive aspect as I'm
24 looking back on it. I mean, we're still questioning
25 the rule as written and how we're implementing it.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 VICE CHAIRMAN BONACA: And the question I
2 have is that you look back to see what difference it
3 makes in scope. What I mean is that if you interpret
4 these components as being sensitive like that, you
5 would include then additional surrounding components
6 to explain your caused failure of this. And you have
7 seen it for previous plants.

8 I mean, is it a significant scope change?

9 MR. HARRISON: Yeah, but I would say it
10 this way. If you put it in scope for (a)(1) and then
11 bring into scope additional components that are non-
12 safety related, you're actually doing something that's
13 more conservative in that mode.

14 So this was, again, reverting back to
15 actually what the ruling said and the positions in the
16 Statement of Considerations for the rule. So we have
17 looked back at like feedwater isolation function at
18 other plants, and there's a lot of different ways to
19 get feedwater isolation, and some are safety related;
20 some are non-safety related. It's a very open-ended
21 solution.

22 So the bottom line is we've looked back.
23 We haven't gone back to licensees and said, you know,
24 take those things out of scope. You've done something
25 that's actually more concerning what the rule

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 requires.

2 VICE CHAIRMAN BONACA: I didn't mean that.

3 I'm just trying to understand what differences it
4 makes.

5 MR. HARRISON: The significance would be
6 how much additional equipment and the practicality of
7 bringing additional equipment into scope. If you're
8 in a building that's got a number of non-safety
9 related components around the isolation valve, that
10 could be problematic for some plants, but that's how
11 we would look at it.

12 MEMBER STETKAR: I think also one of the
13 concerns here is that -- correct me if I'm wrong --
14 Shearon Harris turbine building is an open --

15 MR. HARRISON: Yes.

16 MEMBER STETKAR: -- open turbine building.
17 So there could be additional concerns about
18 environment and how do you control the environment
19 around humidity.

20 MR. HARRISON: And that I would --

21 MEMBER STETKAR: Which might not be faced
22 by another virtually identical, you know, system
23 design, but inside an enclosed turbine building and in
24 an environment that could be more easily controlled.
25 I mean, you're not just worrying about proximity to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 other pumps and pipes and valves.

2 MEMBER MAYNARD: Every one of these plants
3 has unique differences.

4 MEMBER STETKAR: That's right.

5 MR. HARRISON: And I guess from the staff
6 perspective, when we see those unique differences,
7 that's where we start to focus in on our review to
8 make sure we are at least establishing a good
9 regulatory basis for it.

10 VICE CHAIRMAN BONACA: Thank you.

11 MR. MAURICE HEATH: I'm going to move on
12 to first confirmatory item, which is 3.4-1, and this
13 came about because the applicant credits managing
14 changes in materials and cracking of elastomeric and
15 other plastic components with the external surface
16 monitoring program.

17 However, in the GALL aging management
18 program, it recommends visual inspections for carbon
19 steel components, but does not address elastomeric and
20 other plastic components. So the way that we resolved
21 this was the applicant will use the preventive
22 maintenance program which will periodically replace
23 these components based on site and industry operating
24 experience, equipment history, and vendor
25 recommendations.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BROWN: What's GALL? Is that an
2 acronym or is that --

3 MR. MAURICE HEATH: Generic aging lessons
4 learned.

5 MEMBER POWER: It's the Bible for this
6 stuff.

7 MEMBER BROWN: The what?

8 MEMBER POWER: The Bible.

9 MEMBER BROWN: Why in the world --
10 elastomeric stuff degrades, and I guess I'm having a
11 hard -- not just a hard time, but just I have a hard
12 time imagining that you would look at the steel
13 components and it shrinks, particularly if it's in a
14 humid temperature varying environment. So --

15 MEMBER POWER: The basic philosophy of the
16 license renewal that replaceable components are
17 replaced and those that are not get inspected.

18 MEMBER BROWN: So they replace the
19 elastomeric?

20 MEMBER POWER: It's got the principle, the
21 number one principle in the GALL report.

22 MEMBER BROWN: Okay. Thank you.

23 MR. MEDOFF: Let me clear this up for you.

24 This is Jim Medoff of the staff.

25 The issue was that the applicant's

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 external surfaces monitoring program was enhanced to
2 include these types of components, but if you look at
3 the GALL program, it doesn't cover elastomers.

4 Now, if you look at the AMRs for
5 elastomers in the GALL report, it credits visual
6 examinations for changes in properties, and for
7 cracking we had a couple of issues with this. You
8 can't use a visual examination to detect a change in a
9 material property. Usually you have to analyze for
10 it.

11 The second issue was if you were going to
12 credit a visual for cracking, you would certainly have
13 to define what type of visual examination you were
14 using. For instance, if you look at the ASME Section
15 11 IWA criteria, it only credits VT-1 type of
16 examinations for cracking, and for polymers it's not
17 even -- we're not even sure a visual would be capable
18 of doing this. An example would be if you have been
19 riding your bike and you have a plastic water bottle,
20 sometimes it leaks out and you notice your pants are
21 wet, but you can see the water. You can't see the
22 crack.

23 So the issue with the polymers is that
24 GALL may not currently be quite adequate, and we had
25 to raise the issue of how an external surfaces

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 monitoring the program could be used to manage the
2 aging effects for the elastomers and the polymeric
3 components.

4 What Harris has done is they decided to,
5 rather than include them in their AMRs, that they're
6 going to periodically replace them, and under the rule
7 if you have components that are periodically replaced
8 on a specified frequency, then you can take them out
9 of the aging management reviews.

10 MEMBER BROWN: Okay. Thank you.

11 MR. HOLIAN: Just to summarize -- Brian
12 Holian again -- next month I think we have a license
13 renewal update for the committee on where we are with
14 GALL and how we're updating aspects of that.

15 MEMBER ABDEL-KHALIK: Now, what is the
16 current practice at the plant with regard to these
17 components? Are they replaced when they fail or is
18 there currently, you know, a periodic replacement
19 program?

20 MR. MAURICE HEATH: For currently, I would
21 actually pass the applicant for that, what they
22 currently do with these items, these components.

23 MR. SCHNEIDMAN: Hi. I am Barry
24 Schneidman.

25 I looked at the PM program basically sets

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 up periodic replacements for these on a scheduled
2 interval, and that's based on that they saw some
3 surface cracking on some of the hoses and decided to
4 select -- there was no substantial damage. It's just
5 some surface crack, and so they decided to use that as
6 a frequency for replacement.

7 MR. MAURICE HEATH: Our second
8 confirmatory item comes from Section 4.3 of my time
9 limited aging analysis section, and this one came
10 based on the applicant used a WESTEMS special purpose
11 computer code in calculating stresses from transients.

12 The code is benchmarked for pressure, thermal moments
13 and thermal transients. Excuse me.

14 A 60-year fatigue re-analysis was
15 completed for all 6260 components with two components
16 having a 60-year CUFen greater than one. Now, the
17 confirmatory item was issued to insure consistency
18 between the re-analysis and the original design
19 specification.

20 Now, for the resolution, the applicant
21 commits to update the design specification to reflect
22 the revised design basis operating transients, which
23 was commitment 37.

24 Also, the FSAR supplement was updated to
25 reflect that Harris crediting of the fatigue

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 monitoring program to manage aging for reactor coolant
2 pressure boundary components according to
3 54.21(c)(1)(iii).

4 CHAIRMAN SHACK: Okay. So this comes from
5 a different vendor. So there's no problem with a 1(d)
6 virtual surface calculation.

7 MR. MAURICE HEATH: Right, correct. This
8 is the Westinghouse version.

9 MEMBER ARMIJO: Now, what do you do with
10 those two components that have a 60-year usage factor
11 greater than one? Might you resolve it by changing
12 the design basis transience or --

13 MR. MAURICE HEATH: No, we resolve it by
14 monitoring those components, and that's what the aging
15 fatigue monitoring program does. They're going to
16 monitor it for the 60-year period.

17 MEMBER ARMIJO: Okay.

18 MR. MAURICE HEATH: And with that, on the
19 basis of its review, the staff determined that the
20 requirements for 10 CFR 5429(a) have to be met.

21 VICE CHAIRMAN BONACA: There were a number
22 of inspections made, right? Were a number of
23 inspections made?

24 MR. MAURICE HEATH: Inspections for?

25 VICE CHAIRMAN BONACA: Well, site

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 inspections for scoping that you would normally have?

2 MR. MAURICE HEATH: Oh, we had a number of
3 inspections, on-site inspections from audit teams and
4 from our regional inspection team.

5 MEMBER ABDEL-KHALIK: The two components
6 for which the cumulative usage factor is greater than
7 one --

8 MR. MAURICE HEATH: Yes.

9 MEMBER ABDEL-KHALIK: -- was the number of
10 cycles that was assumed in the analysis done based on
11 just linear extrapolation of history?

12 MR. MAURICE HEATH: I'm going to turn it
13 over.

14 MR. MEDOFF: This is Jim Medoff of the
15 staff again.

16 Although I didn't do the fatigue analysis,
17 I was involved with the final concurrence on the LRA,
18 but my understanding is that since the environmental
19 CUFs are not required for the current operating basis,
20 they used the 60-year cycle projections for the
21 transience to do their environmental CUF calculations.

22 For the two components where the CUFs,
23 environmental CUFs have been determined to be in
24 excess of one, they're using the fatigue monitoring
25 program to count the transients that are involved in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 those calculations, and then if they get close to
2 their allowable, they'll take the prompt corrective
3 action. It could be re-analysis or repair and
4 replacement, and they do have a commitment on that.

5 MEMBER ABDEL-KHALIK: The question
6 pertains to the analysis that produced a result
7 greater than one.

8 MR. MEDOFF: Right. What had happened is
9 my understanding is they had one a re-analysis using
10 some updated transients for those components, and
11 staff had reviewed the re-analysis by the applicant
12 and found it acceptable. The discrepancy that the
13 staff found was that the original design basis
14 document for the original CUFs, the transients for
15 those were not the same as the transients in the
16 updated analysis. So there was a confirmatory item to
17 update the design spec based on the revised transients
18 that were used in the original analysis.

19 MEMBER BROWN: Were the new transients
20 more severe than the previous one?

21 MR. MEDOFF: Since I didn't do the review,
22 that I couldn't answer, but I could get back to you on
23 that.

24 MEMBER ARMIJO: What components were
25 these?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. MAURICE HEATH: These were the surge
2 line and the pressurizer lower head penetration, were
3 the ones that were greater than one, the ones you are
4 talking about.

5 Do we have anymore questions on any of
6 that?

7 MEMBER BROWN: What was the other one?
8 Surge line what?

9 MR. MAURICE HEATH: Surge line,
10 pressurizer lower head penetration.

11 MEMBER ARMIJO: Two locations.

12 MR. MAURICE HEATH: Yes.

13 MEMBER STETKAR: Anything more?

14 Maurice, thank you very much.

15 MR. MAURICE HEATH: Thank you.

16 MR. HOLIAN: Just one other item. Brian
17 Holian again.

18 To clarify from a previous discussion, and
19 I don't know if we need to add much to it, but that
20 was the issue of the water in the manholes, and there
21 was a 2002 info notice that went out kind of to the
22 industry on that aspects. So I just wanted to remind
23 the committee of that, and I know there has been
24 discussion amongst the Electric Branch on that, of
25 whether a need industry-wide to update that or not.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 We are finding that in other plants as
2 we're doing our inspections and audits so that Generic
3 Communications has been looking at that issue.

4 MEMBER STETKAR: I think EPRI also has a
5 program. They're concerned about this wet and dry-out
6 issue on underground cables also. I don't actually
7 know exactly what the status of that is right now, but
8 it is an issue that the industry is aware of and
9 concerned about.

10 Thank you very much.

11 Any other questions, discussion?

12 VICE CHAIRMAN BONACA: Well, at the
13 Subcommittee meeting we talked about DLAs, how they
14 were met, et cetera. I'm not sure that this is being
15 communicated through the Committee.

16 MEMBER CORRADINI: I want to just ask the
17 Subcommittee. So you're comfortable with the
18 classification of (a)(2) versus (a)(1)?

19 MEMBER MAYNARD: I am.

20 MEMBER CORRADINI: I mean, this was a
21 discussion point. I want to make sure.

22 MEMBER STETKAR: I'm not going to speak
23 for the rest of the Committee members. Personally I'd
24 have to say yes, from a technical -- knowing the
25 pieces of equipment, the failure modes, purely

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 technical, not a regulatory legal interpretation. I'd
2 feel comfortable with that.

3 How we got there is a different issue.

4 MEMBER CORRADINI: I don't want to see the
5 sausage making.

6 MEMBER STETKAR: Indeed. Anything else?

7 MEMBER BROWN: Yeah, I guess I'll just ask
8 the dumb question. The two CUFs on the surge line an
9 whatever, the pressurizer penetration, I asked a
10 question about did they change based on plant previous
11 operating history, did they redo that analysis with a
12 different set of transients. So those are big pipes,
13 and if they break, there's major consequences to them.

14 And I realize you can monitor fatigue
15 based on the monitoring program, but was there a
16 reason for changing or now obtaining the new numbers?

17 I didn't get a real crisp answer on that.

18 CHAIRMAN SHACK: Well, for one thing,
19 those were environmental fatigue, which wouldn't have
20 been in the original design.

21 MEMBER BROWN: Tell me that again.

22 CHAIRMAN SHACK: It means that you have to
23 take into account the fact that the light water
24 reactor environment decreases the fatigue life
25 typically.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BROWN: But it's an internal
2 environment, not external.

3 CHAIRMAN SHACK: Yeah. It's the internal
4 water environment.

5 MEMBER BROWN: So you still have the water
6 coming in and out and the thermal shocks, all the rest
7 of the stuff.

8 CHAIRMAN SHACK: Just the fact that it's
9 in water rather than air. The ASME code fatigue line
10 that these things were originally designed to was
11 based on fatigue life and air.

12 MEMBER BROWN: Okay.

13 CHAIRMAN SHACK: Since then we've found
14 that fatigue life in water can be, in fact,
15 considerably shorter than the fatigue life in air, and
16 so they have to take that into account in this, and so
17 that gives them a different projection than they would
18 get if they were using the air curve again.

19 MEMBER BROWN: Okay. Now, if I had been
20 in that position, I'm just trying to think what I
21 might have done. Would I then explore my past
22 operations to see if my projection would be that I
23 will really exceed the fatigue life within my plant
24 licensing? It says you will, but look at actual
25 operations to see if I really have the potential to do

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that.

2 CHAIRMAN SHACK: Well, they've done more.
3 They're going ot actually monitor their cycles, and
4 they'll just track this.

5 MEMBER BROWN: No, I understand that. I
6 understand that point. I was just saying if I look at
7 my past, they've got 20 years of plant history.

8 CHAIRMAN SHACK: Well, we never did get an
9 answer to that, whether this was a projection based on
10 past history or just a --

11 MEMBER BROWN: Yeah, and that's I --

12 CHAIRMAN SHACK: -- fraction of an
13 original design spec. That was the question that Said
14 was trying to ask.

15 MEMBER BROWN: And I was trying to pull
16 the string on that.

17 CHAIRMAN SHACK: That never did get
18 answered, but you know, the critical thing from my
19 point of view is that, in fact, they're going to be --

20 MEMBER ARMIJO: They're here. Everybody
21 is here. Let's get an answer. What is?

22 MR. MALLNER: My name is Chris Mallner,
23 and I'll answer that question for you.

24 Originally, when we put together the
25 license renewal application and did these analyses, we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 had used straight line projections for cycles. During
2 the review, there were some questions on the validity
3 of using straight line projections.

4 Subsequent to the original analysis and in
5 discussions with the staff during our audits, we used
6 a full set of design transients to analyze all the
7 locations. Therefore, we used no transient
8 projections whatsoever. So we don't base anything on
9 saying that, for example, if we have 200 heat-ups and
10 cool-downs in our design specification that we can
11 project we're only going to have 133.

12 No, we've looked at environmental fatigue
13 with the full set of design transients for the plant.

14 So there are no projections for Harris license
15 renewal at all.

16 Now, for the fatigue monitoring program,
17 we go back and look at how much we've accumulated in
18 the past by reviewing past operating histories, and
19 that all gets built into the fatigue monitoring
20 software that we're using that was supplied by
21 Westinghouse called WESTEMS, and that provides the
22 models where you can pull the information off the
23 plant computers and provide the delta accumulation of
24 fatigue over the life of the plant, and we will
25 monitor the fatigue accumulation over time, and we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have alarms built into our fatigue management program
2 that will allow us to have sufficient time to either
3 replace, replace, re-analyze or whatever the
4 corrective action would be appropriate for those
5 locations.

6 CHAIRMAN SHACK: But that sounds like a
7 linear -- I mean, if you had 200 cycles for 40 years,
8 you would presumably have 300 cycles for 60 years. Is
9 that what you did?

10 MR. MALLNER: What we did is use 200
11 cycles. We used what's in our design specification.
12 Now, the --

13 CHAIRMAN SHACK: That seems peculiar.

14 MR. MALLNER: Now, the issue of --

15 CHAIRMAN SHACK: The design spec was for
16 40 years.

17 MR. MALLNER: That's correct, and we said
18 we're going to maintain the design specification
19 number of cycles for 60 years.

20 MEMBER BROWN: Is that consistent with
21 what your monitoring program to date? In 20 years you
22 then have used only less than a third of the design
23 transient cycles, however it's calculated?

24 MR. MALLNER: Now, the issue, of course,
25 most importantly is that we are tracking, for those

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 locations, we are tracking accumulated fatigue. So if
2 we were to have a heat-up or cool-down, for example,
3 that happened at less than the design heat-up and
4 cool-down rate, that would accumulate less fatigue for
5 that particular cycle.

6 But we're tracking fatigue. The goal of
7 the fatigue monitoring program is to insure that the
8 component has a CUF less than or equal to 1.0, not to
9 control the number of cycles per se, because what our
10 code requirement is is to maintain the CUF less than
11 or equal to one, and that's what the program does.

12 It's just counting the cycles is an
13 adjunct to insuring that the component remains
14 qualified during the entire operating period.

15 MEMBER ABDEL-KHALIK: And you do have
16 enough data that would allow you to account for
17 everything that happened in the past?

18 MR. MALLNER: What we did is we looked
19 back at actual operating data for about between five
20 and six years, and we looked at all the data and used
21 that as part of our analysis of the previous cycles,
22 and that gave us an understanding of how the plant
23 operated in the past.

24 Going forward, obviously the plant is
25 instrumented, and we use that information and feed

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that into the WESTEMS software to come up with the
2 delta accumulation of fatigue for every present and
3 future cycle.

4 CHAIRMAN SHACK: Okay, but that backward
5 review, is that what gave you the confidence that the
6 200 that you had for 40 years was, in fact, bounding
7 for 60 years?

8 MR. MALLNER: Well, yes. See, the reality
9 of this is that we're using our accumulation to date
10 and our cycles to date to help us design an alarm
11 limit to provide sufficient time for us to do
12 corrective actions. We don't want to bump on the CUF
13 of one and have no time to do anything and be forced
14 to shut down the plant. We want to have sufficient
15 time to be able to manage this, which is the idea that
16 fatigue management program.

17 I just want to add our update to the
18 design specification was really backwards looking. It
19 goes back to our --

20 MEMBER ARMIJO: I'm getting more confused.

21 MR. MALLNER: Okay.

22 MEMBER ARMIJO: What is your CUFen right
23 now for those two pressurizer components?

24 MR. MALLNER: It's less than one.

25 MEMBER ARMIJO: Give me a number, not

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 "less than one." It is .3, .2? What is it?

2 MR. MALLNER: One of the locations was
3 approximately between .8 and .9. However, that
4 location has been --

5 MEMBER ARMIJO: That's close to one.

6 MR. MALLNER: It looks high. However,
7 that location has been mitigated as part of our alloy
8 600 program. There's a weld overlay, and the analysis
9 was revised, and that location is not near that. It's
10 very low now.

11 MEMBER ARMIJO: Okay.

12 MR. MALLNER: So obviously when we go in
13 there and do other repairs, replacements that affect
14 those locations, we have to update the fatigue
15 analysis as required.

16 MEMBER ARMIJO: So you're saying because
17 of stress corrosion cracking issues, you put this big
18 weld overlay.

19 MR. MALLNER: That's correct.

20 MEMBER ARMIJO: And that somehow
21 compensated for the fatigue usage phenomenon.

22 MR. MALLNER: Right. It moves the
23 location someplace else.

24 CHAIRMAN SHACK: It reduces the stresses
25 of that particular location.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER ARMIJO: Sure.

2 CHAIRMAN SHACK: And he's still going to
3 have cycles, but he's going to accumulate no usage.

4 MEMBER ARMIJO: So it's like starting with
5 a new pipe.

6 CHAIRMAN SHACK: Well, no. It's going to
7 be .8 and it's going to stay .8. It isn't going to
8 get any better, but it's not going to get any worse
9 because he has now reduced the stresses at that
10 location because of the overlay.

11 MR. MALLNER: I would like to interject,
12 if I could. One of the drivers was the way we had
13 operating procedures in the past, and years ago we
14 changed or modified operating procedures, and the
15 accumulation now is much lower than it was in the
16 past, and we accounted for the way we used to operate
17 the plant in the old days in the calculations, but our
18 accumulation based on our modified operating
19 procedures is much lower.

20 Big picture though is that these locations
21 are within our fatigue management program. We monitor
22 them, and we have a program manager who looks at these
23 locations, tracks the cycles, looks at the
24 accumulation, and has alarm limits that trigger the
25 corrective action program to do whatever is required

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 for repair, replacement, re-analysis or inspections,
2 whatever they decide is appropriate for those
3 locations.

4 MEMBER ABDEL-KHALIK: What are those alarm
5 limits, .9, .95, .99?

6 MR. MALLNER: The alarm limits, we're
7 working on the -- because we did the weld overlays, we
8 are working on looking at what we're going to make
9 those alarm rates again. We're going to change them
10 now because we can change them to something that will
11 be more appropriate after they've been repaired.

12 But right now that procedure that we use
13 for this program is being revised now, and we're
14 looking to reissue it before the end of the year. So
15 we're going to go review the alarm limits once again.

16 But, again, that's part of the overall
17 license rule implementation plan that we have.

18 MEMBER ARMIJO: Yeah, I'm kind of troubled
19 because you put those weld overlays without
20 inspection, as I understand. You didn't inspect those
21 welds. You just overlaid to address the stress --

22 MR. MALLNER: I would have to refer to the
23 plant whether these were preempted.

24 MEMBER ARMIJO: I think I read in the SER
25 or in your application that they were just a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 preemptive overlay. I'm not -- correct me if I'm
2 wrong, but okay. Let's say --

3 CHAIRMAN SHACK: He probably wouldn't
4 believe the inspection anyway.

5 (Laughter.)

6 MEMBER ARMIJO: But then you have to make
7 an assumption that there might be some stress
8 corrosion cracks there. Now, I've got this other
9 phenomenon of environmental fatigue on top of that.
10 I'm just wondering how all of this works together,
11 fits together so that you can have confidence in your
12 analysis that the CUF is meaningful as far as
13 structural integrity.

14 So has the staff looked at that?

15 CHAIRMAN SHACK: CUF is meaningless once
16 you've got a crack. CUF is an initiation thing. So
17 what you need essentially is a flaw tolerance
18 analysis, which I assume that you do with the overlay
19 because you've assumed -- the overlay assumes
20 essentially a full 360 through-wall crack.

21 MR. MALLNER: If I could interject again,
22 the --

23 MEMBER ARMIJO: When you have a crack
24 already there, it would be different if you have an
25 initiator.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. MALLNER: When you do the weld
2 overlay, there will be two parts. You'll have to redo
3 your Section 3 analysis, which includes the CUF, and
4 you do a flaw tolerance evaluation to meet the
5 requirements of Section 11. It's two piece, parts to
6 it.

7 MEMBER ARMIJO: Yeah, I'll have to think
8 about it some more unless the staff would like to help
9 me out here. Because I think, you know, you could
10 start with the assumption you've got a crack in that
11 component caused by stress corrosion cracking. You
12 didn't inspect it. So you don't know, but you
13 overlaid it just because there might be.

14 MR. MALLNER: The mitigation has been
15 performed.

16 MEMBER ARMIJO: Yea, right. So now you've
17 got potentially a crack. Do you assume that in your
18 fatigue analysis, that there will be fatigue
19 nucleation a lot faster because of the existence of
20 that crack into the weld overlay?

21 How does this all work?

22 MR. MEDOFF: I think you've got a certain
23 perspective of -- this is Jim Medoff of the staff
24 again -- the thing about the CUF in that analyses is
25 they're based on design basis calculations which sort

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 of go into the premise that if your CUF is going to be
2 less than one, any micro cracks in the structure won't
3 go and coalesce into a micro crack.

4 Dr. Shack is correct that once you get a
5 crack, a macro crack in the component, the CUF
6 calculations are basically meaningless. You already
7 have a macro crack.

8 MEMBER ARMIJO: They're nucleation --

9 MR. MEDOFF: Right, right. So if they
10 have a component that has a macro crack, a nozzle, for
11 instance, that they put on a weld overlay. The ASME
12 code has come up with an NRC approved code case that
13 they use for these overlays, and the code case
14 requires a flaw tolerance, a flaw growth analysis of
15 the original flaw because the original flaw has grown
16 through wall. They have slapped some overlay weld
17 metal on top of that.

18 What happens is from what we've heard from
19 the industry is that the overlay has put the cracks in
20 compression. So the crack, existing crack won't grow
21 into the overlay weld metal. So it addresses it that
22 way.

23 MEMBER ARMIJO: All right. I understand
24 you.

25 MEMBER ABDEL-KHALIK: Now, you indicated

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that one of these two locations has or maybe already
2 has been taken care of with the overlay. How about
3 the other location? What is the cumulative usage
4 factor in the other location?

5 MR. MALLNER: At that other location, I
6 can't give you the number off the top of my head.
7 It's probably in the range of about .8. I can't tell
8 you exactly. I'd have to go look it up. I'd have to
9 call up the program manager and have him pull the
10 latest number off the software.

11 MEMBER ABDEL-KHALIK: And the plan is to
12 just simply monitor this and when you reach some alarm
13 value, then you come --

14 MR. MALLNER: We have to take some
15 compensatory measures.

16 MEMBER ABDEL-KHALIK: Thank you.

17 MEMBER STETKAR: Anything else? Anyone?

18 (No response.)

19 MEMBER STETKAR: With that, Mr. Chairman,
20 it's yours.

21 CHAIRMAN SHACK: Okay. Thank you,
22 gentlemen. Thank you, staff and the licensee, for a
23 good presentation.

24 With that, we'll take a break until 10:15.
25 (Whereupon, the foregoing matter went off the record

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 at 10:02 a.m. and went back on the record
2 at 10:18 a.m.)

3 CHAIRMAN SHACK: Gentlemen, we can come
4 back into session.

5 MEMBER BANERJEE: Is it in my hands, Mr.
6 Chairman?

7 CHAIRMAN SHACK: Yes. Our next topic is
8 Generic Safety Issue 191, and Sanjoy will be in
9 charge.

10 MEMBER BANERJEE: Okay. So all the new
11 members, maybe I should give you a little introduction
12 to GSI-191, you know, what it's all about.

13 So to begin with, it's a concern with
14 long-term cooling of the core. Okay? And the concern
15 is following an accident like the loss of coolant
16 accident, you generate some debris and there are
17 screens in front of the pumps which are supposed to
18 take out this debris, and of course, what you're
19 concerned about is that the pumps shouldn't fail or
20 get closed up or the core shouldn't get clogged up.

21 So if you can think of the screens,
22 they're put in front of the pumps hopefully to take
23 the debris out and so that the debris doesn't get to
24 the core or to the pumps. That's the purpose. Okay?

25 Now, what happened? This has been a long-

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 term issue. If you look back in history, in 1979 it
2 was an unresolved safety issue A-41 or something. I
3 don't remember, but in any case, it came to prominence
4 in 1992 with Barsaback 2. You may remember, for those
5 of you who were not involved in this, that a lot more
6 fiber got to the strainers in the BWR than
7 anticipated, and that opened the subject to
8 examination for BWRs.

9 And eventually what happened is they put
10 much larger screens in to take care of the problem,
11 and remember that BWRs don't have a lot of chemistry
12 problems which you'll see come up, and they have less
13 insulation and things that get into the sump, what was
14 these TORI (phonetic), and things like that.

15 Now, what happened is later on there were
16 two evaluations done as to whether this could affect
17 PWRs. One of them showed -- and this was NUREG
18 whatever. I forget the number -- that the CDF
19 increased by an order of magnitude if you considered
20 the plugging of the screens, the existing screens.

21 The second showed that I think about 53 of
22 the 69 plants were affected. There was a study done.

23 This is another NUREG whose number I forget. At any
24 rate, the upshot of all of this was that we had to
25 open this issue and look at it for PWRs. What happens

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 if debris gets in? So it's all brought up in
2 Barsaback.

3 Of course, we started to look at this in
4 conjunction with the staff who came to make various
5 presentations. Eventually GSI-191 was opened. It's
6 still an unresolved issue, and this has to do, as I
7 said, with the concern regarding long-term cooling of
8 the core with this debris.

9 We wrote letters, September 30th, 2003,
10 several letters in 2004. The most recent letter was
11 April 2006. Now, as we're going to write a letter
12 again, let me set the stage by telling you what we
13 said in the 2006 letter.

14 The first thing we concurred with the
15 staff who had recommended that the utilities install
16 larger screens. We thought that even though this
17 might not take care of all the problems, this was a
18 good thing to do. Okay? So that was our concurrence.

19 However, we were skeptical that it would
20 really resolve the issue and pointed out several
21 things.

22 One, we said in our letter that
23 prototypical experiments were required in order to be
24 able to extrapolate from these test conditions to
25 plant conditions. I think that's still an open

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 question that you guys need to consider. Okay? There
2 was concern about writing a letter.

3 The second thing is that we said that
4 there would need to be improved guidance and predicted
5 methods as to how to deal with chemical effects and
6 fiber and particle mixed beds.

7 The third thing we said was that
8 increasing screen sizes may allow more stuff through
9 and give rise to downstream effects.

10 So these were the three sort of things in
11 the sense that more material now may get through these
12 screens even though you have a lower pressure loss and
13 get to the core or whatever and start to block this.

14 Now, I want you to think of this in a way
15 before this presentation as being two screens here.
16 One of these screens is the screen which is supposed
17 to take most of the debris out, but in fact, the core
18 itself has rather small openings. So it acts as a
19 screen as well. Basically you have two screens in
20 series here.

21 And the concern really is whether in this
22 last point I'm talking about, whether the stuff that
23 gets through the first screen ends up in the second
24 screen, which is the core and then starts to block it.

25 Okay. So this is really setting the stage for what

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 they're going to say.

2 Now, I want to warn you about one other
3 point when you look at this because this will come out
4 of the blue for most of the new members. It's a very,
5 very complicated issue obviously and regulatory
6 nightmare because there are dimensions related to
7 chemicals, how much debris is formed, the particular
8 geometries of the containment, where the flow is going
9 through, the particular screens which are being
10 installed, which are all sorts of different screens,
11 the parts to the core and so on.

12 So in this multi-dimensional space, the
13 staff are trying to find a way, and it's not easy
14 because obviously each time they look at something,
15 some other issue pops up, you know, even taking a
16 ballistic effect sort of approach is difficult.

17 At some point we suggested a risk informed
18 approach. I looked ion the letters way back, but even
19 that, I mean, is difficult to take in this case.

20 So in that context, you should look at
21 this and clearly what we're looking at here is what
22 path forward is there to closing out this issue, and
23 this is really what the staff are going to present to
24 you today.

25 Okay? Go ahead.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: It seems to me as you
2 just pointed out that this is a very complex issue and
3 one can have several research projects going on for
4 years. I'm wondering as you said this activation
5 cooling is needed after a LOCA, and a LOCA of pretty
6 good size actually. Now, the frequency of that LOCA
7 is less than ten to the minus five according to here,
8 according to various estimates, if not significantly
9 less.

10 What role does this play in all of this
11 evaluation? The fact that we're talking about
12 phenomena that, you know, may be needed after such a
13 very rare event, does that affect our thinking? I
14 mean, I'm getting the impression sometimes that we are
15 viewing this as a research project in its own right,
16 and we want to understand this. We want to understand
17 that. I mean, to what extent should we really
18 understand what may happen and then say this is good
19 enough?

20 MEMBER BANERJEE: I think we should have
21 the staff wants.

22 MR. RUTLAND: This is Bill Rutland. I'm
23 the Division Director for the Division of Safety
24 Systems.

25 And it's our responsibility along with

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Office of Research and the Division of Component
2 Integrity to disposition this issue. The staff is
3 faced with assuring that the licensees comply with
4 50.46, the long-term cooling criteria, and it is a
5 question for us about do licensees comply with our
6 rules, and the Commission on a number of occasions has
7 suggested to the staff because they understood the
8 relative infrequent nature of very large LOCAs, they
9 have both suggested to us a holistic review which the
10 staff is performing, and we'll go into that, what we
11 mean by "holistic review," and they have also
12 suggested that we look for realistic scenarios.

13 And as a matter of fact, that notion for
14 us to look for realistic scenarios came out of an SRM
15 that was basically from an ACRS meeting on this topic.

16 So that's how the staff has tried to incorporate the
17 notion that this is a very low frequency event.

18 In addition, since it is a low frequency
19 event, that, frankly, has given us the time to, you
20 know, work on this problem. When we issue extension
21 letters to licensees, one of the things we say is
22 because of the relatively low frequency of this event
23 and the unlikely nature of actually having this
24 problem, that gives us the opportunity to resolve this
25 in a more reasonable manner.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: But I don't
2 understand what the holistic approach is.

3 MEMBER BANERJEE: Maybe they will explain
4 that.

5 MEMBER APOSTOLAKIS: We're looking at
6 realistic scenarios. Still, okay, you are looking at
7 scenarios, but how far do you want to push the state
8 of knowledge? That's really the question.

9 MR. RUTLAND: And what I think you're
10 going to hear from the staff today is a set of really
11 engineering testing that has been performed. To some
12 extent some of these technical areas that we're
13 looking at do not have analytical models to support
14 them. We often rely on conservative assumptions based
15 on our engineering judgment.

16 And as you have eloquently pointed out,
17 and as I have said, this could take, you know, two
18 lifetimes to do the research, to really completely
19 understand the phenomenon.

20 So hopefully at the end of this
21 presentation you can ask that question again to us,
22 but that is precisely the heart of the matter when
23 you're trying to address this issue.

24 So before I get the staff to start, I just
25 want to say just to just a very few words. That was a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 great lead-in for my discussion about what you're
2 going to hear. And to some extent it's engineering
3 judgment, and these are engineering tests that we are
4 relying on, and we have asked for conservative pieces
5 to all of the individual technical areas and finally
6 we're looking for a letter, if possible that the ACRS
7 could say they understand or endorse or agree with or
8 don't object to, whichever you wisely think of.

9 MEMBER APOSTOLAKIS: So this is an issue
10 then of design basis.

11 MR. RUTLAND: That's correct.

12 MEMBER APOSTOLAKIS: Let me ask a
13 hypothetical question. You're familiar with an effort
14 to risk inform 50.46.

15 MR. RUTLAND: And I'm responsible for
16 that, too.

17 MEMBER APOSTOLAKIS: Okay. You are. If
18 that had been approved, would it have changed anything
19 here?

20 MR. RUTLAND: Yes, it could have.

21 MEMBER APOSTOLAKIS: It would have.

22 MR. RUTLAND: It could have, yes.

23 MEMBER APOSTOLAKIS: Could have.

24 MR. RUTLAND: Well, licensees would have
25 to adopt 50.46(a), and then they could, in fact, avail

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 themselves of that, yes.

2 MEMBER APOSTOLAKIS: As you very well
3 know, sizes above the transition break size --

4 MR. RUTLAND: Correct.

5 MEMBER APOSTOLAKIS: -- which was going to
6 be something like 12 inches for BRWs, whatever, would
7 not be treated as design basis.

8 MR. RUTLAND: Correct.

9 MEMBER BANERJEE: But I should warn you
10 that the Germans do this and the problem doesn't go
11 away.

12 MR. RUTLAND: Entirely, correct.

13 MEMBER BANERJEE: They don't look at, you
14 know, their debris generation and things are for
15 relatively small breaks.

16 MEMBER APOSTOLAKIS: I think the --

17 MEMBER BANERJEE: And it's the amount of
18 debris actually is -- the problem doesn't only arise
19 from the amount of debris. There are two separate
20 issues. If you generate debris in small quantities
21 even, but of a certain type, it can have as
22 deleterious an effect as larger amounts of debris, you
23 know. So there are many issues. This is a very
24 multi-dimensional problem. So you're not going
25 forward.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: And I'm not saying
2 that the issue goes way. All I'm --

3 MEMBER BANERJEE: Actually it can get
4 worse in some cases.

5 MEMBER APOSTOLAKIS: All I'm asking is
6 because it's a condition of event after a failure
7 event, to what extent do we need to understand it.

8 MEMBER BANERJEE: That's a different
9 issue.

10 MEMBER APOSTOLAKIS: But that's an
11 important issue.

12 MEMBER BLEY: At least for me there's a
13 related question, and maybe this is an easy one to
14 dispense with. Given there was the real Barsaback
15 event, how does that event align with the current
16 issue? I mean there's a real thing that happened.

17 MR. RUTLAND: One of the things that the
18 -- can we talk about the BWR disparities a little bit
19 in this, in your presentation?

20 Just briefly, the staff has asked the
21 question. We have learned an awful lot about chemical
22 effects during this process. When the Barsaback event
23 happened and Limerick, chemical effects really weren't
24 addressed. So we have gone back to the BW Owners
25 Group to engage them to say, "Okay. We can to solve

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 this complete. We don't want to go PWRs, BWRs, back
2 and forth. We want to go back to the boilers," and
3 they're working with us.

4 I think there's a meeting what, next week?

5 MR. HARRISON: Yes.

6 MR. RUTLAND: Next week the BWR Owners
7 Group is meeting on this matter, and we're going to
8 join that meeting. So we're trying to address that
9 issue, too.

10 MEMBER APOSTOLAKIS: Just would you please
11 remind us very quickly in Barsaback, I mean, you would
12 not have any kind of recirculation or we were
13 surprised because there was some blockage? I don't
14 remember.

15 MEMBER BANERJEE: There was quite a bit of
16 blockage.

17 MEMBER APOSTOLAKIS: Quite a bit. Now,
18 what does that mean, "quite a bit"?

19 MEMBER BANERJEE: If I remember, the
20 strainers bent and all sorts of things happened

21 MR. RUTLAND: And we have tried and I
22 think you'll hear today, tried to make that
23 determination. You'll see pictures of strainers that
24 look like they've got a lot of stuff on them, and
25 that's not the criteria. The criteria was sufficient

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 flow, was sufficient net positive suction head for the
2 pumps, and you'll hear that today.

3 CHAIRMAN SHACK: Sanjoy, in order to get
4 through the technical presentation today, we're going
5 to have to get started here.

6 MR. RUTLAND: Thank you, Mr. Chairman.

7 MEMBER APOSTOLAKIS: It's very important
8 though because it sets the point of view.

9 CHAIRMAN SHACK: Well, but I mean, I think
10 we can discuss that in our own session. I think we
11 need to get through this technical discussion today.

12 MR. RUTLAND: Thank you, Mr. Chairman.

13 Take it away, Donnie.

14 MR. HARRISON: Thank you.

15 I'm Donnie Harrison, and I'm the Branch
16 Chief for the Safety Issues Branch currently while
17 Mike Scott is on rotation in Region 1.

18 Today we're going to discuss the generic
19 letter closure process. We're going to discuss a
20 number of selected areas that are currently under
21 review, and those involve the strainer head loss
22 testing. Steve is going to follow my presentation
23 with a discussion on that, and then we'll talk about
24 chemical effects, in-vessel downstream effects, and
25 some trace calculations, hand calculations that were

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 performed on fuel inlet blockage.

2 I'll try to quickly go through a broad
3 overview of the process and how we're approaching
4 closure.

5 First, just as a quick background to the
6 issue, I believe Dr. Banerjee gave a good intro. What
7 that has led us to under Generic Safety Issue 191 was
8 an assessment of sump blockage, sump performance. In
9 2003 we issued a bulletin, 2003-01, that requested
10 licensees to confirm regulatory compliance that their
11 sumps actually could perform as required.

12 Those that did not have the analysis or
13 capability to do the analysis at the time, we asked
14 them to describe their interim compensatory measures
15 that they would implement to reduce risk until those
16 analysis could be performed and any actions that could
17 be taken in response.

18 All of the licensees responded. Those
19 recognized at the time that the methodologies haven't
20 been developed for performing the evaluations at that
21 time. That led to Generic Letter 2004-02, where
22 licensees were requested to perform the actual
23 analysis of the support or a mechanistic evaluation of
24 the sumps. Most licensees requested and received
25 extensions to that generic letter. It's original date

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 was December of 2007 for it to be closed. Most
2 licensees received extensions and were under those
3 reviews. Those extensions were to allow them to
4 complete their testing and the analysis and any
5 corrective actions they had to implement.

6 With that I'll jump to the current status
7 on GSI-191. All licensees have installed
8 significantly larger strainers.

9 MEMBER BLEY: These are already in place,
10 right?

11 MR. HARRISON: These are already in place.
12 Yeah, this has already been done.

13 MEMBER BROWN: By larger do you mean
14 physically or just bigger whole sizes.

15 MR. HARRISON: Physically.

16 MEMBER BROWN: These are more square feet.

17 MR. HARRISON: Upwards of 8,000 square
18 feet.

19 MEMBER BROWN: Okay. I saw that in the
20 write-up. I just didn't know how. Okay.

21 MR. HARRISON: Significantly larger.

22 MEMBER BROWN: Was the sump strainer size?
23 I mean is it large by one inch or --

24 MEMBER BANERJEE: One inch to one-
25 sixteenth.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. HARRISON: One-sixteenth? I think
2 there might be a handful of UP TO --

3 MEMBER BANERJEE: And they're not simple
4 holes.

5 MEMBER BROWN: Okay. One-sixteenth to
6 one-eighth inch, something like that?

7 MR. HARRISON: I think there's a handful
8 that would be a little bit more --

9 MR. RUTLAND: Okay.

10 MEMBER CORRADINI: The hole itself.

11 MR. HARRISON: Yeah.

12 MEMBER BROWN: The strainer holes, lots of
13 holes.

14 MR. HARRISON: Yeah.

15 MEMBER BROWN: Okay.

16 MR. HARRISON: In addition to installing
17 significantly larger sump strainers, licensees have
18 also done a number of other modifications. A number
19 of licensees have removed insulation to reduce their,
20 if you will, exposure to debris. Some have beefed up
21 their banding of the insulation so that it's less
22 likely to come off.

23 A number have reduced the sump buffer or
24 replaced the sump buffer. Some have installed debris
25 interceptors, and there's at least one plant that's

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 pursuing a water management where they control
2 containment sprays.

3 In addition, at least all licensees have
4 performed some strainer testing to try to address the
5 generic letter. I say here they performed it. No
6 everyone has completed their strainer testing because
7 some may have to go back and retest in response to the
8 staff review and establishing a proper path for each
9 closure on the generic letter.

10 Again, as I said before, most licensees
11 requested extensions beyond the December date for the
12 generic letter. This was to allow them to implement
13 additional testing to address the downstream effects
14 analysis that was raised. Questions were raised at
15 the subcommittee back in March of this year, and
16 licensees are addressing that, and to perform plant
17 modifications.

18 The staff is nearing its completion of the
19 licensee's responses to the generic letter and the
20 supplemental responses. You'll hear more about that
21 in a minute.

22 There's a pictorial basically showing how
23 the closure process, how we're approaching closure for
24 this generic letter. At the far left we'll walk
25 through this slide with the following slides, but

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 basically an overview of licensees make a submittal on
2 the generic letter to the staff. We perform a
3 detailed staff review. Out of that detailed staff
4 review and 14 different technical areas, draft RAIs
5 developed. That then feeds into an integration review
6 team. Again, we'll talk about that in a few minutes.

7 That integration review team's charter is to do a
8 holistic review, to review the RAIs, the staff review,
9 and the actual application and make a determination as
10 to if the issue can be closed.

11 That recommendation is said to management
12 to make a decision on closure and either we document
13 closure of the issue or we feed those RAIs to the
14 licensee. Again, we'll walk through this in a little
15 more detail.

16 MEMBER BANERJEE: I think you should
17 mention that there is a set of review guidance which
18 is available.

19 MR. HARRISON: yeah, there is review
20 guidance for performing a number of the staff reviews
21 and for doing the testing that the licensees might
22 perform.

23 MEMBER BANERJEE: And this IRT team not
24 only asks questions of the licensee, but also of the
25 staff doing the review.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. HARRISON: yeah, and there's a little
2 failure, and this will be discussed in a couple of
3 slides, but interaction between the two teams.

4 MEMBER APOSTOLAKIS: Is this the way we
5 close all of the issues? I mean, is there anything
6 unique here about --

7 MR. HARRISON: The unique piece here I
8 would say is the integration review team. They're
9 actually stepping back after the staff does its
10 traditional review of the acquisition and stepping
11 back looking at the broad perspective of the issue and
12 saying -- looking at the conservatisms, the
13 uncertainties in the issue, and making a determination
14 as to can we close this or do we need to pursue this
15 additional --

16 MEMBER APOSTOLAKIS: So that's where this
17 issue --

18 MR. HARRISON: That's where the whole
19 issue of review comes to a head.

20 MEMBER ARMIJO: Will the same integration
21 review team review all of the licensee submittals to
22 try and come up with some consistency?

23 MR. HARRISON: Yeah, and you'll hear that
24 in a couple of slides, but yes. It's essentially the
25 same.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: But there's an overlap
2 always.

3 MR. HARRISON: There's a couple of members
4 that have come and gone, but it's basically the same
5 three to four staff members that sit on that
6 integration review team, and again, in a couple of
7 slides we'll actually get to that.

8 Okay. The licensee submittal, the first
9 block on that diagram, they provided their initial
10 response to the generic letter. All plants provide
11 supplements in the February-March time frame. They'll
12 also need to respond to any RAIs. They'll respond to
13 any open items that were identified at a staff audit
14 that may have been performed at their plant or on
15 their testing.

16 After they've completed all of their
17 testing and evaluations, they need to provide a final
18 supplement that says this is what we've done, and
19 looking forward, if they're relying on this downstream
20 effects topical report that the PWR Owners Group is
21 doing, they would need to address that after that has
22 been issued and approved by the staff.

23 The detailed staff review, the second
24 block in the diagram, what I did on this slide was
25 identify basically the technical areas that are

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 reviewed by the staff. It usually involves about ten
2 staff members from DSS, DCI, and Design Engineering,
3 DE, for the structural part.

4 The output of this initial review, again,
5 is a set of draft RAIs from the staff written in their
6 particular review areas. We're about 60 percent of
7 the way through those detailed reviews. We plan to
8 have the at least initial review completed by the end
9 of October.

10 MEMBER APOSTOLAKIS: Can you tell us what
11 break selection means?

12 MR. SMITH: The break selection is
13 basically where the licensees consider different
14 breaks that could happen in the RCS, and they try to
15 determine which break would be the limiting break for
16 their situation or there may be more than one. There
17 may be two or three that they have to evaluate further
18 down the road.

19 MEMBER APOSTOLAKIS: This is different
20 from what they have already done to get the license?

21 MR. SMITH: Yes, this is different
22 because --

23 MEMBER APOSTOLAKIS: -- 50.46, isn't it?

24 MR. SMITH: The break selection in this
25 case determines how much debris is going to be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 generated.

2 MEMBER APOSTOLAKIS: Also it's a different
3 criterion.

4 MR. SMITH: Yes.

5 MEMBER APOSTOLAKIS: You are looking --

6 MR. SMITH: And how it's going to
7 transport to the strainer and things like that. So
8 there's additional evaluation.

9 MEMBER APOSTOLAKIS: These breaks, do we
10 usually have some idea of the size?

11 MR. SMITH: Generally the limiting breaks,
12 you talk about a double-ended guillotine break of your
13 largest RCS pipe would be your largest break. You may
14 not be limiting. You have a smaller break that could
15 create more debris.

16 MEMBER CORRADINI: So I guess that gets to
17 the point that --

18 MEMBER BANERJEE: Or a different type of
19 debris.

20 MR. SMITH: Or a different type of debris,
21 right.

22 MEMBER CORRADINI: So you have to look at
23 the spectrum.

24 MEMBER APOSTOLAKIS: But it's a fairly
25 sizable break.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: So just to make sure
2 the way you answer, George, so what would be the
3 limiting break size for the thermal hydraulic analysis
4 to show coolability to stay within peak clad
5 temperature is not necessarily the break that's going
6 to generate the debris that you then worry about gets
7 plugging for the largest one.

8 So there's an inconsistency between the
9 debris --

10 MEMBER BANERJEE: This is long-term
11 cooling remember.

12 MEMBER CORRADINI: Well, but it doesn't
13 matter. If they're limited by peak clad temperature
14 and that drives them for a certain break that then
15 they have to show long-term cooling, there is not the
16 same debris loading from that same thing. It's the
17 biggest of the two together.

18 MEMBER BANERJEE: Well, there are two
19 separate criteria for the analysis.

20 MEMBER POWER: If we are going to rehash
21 issues that have been known for five years, it's going
22 to take a long time to get through this.

23 MEMBER CORRADINI: I just want to make
24 sure I understood. I'm sorry.

25 MEMBER BLEY: Well, I'm sorry, but I have

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to ask one regardless. Two related questions. How
2 big was the Barsaback break?

3 And, two, was there an experimental
4 program to look at different kinds of breaks and what
5 kind of debris is generated by them with different
6 kinds of insulation or is it all analysis?

7 MR. HARRISON: Again, I think Barsaback
8 wasn't actually a physical break.

9 MEMBER BROWN: It's a pilot operated
10 relief valve.

11 MEMBER BLEY: Okay.

12 MR. HARRISON: In a steam line.

13 MEMBER BLEY: But that's not a really big
14 pull, and it generated a whole lot of debris.

15 MR. SMITH: The break process, since there
16 hasn't been a lot of evaluation about what different
17 breaks would create, you know, different debris, we
18 try to be conservative with that, with our break
19 selection and pre-generation evaluation.

20 MEMBER BLEY: In centrally analysis or
21 were there experiments done?

22 MR. SMITH: There was some experiments
23 done to determine different zones of influences or,
24 you know, what pressure it would take to create
25 damage for certain types of debris. There was

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 experiments done for that.

2 MEMBER BANERJEE: I think the Committee
3 should know that ACRS considered this in a lot of
4 detail in the past and had some concerns about certain
5 things which I don't want to go into right now, but
6 let's say that we have an agreed on sort of
7 methodology for generating debris in how to do this
8 stuff on this side, on the generation side.

9 MR. HARRISON: If I may go ahead on the
10 integration review team, the team consists of three
11 senior technical staff, including senior level SLs.
12 The membership of that has only been five members in
13 total. One has only reviewed one IRT. There has been
14 one member that's been on every one of the IRTs and
15 another member that's been, I think, on every one
16 except for one IRT.

17 So the goal there is to have a consistent
18 team membership, to do a holistic review. Again, they
19 step back from the actual review. They review the
20 application, the information from the licensee, the
21 staff's detailed review. They look at the RAIs. They
22 interact with the staff to make sure there's
23 understanding on both sides on what's being sought
24 through the RAIs, and they make a determination
25 regarding the need for pursuing additional information

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 or if there's adequate, sufficient information to
2 support reasonable assurance that the sump performance
3 is achieved.

4 Currently we're about halfway through the
5 IRT phase as we've progressed towards plant reviews
6 that have considerably more fiber. We've been doing a
7 screening process on the IRT that an IRT member leads
8 this effort. He believes that because of the fiber
9 amount or for other reasons, that we will for sure be
10 going back to the licensee with RAIs. We'll, if you
11 will, by pass the IRT and just go straight to
12 requesting the additional information.

13 MEMBER APOSTOLAKIS: So this sub-bullet,
14 staff has informed several licensees with more fiber
15 that the staff has a few RAIs. That's what you mean,
16 a few RAIs.

17 MR. HARRISON: Yeah, it has a few.

18 MEMBER APOSTOLAKIS: A few. It makes a
19 big difference.

20 MR. HARRISON: Yeah, yeah. For those
21 plants that are low fiber, typically --

22 MEMBER APOSTOLAKIS: It does.

23 MR. HARRISON: -- we've had a few plants
24 that have just gotten a very limited number of RAIs.
25 We've had one licensee for their plants that did not

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 get any RAIs. Most other plants have received RAIs or
2 will receive RAIs, and in addition, we have a place
3 order RAI dealing with the in-vessel downstream
4 effects since it's still, I'll say, under development,
5 under consideration.

6 MEMBER BANERJEE: There is one plant, I
7 think, that has got yeses in both. I was looking at
8 the chart, right? So even one of those doesn't have
9 any downstream effect.

10 MR. HARRISON: Right. There's one plant
11 that has so little fiber that they were informed that
12 we would not be pursuing any RAIs related to the
13 strainer or downstream effects. So that licensee's
14 three plants is where the staff believes is pretty
15 much through the process.

16 MEMBER BLEY: Given they had so little
17 fiber, did they also though have to put in a bigger
18 strainer?

19 MR. HARRISON: They also installed a
20 larger strainer. That's the counterbalancing.

21 For closure of these issues as we go
22 through, the staff reviews the supplement information,
23 the licensee's RAI responses in accordance with that
24 process that I laid out earlier. The regions inspect
25 the implementation of any modifications or any other

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 commitments for procedure changes or whatever.

2 After a licensee provides sufficient
3 information to be determined to have closed the issue,
4 we'll --

5 MEMBER APOSTOLAKIS: This is a judgment at
6 this time.

7 MR. HARRISON: This becomes a judgment of
8 the staff, and it's the staff, the IRT, and the
9 management become aligned on closing out the issue.
10 At that point then we'll issue a closure letter to
11 individual plants.

12 After we close the issue for all the
13 plants, then we'll formally close the generic letter.

14 Recognize that even after we close the generic
15 letter, some plants may have to perform plant
16 modifications to be able to be at the right place to
17 support the closure, and they'll make commitments for
18 maybe future outages to take out fiber or something
19 like that to match. Those future activities would be
20 tracked under the normal NRC commitment tracking
21 approach.

22 Our expectation, our plan is to complete
23 all of the technical reviews by next year to support
24 closure of the issue.

25 With that I'll turn it over to Steve Smith

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to talk about the sump strainer testing.

2 MR. SMITH: Good morning. Steve Smith of
3 NRR.

4 This is what we're going to talk about
5 this morning. First, just a quick overview. The
6 plants and vendors for the plants are doing plant
7 specific strainer testing to insure that their ECCS
8 and containment spray systems will function during
9 recirculation. The staff has witnessed testing at
10 these vendors and we've applied the lessons learned to
11 assessment of the testing and also applied the lessons
12 learned to our review of their submittals and to some
13 guidance that we put out.

14 Today we're going to talk about the
15 observations that we've made, the lessons learned
16 regarding head loss testing, a little bit about the
17 review guidance we put out, and a little bit about our
18 review of the responses in the head loss area, and how
19 we see things going forward.

20 Okay. We have witnessed a number of head
21 loss tests at each vendor, and we've been on about 25
22 trips and we've been to at least each vendor one time.

23 Each vendor we've seen at least one time, and the
24 ones that we've only seen once only did a limited
25 number of tests.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 The lessons learned from watching this
2 testing, we've incorporated into the review guidance
3 that we put out for testing and evaluation of the
4 testing. And we've also incorporated the lessons
5 learned into a review of the licensee's generic letter
6 submittals.

7 And because of the significant unknowns
8 that we encountered with the head loss testing and
9 evaluation area, we pushed the vendors and the
10 licensees to use conservative test methods and
11 conservative evaluation of the results.

12 Most strainer vendors or testers, since
13 not all the testers are vendors, have now developed
14 what we consider to be acceptable test practices for
15 testing the strainers. Some vendors haven't come up
16 with a protocol that we consider to be approved. We
17 just haven't seen enough from them that we consider
18 the protocol to be conservative.

19 And the licensees that use what we
20 consider to be what we haven't approved or what we
21 haven't accepted as a good test practice, they may try
22 to justify the use of this, but in order to do that,
23 they're going to have to answer some questions and
24 show us that they actually had a conservative test
25 that they ran when they tested their strainer.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 And we believe that some licensees are
2 going to have to retest in order to show us that their
3 strainers will function properly.

4 Okay. These are the major lessons learned
5 that we learned when we went out to look at the
6 strainer testing. I just listed four of the major
7 ones there.

8 The first one is debris preparation, and
9 what we had learned is that, in general, vendors had
10 been using the generic debris preparation where most
11 of them would just throw it through a leaf shredder
12 and then they'd say, "Okay. That's what we're going
13 to test our strainers with."

14 And what we found was that the debris
15 sizing that they were coming out with after they threw
16 it through the leaf shredder was not matching what
17 their transport evaluation said would end up at the
18 strainer. It was generally coarser and we found that
19 finer debris ends up with a more conservative or it
20 will give you higher head loss if you test with finer
21 debris.

22 The second one is the debris introduction
23 methods. Even if they prepared the debris properly,
24 they might put the debris into whatever they're going
25 to put it with the test, with a bucket or something

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 like that, and if they didn't have enough water with
2 it, it would just -- even if it was prepared finally,
3 it would agglomerate into like a large clump, and it
4 might just -- when they put it in, it might sink to
5 the bottom of the flume. It wouldn't transport
6 conservatively and get on the strainer in a fine,
7 uniform bed, which would create the most head loss.

8 MEMBER CORRADINI: This was probably said
9 in the Subcommittee, and I forgot or missed it.

10 MR. SMITH: Okay.

11 MEMBER CORRADINI: Has any of you done a
12 test where they actually try to obliterate the
13 insulation with a blow-down? So actually you have a
14 real blow-down with a real sphere of influence so that
15 you see what you really produce?

16 MEMBER BANERJEE: There were experiments
17 done.

18 MR. SMITH: Yeah, there was some testing
19 done. Back in the BWR days the majority of the
20 testing was done.

21 MEMBER CORRADINI: Oh, was there?

22 MR. SMITH: Now, that debris wasn't taken
23 from that and then put into the test. That was
24 just --

25 MEMBER CORRADINI: Characterizing the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 morphology.

2 MR. SMITH: That's correct.

3 MEMBER CORRADINI: Fine. Thank you.

4 And that's where you did the comparison.

5 MEMBER BANERJEE: Just to give you -- this
6 is not a completely closed subject, the
7 characteristics of the debris.

8 MEMBER CORRADINI: Okay. I just couldn't
9 remember. I figured it --

10 MEMBER BANERJEE: There was some two-phase
11 jet testing done and some air testing.

12 MEMBER CORRADINI: Okay.

13 MR. SMITH: The third area was thin bed
14 test protocol. Thin bed may be a new concept to some
15 people. Basically what you're doing when you look for
16 what we call a thin bed is you're looking for a given
17 amount of fiber to become saturated with particulate
18 debris. When the fibrous debris becomes saturated
19 with particulate debris, it creates a very dense and
20 high head loss bed.

21 So if you have a lot of fiber with a
22 relatively low amount of particulate debris, it may
23 create a much lower head loss than if you have a
24 smaller amount of fiber with the same amount of
25 particulate debris that creates a very dense bed.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: This is addressing your
2 question, George, about it doesn't have to be the
3 largest break, which gives you a lot worse effect.

4 MR. SMITH: That's correct.

5 MEMBER APOSTOLAKIS: But it's still large.
6 Let's settle that.

7 MEMBER BANERJEE: Well, large, yes.

8 MR. SMITH: If it requires recirculation,
9 it's going to be a relatively large break. I mean, it
10 could be not huge, maybe six inches or so. I don't
11 know. Different plants are different.

12 MEMBER APOSTOLAKIS: Be as low as six
13 inches?

14 MR. SMITH: Maybe. It might still require
15 a --

16 MEMBER APOSTOLAKIS: -- minus four, three.

17 MEMBER BANERJEE: It certainly could be a
18 line which is leading to the pressurizer or something
19 breaking off. That would be sufficient.

20 MEMBER APOSTOLAKIS: It would create
21 debris of this magnitude and all of that, I mean?

22 MEMBER BLEY: If the relief valve created
23 that kind of debris, George, that's a smaller hole
24 than they're talking about here.

25 MEMBER BANERJEE: I think we should

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 separate these two issues right now. I think we
2 should proceed to understand that this is a real
3 problem, and let's not try --

4 MEMBER APOSTOLAKIS: -- design basis case.

5 CHAIRMAN SHACK: We need to understand
6 regardless of what break size we're addressing. So if
7 we could just keep going.

8 MR. SMITH: Okay. So we understand what a
9 thin bed is. What we found is that the introduction
10 order can have an effect on the amount of head loss.
11 The amounts of debris need to be considered. The
12 ratio of the fibrous debris to the particulate debris,
13 and the debris sizing needs to be also considered. In
14 general, we think the fine debris is more likely,
15 again, to give you a higher head loss.

16 The other thing is that we do insure that
17 all licensees perform within bed tests because we
18 think that could be the most limiting test for a lot
19 of plants.

20 The other thing that we saw issues with
21 was test flume flow patterns. Some plants use
22 stirring in order to keep the debris in suspension, to
23 make sure that it all transports to the strainer,
24 which we consider to be conservative. That's a good
25 thing, but on the other hand, if you have to much

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 turbulene created by the strainer, you can be washing
2 debris off your strainer. Things like that can
3 happen. So we have to be very careful of how we
4 introduce the turbulene that keeps the debris in
5 suspension.

6 There's other issues that we saw that the
7 test plume didn't really model how the strainer is in
8 the plant. Some strainers are down in sump pits. So
9 they have a very confined space around them where some
10 are laid out on the floor. So we had to take that
11 into consideration.

12 And I think the point that I'm trying to
13 make here is that we've looked pretty hard at the
14 tests, and we've learned some lessons, and we've
15 incorporated into the work we're doing.

16 Now, here is a --

17 MEMBER BANERJEE: I think you went over
18 something quickly or not at all, which is the
19 similarity to the previous slide, plant conditions,
20 and I think the Committee should know that the
21 Subcommittee had concerns about how that last bullet
22 there could be sort of achieved because it's not very
23 easy to have similitude, and one of the points Mike
24 Corradini made at this meeting was that it might be
25 worth looking at this at two different scales to see

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 whether, in fact, scale had an effect or not in terms
2 of the phenomena.

3 As far as we know, no real attempt to
4 scale things at all have been done up to now; is that
5 correct, Steve, or do you have some experiments that
6 are different?

7 MR. SMITH: Well, we've seen a number of
8 experiments done with various scaling. What we call
9 scaling is the ratio of the test strainer to the size
10 of the plant strainer basically based on area.

11 MEMBER BANERJEE: Yeah, we realize. We
12 were talking with more hydrodynamic scaling because of
13 this issue with settling and things which arose, if
14 you recall, in the meeting. Strainers where you stir
15 everything up, test them, there was no issue.
16 Everybody felt this was likely to be conservative.

17 However, some designs it was necessary to
18 take into account settling on the way to the strainer,
19 and in fact, people were taking advantage of that in
20 some way in their testing.

21 MR. SMITH: Yes.

22 MEMBER BANERJEE: And there was concern
23 whether these tests were actually representative of
24 what might happen in the plant, given that the scales
25 in the plant are much larger, and therefore, could

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have phenomena which were --

2 MR. SMITH: I understand, and I think we
3 were talking about Reynolds numbers and things like
4 that, and what our position has been is that we have
5 asked the vendors to create at least the same
6 elasticities and turbulence levels, and I can't
7 address, you know, anything --

8 MEMBER BANERJEE: That's fine. He
9 suggested just stir it up as well and see if it works.

10 MR. SMITH: Right, right.

11 MEMBER BANERJEE: You know, that's the
12 easiest way.

13 MR. SMITH: We have seen these tests that
14 the last element end up with extremely high head
15 losses. So we know that --

16 MEMBER BANERJEE: They have to do
17 something else.

18 MR. SMITH: -- that transport is occurring
19 in these tests. The other thing that we know about
20 these tests is that the tests that allow transport,
21 we've been somewhat stricter in the rules, you know,
22 the way we allow them to introduce the debris into the
23 strainer, into the test flume before it gets to the
24 strainer. We've been somewhat more strict. We have a
25 little bit stricter rules on chemical effects and how

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that particulate chemicals can settle and things like
2 that.

3 MEMBER BANERJEE: How many plants are
4 coming under this problem where they have to appeal to
5 settling in order to get adequate performance?

6 MR. SMITH: I wouldn't characterize it as
7 they have to do it. This is just the way that their
8 strainer vendor is testing.

9 MEMBER BANERJEE: Right.

10 MR. SMITH: But I'd say probably 15 plants
11 may be using this type. That's just a rough number.
12 There's only two vendors that I'm aware of that use it
13 and one vendor only does it sometimes.

14 MEMBER BANERJEE: Okay. Well, I think
15 that's good enough. Let's move on.

16 MR. SMITH: Okay. We were looking at the
17 picture. This is a picture of even though this debris
18 was prepared as fine debris, it shows how it has
19 agglomerated. Because they did not have enough water
20 mixed in with the debris you have a big clump of
21 debris and excessive settling of the debris can occur,
22 and like we've said before, this when it goes into the
23 flume is a big clump. It's less likely to get on the
24 stringer and cause the conservative head loss.

25 MEMBER ARMIJO: Does that have any

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 aluminum in there? That looks all fibrous.

2 MR. SMITH: That's just fiber. That is
3 basically Nukon, Nukon fiber.

4 I think we've got to go to the movie next.

5 The next one we're going to show you, this
6 is a short movie. It's what we consider to be an
7 appropriate debris addition, and you can see that when
8 this debris goes in, it is going to basically be a
9 cloud in the water. Some of you guys have seen this
10 before.

11 And this also gives you an idea of what
12 the test flume flow is like. The flow rate in this
13 flume models what the flow rate would be in the plant.

14 So you have an idea of what the flow rate is here,
15 and you can see that this is very fine debris. This
16 is what we consider will be the highest head loss on
17 the strainer.

18 MEMBER BANERJEE: You didn't mention
19 anything about chemical effects. I know there's
20 another presentation, but obviously you're integrating
21 some chemical effects in here, right?

22 MR. SMITH: Yeah. In general the chemical
23 effects, first, the fibrous and particulate debris are
24 added to the strainer. The chemical effects usually
25 will not occur until later in the event. The

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 corrosion has to take place. The chemical reactions
2 have to take place, and then the worst chemical
3 effects, which are the aluminum state, actually have
4 to get the sump temperature down quite a bit before
5 they come out of solution.

6 And I think Paul will discuss --

7 MEMBER BANERJEE: But in these tests, do
8 you add surrogates in order to later in the test see
9 what effects they would have?

10 MR. SMITH: In general, the surrogates are
11 not added until later on. There is some testing, and
12 Paul will go over the different types of testing that
13 are done.

14 MEMBER BANERJEE: But is not part of this
15 prototype tests the chemical effects?

16 MR. SMITH: After the particular in-fiber
17 goes on the strainer, they have a head loss for that.
18 Then they put the chemicals in.

19 MEMBER BANERJEE: So it's done in series.

20 MR. SMITH: Yes.

21 MEMBER CORRADINI: So just one question
22 just to nail down the understanding. So the way these
23 are designed is they try to maintain some given
24 turbulence level as pre-predicted by some calculation
25 and velocity.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: For this particular test, only
2 what is the same as the plant, as the strainer
3 approach velocity. So the velocity at which it
4 approaches the screen.

5 MEMBER CORRADINI: Yeah, I'm with you.

6 MR. SMITH: That's the only thing in this
7 particular test because they don't allow settling.
8 Now, if any debris settles, they stir it up. So it's
9 going to get on the strainer.

10 MEMBER CORRADINI: Okay, all right. So
11 it's strictly the approach velocity to the screen.

12 MR. SMITH: Yes.

13 MEMBER CORRADINI: Thank you.

14 MEMBER BANERJEE: Paul has a comment on
15 the chemical test in particular.

16 MR. KLEIN: Paul Klein from NRR.

17 I just wanted to add one clarification.
18 All of the tests that Steve's referring to have
19 chemical addition at some point in the test. So the
20 test that he describes all incorporate chemical
21 effects one way or another.

22 MEMBER ARMIJO: In the picture, in the
23 video, you showed three different editions. Are those
24 three different types of debris? One, the fibrous
25 first and then maybe the aluminum involved second?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: It was two different types of
2 debris and not all went in. They didn't want to put
3 it all in the bucket at the same time. So they had to
4 split it up, but, yes, first was the fibrous debris,
5 and then comes the particulate debris, which it's a
6 surrogate for paint basically coatings, and then
7 third, other things that would be in --

8 MEMBER ARMIJO: And the aluminum or
9 dissolved aluminum?

10 MR. SMITH: Yes, aluminum. Now, okay.
11 Any aluminum paint would be in there, but then the
12 dissolved aluminum components that are chemical
13 effects, that comes later.

14 MEMBER ARMIJO: And that's a protocol that
15 you endorse, to do it in that sequence?

16 MR. SMITH: Yes.

17 MEMBER ARMIJO: Okay.

18 MEMBER BANERJEE: I think that could also
19 be CalSil or something, the particulate stuff, right?

20 MR. SMITH: Yes, it could be. In this
21 particular case it wasn't, but yes.

22 MEMBER BANERJEE: It depends on the plant.

23 MR. SMITH: Yes. It could be CalSil,
24 MicroTherm, NK, all of those bad things.

25 MEMBER BANERJEE: Okay. Let's go.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER ABDEL-KHALIK: Do the experiments
2 scale the total inventory of the debris to the total
3 inventory of water in the containment, the ratio
4 between the two?

5 MR. SMITH: No. In general the debris and
6 the testing is more concentrated because the volume
7 ratio is much -- there's a lot more volume in the
8 containment per debris than there is volume per
9 debris. I mean, it's just too hard to build a test
10 flume that big, you know, unless you put a really
11 small strainer in there, which would create other
12 issues.

13 MEMBER BANERJEE: Debris scaled to the
14 strainer area. That's more --

15 MR. SMITH: The debris is scaled to the
16 strainer area.

17 MEMBER BANERJEE: The volume of the water
18 is not scaled to the strainer.

19 MR. SMITH: That's correct. In general, I
20 would say that the volume of water is much lower. So
21 you have more concentration of debris.

22 The head loss testing review guidance,
23 this is something that we put out updated guidance in
24 March of 2008. It has incorporated the lessons
25 learned from our industry head loss testing that we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 talked about earlier. It is publicly available so
2 that the vendors and the licensees can reference it
3 when they're doing their testing and doing their
4 evaluation of the data.

5 And we believe that tests and evaluations
6 that are conducted in accordance with this guidance
7 will end up with a conservative result for a strainer
8 qualification.

9 On our path forward, we're going to look
10 at plants that have RAIs, and they're going to have to
11 provide acceptable responses, and this is going to
12 require some additional analysis and may require
13 additional testing for the plants. Some licensees
14 that have had unacceptable results with their current
15 or their most recent testing are now doing what we
16 call -- they're coming in since they didn't pass.
17 They're asking for an extension, and what we do at
18 that point is we say we're asking them to test for
19 success. That's our term, and what that means is
20 they're going to test various plant configurations,
21 debris loads, whatever it takes until they come up
22 with an acceptable head loss for their strainer. Then
23 they will know what modifications they need to make to
24 the plant, and they'll go and do those, and that may
25 require a modification, analytical changes, testing.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Different things for them to be able to show that
2 their strainer will work.

3 And in the conclusions, we talked over all
4 this stuff. We think that the testing methods have
5 improved. Some licensees have demonstrated acceptable
6 strainer performance. Some licensees have not and
7 they're working to reduce their debris loads, and they
8 may have to do some retesting, and some licensees are
9 going to attempt to stand on the older test methods,
10 and these licensees are going to get some RAIs, and
11 we're just going to have to evaluate the RAIs, the
12 answers to the RAIs as they come in.

13 MEMBER BANERJEE: So I have sort of a
14 general comment to make about this. So if you look at
15 these tests, they are quite conservative. So in the
16 sense that they are going to give you the highest head
17 losses, but they don't necessarily give you what is
18 going downstream realistically because as I said, they
19 are two screens in series here, and we're not testing
20 these two screens together. Okay? We're testing one
21 screen and they're going to test the other screen,
22 which is the core.

23 So the conditions passing from one screen
24 to the other, if you're conservative with the first
25 screen, you might get less going to the core. So one

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 has to be careful and keep this in mind because we
2 revisit this point at the end of this discussion.

3 MR. KLEIN: Good morning. I'm Paul Klein
4 from NRR.

5 I have four slides here to talk about
6 chemical effects, and before I get started on those,
7 which are pretty much a snapshot of where we are at
8 this point, I thought I'd just spend a minute talking
9 a little bit about where we were. I understand we
10 don't have a lot of time, but initially a concern
11 about chemical effects was raised by the ACRS in
12 either late 2002 or early 2003. Because of that,
13 there was some initial scoping studies done at LANL
14 and then the ICET test series was started in around
15 2004-2005 time frame.

16 Those tests pretty much showed that under
17 certain conditions some combinations of plant
18 materials and buffers could cause certain chemical
19 precipitates to form. Those tests really were to see
20 if there could be an issue.

21 As a result of those tests, the NRC also
22 sponsored some work at Argonne National Lab, and the
23 focus of those tests were to try and evaluate the head
24 loss consequences of these type of amorphous
25 precipitates if they were to form in the post-LOCA

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 environment.

2 So that work went on roughly in the 2005-
3 2006 time frame. We saw that these products could
4 cause significant head loss under the right set of
5 conditions with a filtering debris bed, and that sort
6 of led onto additional tests by industry, and that's
7 what I'm primarily going to talk about today, is the
8 work that industry is currently doing as well as some
9 additional work that we've done at Argonne National
10 Lab.

11 Next slide.

12 At this point, you know, industry has
13 taken a number of different approaches to chemical
14 effects testing. It's very vendor specific. There
15 are predominantly three different methods that they
16 use to generate precipitates in a test group. One is
17 to use a Westinghouse topical report methodology that
18 prepares precipitate outside the test loop. It's
19 premixed, and then it's added to the test flume or
20 test tank after the debris bed is established.

21 The second basic approach is to actually
22 form precipitates in the test loop by chemical
23 addition, and the third type that we call evolving
24 chemistry is done one of two ways, either by putting
25 all plant materials, including aluminum and metallic

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 coupons in a 30-day test at temperature and at the
2 appropriate pH levels, and the other is to form the
3 debris bed within the long-term test, but then add the
4 aluminum by metered additions of dissolved aluminum
5 rather than using metallic coupons.

6 We have been very involved with the
7 different vendors. We've observed tests at each of
8 these sites, and we've had multiple interactions to
9 try and understand their test procedures and to try
10 and assure ourselves that each vendor has a
11 conservative approach and that there has been review
12 guidance that we've issued in September of last year.

13 We also issued a safety evaluation on the basis
14 industry WCAP topical report that talks about chemical
15 effects.

16 Because it has been such a challenge,
17 staff has also tried to bring in some additional
18 technical expertise in the chemical effects area, and
19 in addition to earlier work that was sponsored b the
20 Office of Research, at LANL and ANL and also Southwest
21 Research, we have more recently asked Argonne National
22 Lab to perform some more NRR specific type tests to
23 evaluate different pieces of some of these approaches,
24 and we've also brought in additional expertise from a
25 company that is named EMS, but in particular, their

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 expert is Dr. Bob Litman, who has been in industry for
2 a number of years and provides additional chemistry
3 expertise.

4 Next slide.

5 Of the two major pieces that we've had
6 Argonne evaluate within the last two years, one of
7 them has been to try and compare the head losses from
8 precipitates formed in a number of different ways, and
9 so they've done that in their vertical head loss loop.

10 And we have in this slide a relative
11 ranking of what we've seen. So we've used the WCAP
12 methodology to generate their two different types of
13 aluminum precipitates. We've also used the in situ
14 formation by adding chemicals, and we also put in in
15 one test or actually a couple of tests, aluminum
16 coupons and elevated temperature, high pH conditions
17 to corrode the aluminum and then use the temperature
18 changes to cause precipitation.

19 And I think the key point that we want to
20 show there in this slide is that the industry
21 approaches tend to be more efficient at driving head
22 loss compared to a version of the aluminum coupons.
23 The bottom line there, the WCAP sodium aluminum
24 silicate high purity water is really not relevant to
25 industry test since they don't use high purity water

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 for their type larger scale tests.

2 Next slide.

3 In addition to the head loss test, we have
4 been asked to go on to perform a series of benchtop
5 type tests to evaluate different parameters that we
6 think may be important to chemical effects, and this
7 slide here is trying to show a plot of different
8 solubility type tests that have been done with
9 aluminum. The solid symbols show tests where a
10 precipitate was formed. The open symbols show tests
11 where aluminum remained in solution and did not
12 precipitate, and you can see on the slide that as you
13 go to higher temperatures and also to higher pHs that
14 favors the aluminum staying in solution.

15 What we're plotting is a term on the Y
16 axis which is a combination of pH plus/minus the log
17 of the aluminum concentration. To try and put it in a
18 little better perspective, we tried to plot a pH of
19 eight and 140 degrees where three different data
20 points would show up on this plot. If you could hit
21 that, this would be for concentrations of ten, 50, and
22 100 parts per million.

23 MEMBER BLEY: Are there thoughts that this
24 kind of an idea might lead to some change in emergency
25 procedures for cool-down?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. KLEIN: I guess the driver on trying
2 to do this type of plot, we know from the WCAP
3 methodology is very conservative because it assumes
4 that all aluminum that is dissolved and goes into
5 solution precipitates, and we know from a lot of the
6 earlier tests that's just not reality. Some of it
7 will remain in solution.

8 So we're trying to get an idea about for
9 different plant specific conditions, you know, what
10 would we expect to precipitate and what may stay in
11 solution. So we eventually took this plot and put it
12 into a more user friendly plot that shows solubility
13 as a function of pH and temperature, and we'll use
14 that to inform our reviews of individual plant
15 licensee conditions.

16 MEMBER BLEY: Okay. Back to what I first
17 asked you, do you know if any of the vendors are using
18 this kind of information to adapt their LOCA
19 procedures?

20 MR. KLEIN: I don't know that they're
21 changing, say, the emergency operating procedures as a
22 result of dissolution. I think some of the vendors
23 recognize some of the conservatisms that are in the
24 original WCAP methodology and they've adopted test
25 approaches that might try to take advantage of this.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 For example, in some of the longer, 30-day
2 tests where they allowed the chemistry to evolve, in
3 general they saw much less precipitate than they would
4 have had to accommodate under a WCAP testing
5 methodology.

6 MEMBER BANERJEE: These are all
7 experiments, right?

8 MR. KLEIN: These are all experiments,
9 correct.

10 MEMBER BANERJEE: What is the bottom line?
11 Can you explain its significance?

12 MR. KLEIN: The two lines that were
13 plotted here were just trying to show there might be a
14 difference in behavior depending on temperature. So
15 what we tried to do was develop a bounding solubility
16 line that would accommodate all of the data points on
17 here, including the couple of cases of aluminum
18 coupons that seemed to be somewhat different than some
19 of the other tests, and so the lines take into account
20 the temperature.

21 We probably should have cropped the one
22 more horizontal line to show a bounding type approach.

23 Next slide.

24 In summary, I'd just like to mention that
25 we have been to all the vendor facilities. We have

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 seen in general that the vertical head loss type tests
2 are typically a lot more susceptible to chemical
3 effects compared to the larger scale tests, and we
4 think there's a number of reasons for that, not that
5 I'm going into at this point.

6 Most of the plants that we have talked to
7 and interacted with are using methods that are
8 acceptable to the staff. There is one vendor approach
9 that we recently concluded was not going to provide a
10 conservative approach, and so there is one subset of
11 licensees that are going to be on to a new testing
12 methodology. From the tests that we have seen from
13 both ANL and industry thus far, we think that the WCAP
14 methodology is a very conservative methodology with
15 respect to both the amount of precipitate that forms
16 and that the properties of the precipitates that are
17 used in that approach.

18 We plan on performing in the next few
19 months a few chemical effect audits at licensees. You
20 might be aware that the GSI team went out to about
21 nine or ten plants and performed audits across the
22 board. Our earlier audits were pretty much incomplete
23 in chemical effects because they were in the process
24 of testing. So the staff plans to go back to a few of
25 the more interesting licensees and a variety of test

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 methods and try to take a more complete look at how
2 they do chemical effects.

3 MEMBER CORRADINI: I'm trying to
4 understand what you just said, meaning that -- give me
5 more detail of what you just said. You're going to go
6 back and do what?

7 MR. KLEIN: We will go on site to a few
8 licensees and try to look from the beginning to the
9 end of their chemical effect evaluation to look at the
10 assumptions that they've made.

11 MEMBER CORRADINI: Oh, to understand their
12 analysis.

13 MR. KLEIN: Yeah, basically to understand
14 their complete analysis.

15 MEMBER ABDEL-KHALIK: Is there a big
16 picture metric that you use to rank plants with regard
17 to the severity of chemical effects?

18 MR. KLEIN: One measure that's used if you
19 use the chemical spreadsheet that's within the WCAP
20 16.530, that will predict the total amount of
21 precipitate that's formed in that plant specific
22 conditions, and that's a rough measure of, for
23 example, how much chemical precipitate they might need
24 to deal with.

25 MEMBER BANERJEE: Are any plants changing

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to sodium tetraborate or things like that?

2 MR. KLEIN: There's been, I think, about
3 ten units that have done buffer changes and the most
4 common one is the switch to sodium tetraborate. There
5 has been other switches as well. Depending on the
6 plant specific conditions, if there's a higher calcium
7 load, they tend to switch from trisodium phosphate as
8 a buffer.

9 MEMBER POWER: You're focused on the
10 aluminum hydroxide, gibbsite (phonetic), boromite
11 (phonetic) equilibria, which is always problematic
12 because it's non-equilibrium and things like that.
13 You don't seem to be paying much attention to the zinc
14 hydroxycarbonate.

15 MEMBER BANERJEE: Question. We asked
16 that.

17 MR. KLEIN: I think that's a true
18 statement. Some of the ICET tests and some of the
19 other tests that have been done at temperature and in
20 the appropriate pH range have shown little zinc
21 corrosion compared to aluminum.

22 MEMBER POWER: I mean, that's correct.
23 The aluminum is much more sensitive in basic pH than
24 the hydroxycarbonate, but it does form. I mean, I
25 would think it would be of interest like in the 30-day

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 test, but I certainly don't know.

2 MR. KLEIN: The ICET series had fairly
3 low, which were 30-day tests, had fairly low zinc
4 concentrations compared to some of the other materials
5 that either corroded or leached out of insulation
6 materials.

7 MEMBER POWER: I'm thinking that it is my
8 perception, accurate or inaccurate, that many of the
9 plants are using a zinc primer solely as their
10 coatings for the steel liners, the primer in
11 particular, AP-1000, but I think some of the existing
12 plants also use just the zinc primer coating.

13 That gets you into a redox equilibria, the
14 atmosphere. I mean a condensation draining down from
15 the walls and things like that might load zinc
16 carbonate more extensively.

17 MR. EWER: Matt Ewer from the staff.

18 In regards to coatings, there are some
19 plants that have just the inorganic zinc primer as
20 their coating. The majority are top coated with
21 epoxy, and there are some just epoxy on steel systems.

22 So to say that the majority of the plants
23 are just exposed zinc I think might be a little bit
24 inaccurate, but they certainly are --

25 MEMBER POWER: I really didn't mean that.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. EWER: There certainly are some plants
2 that have that situation.

3 MEMBER POWER: Yeah, I think there's some
4 that use, like you say, just the primer. I mean,
5 there are lots of reasons that you'd want to do that,
6 and I'm just wondering if that would increase the
7 hydroxycarbonate because the dissolution is actually
8 occurring in an acid pH, and then it comes down to the
9 sump where it's basic and precipitates.

10 MR. KLEIN: We did include zinc primed
11 coupons in the ICET in both the submerged condition
12 and in the atmospheric condition, and some of those
13 tests did have initially lower pH spray before TSP was
14 added.

15 MEMBER POWER: Covering it. That's good.

16 MEMBER BANERJEE: What was the pH of the
17 spray?

18 MR. KLEIN: I think it depended on the
19 ICET test, but some of the tests I know the buffer was
20 added after a period of time. So there was pH I think
21 that could have been as low as four and a half or
22 five, I believe, for some period of time.

23 MEMBER BANERJEE: Well, you know, of
24 course, all of the German experience with zinc, which
25 came up as a question in the Subcommittee meeting.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. KLEIN: We are aware of the
2 experience.

3 MEMBER BANERJEE: Yeah.

4 MR. EWER: One more comment in regards to
5 the German experiment. It's our understanding that
6 most of those corrosion products from zinc during the
7 German experiments were just that. They were more of
8 an erosion particulate zinc material, not necessarily
9 a precipitate that came from zinc corroding,
10 dissolving, and then forming some other material.

11 MEMBER BANERJEE: I didn't follow it
12 exactly. So I don't know, but they told me that it
13 came off the ladders and everything. I mean, wherever
14 they had galvanized iron.

15 MR. EWER: Well, our understanding was
16 that that experiment incorporated both flow and
17 chemistry such that most of the material that was
18 causing the head loss was pieces of galvanizing
19 material that was actually eroding off when it was
20 exposed to this high pH, and you know they're in an
21 unbuffered situation as well. So that contributed to
22 some of that.

23 But our understanding from meeting with
24 them was that those were particulate material, not
25 necessarily chemical products.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. KLEIN: I think, to add to Matt's
2 comment, I think the other thing we looked at, there
3 was a time effect with their data, and we concluded
4 that we would not be at that low pH for the extended
5 amount of time that they observed in that test before
6 they did start to see appreciable zinc corrosion
7 products.

8 MR. HARRISON: We'll move on to in-vessel
9 downstream effects, and Steve Smith, again, will make
10 a presentation on this topic.

11 MEMBER BANERJEE: We may want to get you
12 back, Paul, to talk about in-vessel chemical effects.
13 You're not escaping.

14 MR. SMITH: Steve Smith back again.

15 Okay. This is just what we're going to go
16 over today. We're going to talk a little background
17 on the downstream effects, debris in the core, and how
18 it is modeled and testing; how debris loads for
19 testing are determined; and then we have two sets of
20 testing that we're looking at, and one is done.
21 That's Diablo Canyon testing, and the PWR Owners Group
22 is doing some testing over a little bit more wide
23 range of conditions, and we'll talk about that.
24 They're just getting started with that test program.
25 Okay.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: I see no pictures here,
2 Steve. Can't you show us some nice pictures?

3 MR. SMITH: Yeah, we heard you might want
4 to see some pictures. Donnie is going to be ready to
5 give some pictures out here. When you want to see the
6 pictures, let us know.

7 MEMBER CORRADINI: We're a very visual
8 group.

9 MR. SMITH: Okay. WCAP 16.793 is the
10 downstream in-vessel WCAP that was issued to provide
11 guidance to the plants on in-vessel debris effects.
12 That was presented in March to the Thermal Hydraulic
13 Subcommittee and the ACRS raised some concerns with
14 the adequacy of the WCAP and the methodologies and
15 assumptions that went into that.

16 And the PWR Owners Group is now working to
17 provide a more rigorous or a better guidance document.

18 In order to do that, they started a program to test
19 for potential head losses in the core, and they're
20 also addressing some staff RAIs.

21 The testing that they're doing, they're
22 using representative fuel inlet types. There are
23 several inlet nozzle types used throughout the
24 industry and varying debris loads, and when the WCAP
25 is done, when the WCAP is completed, we're going to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 review it, and we're also going to keep track of the
2 testing that goes on that the PWR Owners Group is
3 doing.

4 MEMBER ARMIJO: Those are the various
5 types of debris filters that the fuel manufacturers --

6 MR. SMITH: Yes.

7 MEMBER ARMIJO: There's several types.

8 MR. SMITH: Yes.

9 MEMBER ARMIJO: Areva stuff, Westinghouse
10 stuff.

11 MR. SMITH: Areva, yeah. Areva has, I
12 think, four different types, and Westinghouse has two
13 plus a CE one, which is somewhat similar to theirs.

14 MEMBER ARMIJO: Right.

15 MR. SMITH: So the Westinghouse and the CE
16 ones are relatively similar. The Areva ones are a
17 little bit more wide ranging in the way that they work
18 and the way they look.

19 MEMBER ARMIJO: Right. All of those have
20 to be tested in this program or evaluated in some way?

21 MR. SMITH: Yes, they'll all be evaluated,
22 and I think what the PWR Owners Group may do with a
23 different inlet nozzle type, they have two separate
24 programs, one for the Areva and one for the CE,
25 Westinghouse, and they may try to determine which is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the limiting -- which gives the limiting head loss
2 when debris gets on it and then just test further with
3 that.

4 MEMBER BANERJEE: But there's also the
5 problem with the spacers and the grids as you go up,
6 right?

7 MR. SMITH: Yes.

8 MEMBER BANERJEE: So those are also
9 somewhat --

10 MR. SMITH: What we've seen is that the
11 debris doesn't just collect on the inlet nozzle. It
12 collects throughout on the grid spacers and whatever
13 the flow diverters that they have to keep the water
14 stirred up on the fuel. So, yeah, it all plays into
15 the equation.

16 MEMBER BANERJEE: All sharp, sort of
17 pointy things are very good fiber catchers.

18 MR. SMITH: Okay. Debris at the fuel
19 inlet. The debris that gets to the core is a plant
20 specific thing. It can include all of the debris that
21 we've talked about already, fibrous insulation
22 materials, coatings, chemical effects, all that has to
23 be considered.

24 The fibrous debris that gets to the core
25 is determined by testing that's done by the various

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 strainer testers. They do bypass testing to determine
2 how much fiber is going to get by their strainer.

3 MEMBER ARMIJO: These chemical, when they
4 go through the core, you have all of that gamma
5 radiation. Do they change in the dissolved or
6 flocculated aluminum hydroxide?

7 MR. SMITH: I couldn't tell you. There's
8 been --

9 MEMBER ARMIJO: Any testing that says,
10 "Hey, look. If it goes through it's going to keep in
11 solution or flocculated"?

12 MEMBER BANERJEE: That's why I said Paul
13 doesn't get off the hook.

14 MR. SMITH: We'll let Paul.

15 MR. KLEIN: Okay. Paul Klein.

16 The effect of temperature has been pretty
17 well characterized with these materials, but not the
18 effects of radiation.

19 MEMBER POWER: Yeah, I can't think of
20 anything more stable. I mean, if I had to run things
21 into a radiation field and hope that they came out
22 intact, that would be my choice.

23 MEMBER BANERJEE: But, Paul, there was a
24 concern about reverse solubility, particularly with
25 things like calcium, right? Can you address that?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. KLEIN: Yes. I think, you know, when
2 we looked at some of the precipitates that could form,
3 that calcium base could have retrograde solubility,
4 which would encourage them to deposit on hotter areas.

5 The aluminum base tend to be more likely to go into
6 solution at elevated temperatures.

7 MEMBER BANERJEE: So what happens with
8 plants where there is some high calcium loading?

9 MR. KLEIN: The LOCA DM model, i think,
10 tries to deposit those according to the power density
11 at given locations in areas where you have hotter
12 conditions, where you might have boiling. You get
13 more rapid deposition.

14 MEMBER BANERJEE: Well, that's barter
15 (phonetic) fuel modeling effort.

16 MR. KLEIN: That's part of the owners
17 group DM code.

18 MEMBER BANERJEE: Okay. Go ahead.

19 MR. SMITH: Okay. The fibrous debris
20 that's used in the testing actually is not just what's
21 used in strainer testing. It's representative of what
22 would bypass a strainer. So what has bypassed a
23 strainer has been looked at. We k now what the size
24 distribution is, and that's what they assume gets to
25 fuel when --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: When you come back to
2 this I have some concerns about this.

3 MR. SMITH: Okay.

4 MEMBER BANERJEE: But let's table it at
5 the moment.

6 MR. SMITH: Okay. And the testing to date
7 has assumed that there is no filtering occurring on
8 the strainer, okay, because the debris has to go
9 through the strainer, through the pump and then get
10 into the core. So it's assuming that all of the
11 particulate debris has made it through the strainer
12 and all of the chemical debris has made it through the
13 strainer, and that's a conservative assumption because
14 we're basically assuming that all of that gets to both
15 places.

16 And the chemical loading in the testing
17 that has been done has been determined by the WCAP
18 16.530 that Paul discussed earlier.

19 Okay. The vendor fiber bypass testing
20 on --

21 MEMBER BANERJEE: I wanted to qualify this
22 for the Committee by saying that there's a certain
23 size distribution which is assumed getting through.

24 MEMBER CORRADINI: But that is more, as
25 you said, assumed. It is not calculated or estimated

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 from other testing.

2 MEMBER BANERJEE: That's correct. So if
3 you get longer fibers through, clearly, it has a very
4 different effect from shorter fibers.

5 MEMBER CORRADINI: I just want to make
6 sure. Is what I just said wrong or is that true?

7 MEMBER BANERJEE: What?

8 MEMBER CORRADINI: That there's an assumed
9 distribution.

10 MEMBER BANERJEE: It's an assumed
11 distribution.

12 MR. SMITH: The distribution that is
13 created for the testing is based on fiber that has
14 bypassed the strainers.

15 MEMBER CORRADINI: Oh, okay.

16 MR. SMITH: So we know basically what the
17 size distribution that gets past the strainer is, and
18 it's probably a little bit different depending on the
19 strainer, but --

20 MEMBER BANERJEE: That's why I need to
21 tell you about my strainer experiment later.

22 MEMBER MAYNARD: Well, it's my
23 understanding in the strainer testing through the main
24 strainer that they do not only CAP, but they also
25 measure the size of the particles that are bypassing.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: That's correct, yes.

2 MEMBER BANERJEE: Yeah, but it's after
3 sort of recirculation. They call it a cumulative
4 number, but I'll comment on that in a while because
5 there's some issue there.

6 MEMBER MAYNARD: Do they take that at a
7 couple of different stages or is it only after
8 everything is done that they take what's left to
9 measure?

10 MR. SMITH: All right. The next bullet,
11 the downstream sampling methods, there's basically two
12 ways that they get the downstream samples. Either
13 they take a grab sample, you know, every once in a
14 while or they set up a bag filter downstream and they
15 catch everything. So that's the two different ways
16 that they would collect the samples.

17 MEMBER BANERJEE: But I think his question
18 is a germane one because are you sampling in time as
19 you go down and looking at how the fiber size
20 distribution is changing or are you just -- because
21 the concern is always with the long fibers.

22 MR. SMITH: Okay. Well, I don't think
23 that I have -- I'm not aware of anybody who does that.
24 I'm aware that they do --

25 MEMBER BANERJEE: I'll tell you about my

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 two D-strainer experiment after this.

2 MR. SMITH: When you filter, when you're
3 catching everything downstream, of course, you don't
4 know when it got there. You're just catching
5 everything. When you do the grab samples, you could
6 possibly determine, you know. You could take and look
7 at each one and say, you know, right after the event
8 happened we got bigger through -- which is probably
9 true.

10 CHAIRMAN SHACK: Yeah, but the question is
11 whether you take the first grab sample before it
12 recirculates. You take the first grab sample on the
13 first pass-through.

14 PARTICIPANTS: Right.

15 CHAIRMAN SHACK: and that, I think, is the
16 question.

17 MEMBER BANERJEE: And until you get long
18 fibers through.

19 CHAIRMAN SHACK: Well, whatever you get
20 you get, but you clearly need to make a grab sample
21 before it recirculates in order to address that
22 question.

23 MEMBER BANERJEE: You put your finger on
24 exactly the issue.

25 MR. SMITH: And I think that there is grab

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 samples that are taken on the first pass, and then
2 generally what they do is they take them very
3 frequently, maybe every minute or every two minutes,
4 and then as time goes on, ten minutes, every hour, you
5 know, just because there's so much less debris getting
6 through.

7 CHAIRMAN SHACK: Well, I guess what we
8 need is not so much what you think happens, but what
9 does happen.

10 MR. SMITH: I see John coming over here to
11 help me out.

12 MR. LENNING: This is John Lenning.

13 What Steve says is correct. There are
14 some vendors that do that testing. I've seen results,
15 I think, from PCI, is one, and ACL is another, and
16 then there are some vendors that do a cumulative
17 without time information.

18 CHAIRMAN SHACK: But if you've got a bag
19 filter and it's truly cumulative, that's fine, but
20 what you don't want is some guy running a grab sample
21 on the third pass, on the seventh pass.

22 MR. LENNING: We understand that, and we
23 look at that one.

24 MEMBER BANERJEE: Clearly, there are
25 designs with low bypass of these.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: they've got the steel wool in
2 them basically to cut the bypass.

3 MEMBER BANERJEE: Okay.

4 MR. SMITH: Well, after they collect the
5 debris, they dry it, and they weigh it to determine
6 the mass, and then they determine the size
7 distribution, and the PWR Owners Group is on the hook
8 after our last Subcommittee meeting to get us some
9 fiber bypass data, and we'll forward that to you guys
10 once we get it.

11 Okay. The Diablo Canyon fuel testing.

12 MEMBER BANERJEE: Now you can show us some
13 pictures, I think, after this.

14 MR. SMITH: Okay. See if we can get the
15 pictures ready.

16 And I would say that you're correct in
17 stating that you almost have two strainers or two
18 filters there, and I think we've taken a lot of the
19 lessons learned from our strainer testing and we've
20 applied it to the test, and it's being done for the
21 fuel inlet or further up the fuel blockage tube
22 because it's not just the inlet.

23 The Diablo canyon testing, they did about
24 18 tests in various regions.

25 MEMBER ARMIJO: Could you enlarge that so

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 we can see that?

2 MR. SMITH: You want to see the --

3 MEMBER BANERJEE: Yeah, and if the
4 Committee wants, of course, we'll provide those
5 beautiful slides.

6 MR. SMITH: Okay. This shows how the
7 Diablo Canyon testing was done. There was testing
8 that was done at CDI. Basically here's the mixing
9 tank where all of the debris goes in at first. They
10 have a pump here that pumps through a flow meter so
11 that they know what the flow rate is. This is how
12 they control the flow rate, and then it pumps up
13 through.

14 Basically they had a very small test
15 article, I would say. It was a normal cross-section,
16 about eight by eight, and it had the bottom nozzle on
17 it. It had the P-grid, protective grid on top of
18 that, which sort of blocks, puts like cross patterns
19 on the holes to keep anything big from going up
20 through.

21 And then they had one intermediate grid,
22 and that's all they had. So anything that got through
23 that bottom nozzle and intermediate grid, it would
24 cycle back around, and it would come back here. So we
25 think they had a pretty conservative test. It

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 collected probably a lot more debris in a smaller area
2 than what happened if you had the debris collecting on
3 a lot larger assembly.

4 MEMBER ARMIJO: And the flow rates,
5 pressure drops, temperatures were what you would
6 expect would exist in that region?

7 MR. SMITH: The temperatures were not.
8 The temperatures were low because basically this is a
9 piece of plexiglass so we could see what was going on,
10 and that's how the testing is being done. Basically
11 Lexan or plexiglass are building these things out of
12 so that it's basically a room temperature test, you
13 know. We're not testing at 200, 300 degrees.

14 MEMBER ARMIJO: So it would tend to be
15 conservative in respect to keeping things precipitated
16 and stuff like that.

17 MR. SMITH: Yes, for the aluminum based
18 precipitous things, yes, it would definitely be --

19 MEMBER BANERJEE: But you are adding
20 surrogates, right?

21 MR. SMITH: yes, yes. Surrogates were
22 added to the test, but in the Diablo Canyon testing,
23 they used basically the predicted debris for their
24 plant. They're a relatively low fiber plant, and
25 that's probably why it was such a small test article.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 They were able to -- their tests actually came out
2 with acceptable head --

3 MEMBER BANERJEE: They are a very low
4 fiber plant.

5 MR. SMITH: Yeah, it's pretty low, yes.

6 MEMBER BROWN: Is that the orientation of
7 the chamber, vertical? I mean, you're pumping stuff
8 upwards?

9 MR. SMITH: Pumping upwards, yes, and --

10 MEMBER BROWN: How do you catch filter
11 stuff? I pump stuff up. I've got a filter. I got on
12 through. Why doesn't it fall back down?

13 MR. SMITH: It's done by the core.

14 MEMBER BROWN: Oh, you're checking a core
15 approach.

16 MEMBER MAYNARD: This is a central fuel
17 assembly.

18 MEMBER BROWN: Yeah, I didn't get that
19 from your earlier discussion.

20 MEMBER BANERJEE: You see the picture
21 there.

22 MR. SMITH: Here's a picture. Say, this
23 would be like the vessel bottom here. Here's one fuel
24 assembly out of the whole thing. The water is flowing
25 up through here. Unfortunately you can't see the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 bottom nozzle, but this is the protective grid which
2 sits right here, which sits right on the bottom
3 nozzle, and this is the intermediate grid. So all of
4 the debris got trapped in here.

5 MEMBER CORRADINI: These are four
6 assemblies, four subassemblies?

7 MR. SMITH: It's just one.

8 MEMBER CORRADINI: Oh, this is one.
9 Excuse me.

10 MEMBER BLEY: Say again where the debris
11 ended up getting trapped.

12 MR. SMITH: Go down. We'll show.

13 Okay. This is clean. This is the bottom
14 nozzle, clean before the test. This is the view from
15 the top before the test, clean.

16 Okay. Here is the bottom nozzle. So you
17 can see there was quite a bit of debris caught in the
18 bottom nozzle holes.

19 MEMBER ARMIJO: It looks like the
20 periphery more than the center part.

21 MEMBER BANERJEE: Yeah, but when you open
22 it up, you see more.

23 MR. SMITH: Okay, and here's a view from
24 the side. So you can see there was some debris around
25 the external sides, too. Now you can see where there

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 was debris that got through, and actually there was a
2 lot of debris covering the entire protective grid.

3 MEMBER BANERJEE: That's why we only asked
4 for a uniform calculation.

5 MEMBER BLEY: But with all of that debris
6 we're seeing, you still have pretty good flow it
7 sounded like. You didn't have any pressure drop.

8 MR. SMITH: They were usually in the range
9 of inches of head loss. They did one test where they
10 like doubled their CalSil and it went up to 70 inches,
11 which is a pretty significant head loss, you know,
12 maybe five feet of head loss, but with their expected
13 debris, they were down around ten to 20 inches of head
14 loss.

15 MEMBER BLEY: Is there any way that you
16 know whether flow was blocked almost completely in
17 some areas and not in others, or do we always get good
18 mixing coming out of here?

19 MR. SMITH: You couldn't really tell.
20 There was a lot of turbulence. You could see, you
21 know, debris, you know.

22 MEMBER BANERJEE: You mean localized
23 nucleate boiling could occur?

24 MEMBER BLEY: Something, something you're
25 not planning on.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: Yeah. I think probably
2 not. I think this is -- in this case, this is low
3 fiber plant. I mean, it's not a big deal. I mean,
4 it's different if you're at a high fiber plant.

5 MR. SMITH: And the next thing we were
6 going to talk about is the PWR Owners Group.

7 CHAIRMAN SHACK: With this low a fiber
8 loading, you say they doubled the CalSil and it went
9 through the roof then, I mean, from two to 70.

10 MR. SMITH: It made a significant increase
11 in head loss, yes, by putting more CalSil, and they
12 may have put more chemical precipitates in also. They
13 did one test where they threw a lot of stuff at it.

14 MEMBER BANERJEE: Was that just atypical
15 or was there some limiting scenario which they were
16 testing?

17 MR. SMITH: You know, they were just
18 trying to see sensitivity, is what they were doing.

19 MEMBER ABDEL-KHALIK: Were there always
20 breakthrough holes?

21 MR. SMITH: Breakthrough holes, I don't --

22 MEMBER ARMIJO: That were unplugged. Was
23 this uniform?

24 MR. SMITH: It was relatively uniform. I
25 couldn't tell by looking at it if there was any, you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 know, particular channeling or bore holes or something
2 like that.

3 MEMBER BANERJEE: They disassemble it.

4 MR. SMITH: Yes.

5 MEMBER BANERJEE: You do things which is
6 very hard to -- you know.

7 MEMBER CORRADINI: So just if I can get a
8 feeling for this, so the purpose of this test was just
9 to get an idea of the delta P in the entry region of a
10 typical assembly assuming you had uniform flow coming
11 in.

12 MR. SMITH: That's correct. The
13 assumption was uniform flow across all of the
14 assembly.

15 MEMBER CORRADINI: So similar scaling is
16 the approach philosophy. Here was what somebody
17 somewhere calculated would have been the approach
18 philosophy as I have the low pressure RHR or low
19 pressure pumps going into recirc mode.

20 MR. SMITH: Right. Their approach
21 philosophy was based on two different break cases.
22 One was the cold leg and one was the hot leg.

23 MEMBER CORRADINI: Yeah, but it was the
24 same logic.

25 MR. SMITH: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: Okay, and the picking
2 of the length was considered immaterial. You just
3 wanted to get the initial inlet plate and a few inches
4 of a mock assembly in just to create the screen
5 effect?

6 MR. SMITH: I believe that when they first
7 designed this experiment that they thought it would
8 all collect on the protective grid, and they weren't
9 thinking that a lot was going to collect on the
10 intermediate grids, but what we've seen with the PWR
11 Owners Group testing is that it collects throughout
12 the assembly.

13 MEMBER CORRADINI: Well, that's not
14 surprising.

15 MEMBER BANERJEE: They hadn't seen the
16 German test which showed you that it goes through the
17 inlet and hangs up on these.

18 CHAIRMAN SHACK: But since they recycle,
19 it just keeps building up.

20 MEMBER CORRADINI: Okay, and so, again, I
21 wasn't here for that part of the Subcommittee meeting.
22 Did they sample the mixing tank as a function of
23 time?

24 MR. SMITH: No.

25 MEMBER CORRADINI: Was anything sampled as

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 a function of time, grab samples? I know you didn't
2 coming into the flow, but I'm talking about the mixing
3 tank, to look at the concentration of the stuff
4 degrading as you're building up.

5 MR. SMITH: I don't think that they took
6 any samples.

7 MEMBER CORRADINI: That's fine. Thank
8 you.

9 MEMBER BANERJEE: Again, I want to warn
10 you that everything is very, very sensitive to fiber
11 length in these things. So if you've got long fibers,
12 you get a very different --

13 MR. SMITH: What I should say about this
14 testing, they actually took fiber that bypassed their
15 strainer and they put the fiber in relatively slowly
16 because they were trying to collect bypass. They
17 didn't want to clog it up. So they probably had
18 somewhat longer fibers, a higher percentage of longer
19 fibers than what you would have, you know, eventually
20 a fiber layer built in.

21 MEMBER BANERJEE: But they were taking the
22 -- so let me get it clear. They were doing this two
23 screen experiment almost realistically. They were
24 taking typical fiber lengths as it was passing through
25 and putting it in --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: They were passing fibrous
2 debris through a strainer, and then they would just
3 collect that in a filter, and then they would take
4 that and use it for this test for the fuel --

5 MEMBER BANERJEE: But was it as a function
6 of time they were doing it?

7 MR. SMITH: They were just passing fiber
8 through a strainer in order to get some to use in the
9 test. They were --

10 MEMBER BANERJEE: The concern, I guess, is
11 really this, that would long fibers pass through in
12 the early stages and get caught in the core because
13 the pressure losses are very much a function of fiber
14 length. We know that. It has been done before for
15 BWRs or whatever. I can probably dig it up.

16 Allian did some testing way back. So we
17 know fiber length is very important in this exercise.

18 MR. SMITH: I think that if the fiber
19 collects, I don't really know. I couldn't --

20 MEMBER BANERJEE: So the only question I
21 think we're concerned about or might be is that if you
22 do this in real time, but the screen maybe in the
23 early stages long fibers are coming through and
24 perhaps getting caught, and those could give you
25 relatively high pressure losses compared to later

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 stages when, you know, you've built up and only very
2 short fibers are going through.

3 So let's just table it as a concern and
4 let's move on.

5 MR. SMITH: Okay.

6 MEMBER ABDEL-KHALIK: What was the total
7 duration of these experiments?

8 MR. SMITH: I would say they ran for three
9 or four hours, maybe five, six. You know, it depended
10 on the test, how long it took to stabilize and get all
11 of the debris and things like that.

12 CHAIRMAN SHACK: But they ran until they
13 stabilized.

14 MR. SMITH: They ran until they got to a
15 certain -- you know, they had a limit on one percent
16 in 30 minutes. I don't remember exactly what the
17 limit of increase was.

18 MEMBER ARMIJO: What does "stabilize"
19 mean?

20 MR. SMITH: Head loss, head loss rate of
21 change.

22 MEMBER ARMIJO: Never got any worse.

23 MR. SMITH: I think a lot of these were
24 still -- some of them were still --

25 MEMBER BANERJEE: Rising.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. SMITH: -- slowly when they turned the
2 test off.

3 PARTICIPANT: I mean, this is a closed
4 loop.

5 MEMBER ABDEL-KHALIK: So if you run this
6 for an infinite period of time, all of the stuff will
7 eventually deposit.

8 MR. SMITH: Eventually it will level out,
9 but I mean, they had a curve that was, you know,
10 exponential type.

11 MEMBER ABDEL-KHALIK: Yeah, will never
12 level off.

13 MR. SMITH: Well, once all the debris is
14 taken out of the system it may level. I mean, in head
15 loss testing we've seen where they do eventually
16 really level out.

17 MEMBER BANERJEE: But these were still
18 rising as I recall, right?

19 MR. SMITH: Yes, these were still rising.
20 Some of these were still rising when they terminated
21 them. The thing about this test is that after a
22 certain amount of time they're going to go into hot
23 leg recirc, and it's going to reverse the flow through
24 the core.

25 MEMBER CORRADINI: So do you have a -- I'm

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 sorry. I'm sorry, Sam. Excuse me.

2 MEMBER ARMIJO: No, go ahead.

3 MEMBER CORRADINI: Is there a typical plot
4 of head loss as a function of time? I mean, to get
5 your idea of stabilization, it's coming up and it's
6 hanging up, increasing, but the rate of increase is
7 decreasing. Is there an example somewhere that you
8 showed?

9 MR. SMITH: You can get that from -- I
10 mean, we have that information from them.

11 MEMBER CORRADINI: That's fine. That's
12 fine. If you've got it, later is fine.

13 MEMBER BANERJEE: Please.

14 MR. SMITH: We're going to talk about the
15 PWR Owners Group testing now. The PWR Owners Group
16 has just started their testing. The last I knew they
17 had two tests done. We saw the second test that was
18 run up there a couple of week ago.

19 What they used for their test was the
20 standard P grid which seems to be a little bit more
21 able to create a little higher head loss than the
22 alternate P grid because Diablo Canyon actually did
23 both. They did a little test to see which one was
24 worse for head loss.

25 Their testing is using the hot leg flow

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 rate, and that's 44 gpm per assembly, typical for I
2 guess they're using a Westinghouse four loop reactor
3 as their model, and that's a little bit higher.
4 Forty-one gpm is what they used for Diablo Canyon.

5 MEMBER BANERJEE: But they're not doing a
6 cold leg then.

7 MR. SMITH: The cold leg flow rate is much
8 lower.

9 MEMBER BANERJEE: Will they be doing that?

10 MR. SMITH: They may have to do that, but
11 right now the plan, the last I understood it -- and Mo
12 can correct me if I'm wrong -- was to use the hot leg
13 flow rate, and if they could get acceptable results
14 with the hot leg flow rate, they would apply the cold
15 leg acceptance criteria.

16 MEMBER BANERJEE: But the Diablo Canyon
17 did both, right?

18 MR. SMITH: Diablo Canyon did both, yes.

19 MEMBER BANERJEE: And I think later on
20 calculations were done for the cold leg break, right?

21 MR. SMITH: I don't remember.

22 MEMBER BANERJEE: Yeah.

23 MR. SMITH: Cold leg, he may have done
24 both. He may have done both.

25 MEMBER BANERJEE: I remember the cold leg

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 break.

2 CHAIRMAN SHACK: He represented the cold
3 leg.

4 MEMBER BANERJEE: He represented the cold
5 leg.

6 MR. SMITH: He did do the cold leg.
7 That's for sure because I remember we were talking
8 about the acceptance criteria for the two different
9 valuations.

10 Basically what we saw up there at the
11 Westinghouse testing or at the testing that was
12 conducted at Westinghouse is that we think that the
13 protocol they're using can create conservative
14 results. What they're doing, what their plans are is
15 that they're going to test, as we discussed a little
16 while ago, they're going to test; the PWR Owners Group
17 will test all of the fuel inlet assemblies. They
18 haven't started any Areva testing yet, and I think
19 that one might be a little bit more interesting as far
20 as the actual bottom blockage because I think the
21 openings are somewhat smaller on the Areva fuel
22 inlets.

23 And then they plan to increase their
24 debris loads to see how many plants they can actually
25 bound. So they're going to increase the fibrous load,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the particulate load, the chemical loads, and they're
2 going to see how many plants they can bound with the
3 testing.

4 And we're going to continue to look at the
5 data and look at their test results as it becomes
6 available, and like we talked about, the PWR Owners
7 Group is going to try to limit the -- we're going to
8 go back and look at what the limiting head losses,
9 allowable head losses are for the cold leg breaks and
10 the hot leg breaks.

11 MEMBER BANERJEE: I think now that you
12 have these nice TRACE calculations done by RES, it
13 would be worth feeding that information back.

14 MR. SMITH: Yeah, and that's something
15 we're going to look at. We're going to look at the
16 trace calcs. We're going to look at the PWR Owners
17 Group calculation, and you know, we'll get a few other
18 inputs probably, too, because it's pretty important to
19 get this right.

20 And the conclusions in this is that
21 Westinghouse in CE fuel testing is underway. Areva
22 testing will be done later. It's supposed to start
23 later in the year. The testing is going to determine
24 what the allowable debris loads are for various fuel
25 designs, and plants will use that to determine, you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 know, whether their loads are acceptable.

2 If it's not, they're going to have to do
3 some additional evaluation or modification to their
4 plant, and WCAP 16.793 will be revised based on the
5 test results and other questions that we've asked.

6 MEMBER CORRADINI: And so they're going to
7 be looking at what is deposited initially? When you
8 say "testing to determine acceptable debris loading,"
9 can you tell me more about what debris loading means?

10 MR. SMITH: Well, I think we still have
11 the question that we talked about about the fibrous
12 debris sizing, but the debris loading is a plant
13 specific thing. So every plant has done an evaluation
14 to determine how much chemical effects we're going to
15 have, how much particulate debris they're going to
16 have and how much fiber is going to be generated in a
17 plant.

18 So I guess there's particulate coatings
19 debris. All of that has to be looked at, and what
20 they're going to do is they're going to try to test
21 with maximum amounts of those debris to bound the
22 plants.

23 MEMBER CORRADINI: Right, but let me ask
24 it a little bit differently because maybe you've
25 answered it and I just don't -- so they're going to

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have some characteristic debris loading that is
2 specific to their plant, their break, their zone of
3 influence, and their screen.

4 MR. SMITH: Yes.

5 MEMBER CORRADINI: And then something
6 passes through, and then so that's your source term,
7 so to speak.

8 MR. SMITH: Yes.

9 MEMBER CORRADINI: So given that source
10 term, what are they going to measure to determine how
11 much gets caught up so that you can actually look
12 representative from plant to plant?

13 In other words, if the source term has so
14 much chemical and so much fiber and so much little
15 stuff and so much big stuff and they run the test,
16 what are they going to look at to decide that it was
17 good, bad or indifferent? Only delta P?

18 MR. SMITH: Head loss, and that will also
19 be dependent on the fuel design, the fuel
20 characteristic.

21 MEMBER CORRADINI: So the assumption is if
22 they know head loss and they compute that into some
23 sort of thermal hydraulic calculation, they will then
24 do a calculation to see that they get adequate
25 cooling, given the additional --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: This is coming.

2 MEMBER CORRADINI: Okay.

3 MEMBER BANERJEE: If you just wait.

4 MEMBER CORRADINI: Okay. Sorry. Thank
5 you.

6 MEMBER ARMIJO: But that's kind of a gross
7 measurement, but are they going to look at the
8 localized --

9 MEMBER CORRADINI: I don't think they can.

10 MEMBER ARMIJO: -- spatial, you know,
11 accumulation around a spacer over a fuel rod causing
12 localized damage, that part of the analysis?

13 MR. SMITH: That's part of the analysis
14 that's not part of this particular part of the
15 analysis.

16 MEMBER BANERJEE: I guess there's a good
17 question related to this though. I mean, just looking
18 at the fact that you don't want to uncover the core,
19 but in this situation you're going to have many fuel
20 failures anywhere, so you get local fuel failures, are
21 you going to worry about this or are you just going to
22 worry about core uncovering? That's really the issue.

23 MR. DINGLER: This is Mo Dingle with the
24 Owners Group.

25 What we're talking about here is only one

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 aspect. There's four other aspects. As Paul Klein
2 says, we develop a DM LOCA, which is there to define
3 how much debris. We assume all of the chemical, all
4 of the calcium in that and power distribution is
5 sorted onto the fuel assembly. That's one part of the
6 aspect.

7 We also evaluated local hot spots and see
8 if we maintain that, as you're saying, collect one
9 location. We assume 50 mLs, and it's less than 800
10 degrees. So the blockage that we're talking about,
11 that Steve and them were talking about is only one
12 aspect of four others that we looked at the total
13 integral.

14 We did COBRA tracking, the same as what is
15 going to be talked about on TRACE code to show that
16 you've got so much blockage you still have adequate
17 floor or core cooling.

18 So you put it all together. At the end
19 we're only talking, again, one aspect of many to do
20 the whole thing.

21 MEMBER CORRADINI: So can I ask a question
22 here?

23 MEMBER ARMIJO: Ultimately we'll get to
24 see some of those analyses.

25 MR. DINGLER: You'll be able to see all of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 it, yes.

2 MEMBER BANERJEE: And you can ask a
3 question, but we're going to have to move on.

4 MEMBER CORRADINI: Okay. Then I'll wait.
5 I'll wait.

6 MR. HARRISON: At this point I'll have
7 Ralph Landry come up and present. Bill Crutiak is not
8 available today to present for Research. So Ralph was
9 gracious enough to step in and present on this.

10 MEMBER BANERJEE: Head in the lion's
11 mouth.

12 MR. LANDRY: Foolish enough to come up
13 here.

14 Okay. To put this analysis into
15 perspective, back in march when we appeared with the
16 Thermal Hydraulic Subcommittee, the staff presented
17 some analyses which we had performed with TRACE, and
18 the Owners Group presented analyses which they had
19 performed with WCOBRA TRAC.

20 The purpose of those analyses was to
21 determine what the level of core inlet blockage could
22 you sustain and still maintain enough coolant flow
23 into the core to match the boil-off.

24 We found with the TRACE analyses that we
25 could take a 95 percent core inlet blockage and still

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 have adequate cooling for the core. That blockage
2 though was taken as one little area, by only five
3 percent of the core inlet. Now, the core model that
4 we have is 16 cells, 14 cells high.

5 So out of those 16 cells, we enough of
6 them blocked so that only five percent area slot was
7 still available for core inlet cooling. The Owners
8 Group had something like a 90 percent blockage that
9 they said they could -- their calculations showed they
10 could take.

11 With that five percent available inlet
12 area we only got a 300 degree Fahrenheit increase in
13 core temperature. The Committee raised or the
14 Subcommittee raised a number of questions at that
15 point as to the realism of the calculation. Since we
16 were blocking off 95 percent of the area, their
17 concern was do we get jetting coming in or do we get
18 that kind of a spread of a fluid that TRACE was
19 predicting so that the fluid was spread through all of
20 the core rather than just jet and go up in a plume
21 through the center of the core.

22 Following that meeting, we went back to
23 cohorts in the Office of Research and we said, "Well,
24 let's try something. Let's try taking those 16 nodes,
25 16 volumes at the core inlet, and let's put a five

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 percent area on each one of those instead of one big
2 five percent area so that we're distributing the
3 area."

4 We did that calculation, and the
5 temperature was within four degrees of the temperature
6 we had previously calculated. Cohorts in the Office
7 of Research said, "Well, why don't we try something
8 with TRACE? TRACE has the ability to model a porous
9 medium. So let's model the inlet of the core as a
10 porous medium rather than a restricted opening."

11 So Research decided they would do a porous
12 medium so that you have a head loss over the entire
13 area of the core rather than a simple five percent
14 opening in each cell, and then since we had not
15 performed a lot of the analyses of this nature, they
16 decided they were going to do a hand calc.

17 I put "hand calc" in quotes because
18 actually it was a calculation using an Excel
19 spreadsheet.

20 Now, the way the core inlet was modeled as
21 a porous medium was to take data which we had from
22 PNNL tests that were reported in NUREG CR-6917 and
23 NUREG 1862, test data that were taken using Nukon and
24 CalSil debris bed material.

25 That material was then used to model a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 pressure drop, porous medium for the entire inlet of
2 the core.

3 Now, keep in mind as you've heard all of
4 these discussions so far, they have talked about
5 particulate and all of this other material and
6 chemicals. Those were not considered in this
7 analysis. This was restricted to Nukon, which is
8 fiberglass, and to CalSil because the data that were
9 taken in support of those NUREG reports did not take
10 marinite, dirt, paint chips, chemicals, all the other
11 material, and we decided very deliberately that we
12 were going to restrict the porous medium pressure drop
13 to where we had data only. We're not going to try to
14 project into what would be a pressure drop, where we
15 did not have data to support that decision.

16 Now, you've heard a number of comments
17 already this morning, and Steve talked about it in his
18 first presentation that the volume of debris, whether
19 there's ratio in the fiberglass to particulate can
20 make a huge difference in pressure drop. So we did
21 not want to depart from where we had hard data.

22 That determination came out with a delta P
23 for the bed as being a function of the bed thickness
24 and the approach philosophy of the fluid. We modeled
25 four cases, the unbroken or unblocked case, and then

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 1.2, 2.4 and 4.8 inches of debris.

2 MEMBER CORRADINI: And those numbers were
3 arrived at?

4 MR. LANDRY: Those were --

5 MEMBER BANERJEE: Parametric.

6 MR. LANDRY: Right. It was just
7 parametric numbers to see. This was to determine
8 could we get to a point where this debris bed, this
9 porous bed would get to the point that it would
10 sufficiently slow down the flow, that we could start
11 to see a core heat-up.

12 MEMBER BANERJEE: You were just looking
13 for core uncovering.

14 MR. LANDRY: Right. This was not to be a
15 definitive analysis of how thick the debris bed on a
16 core inlet can be. This was to determine could we
17 model a distributed flow into the core. Could we
18 model a restriction sufficient to cause core --

19 MEMBER BANERJEE: Yes. Mike, to give you
20 back ground, the Subcommittee asked for a uniform bed
21 to be formed and to find what pressure loss across
22 that bed could lead to core uncovering, and that's
23 really what they're trying to answer with this. It's
24 a straightforward question.

25 MR. LANDRY: Now, this plot is of the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 collapsed liquid level in the core, and you can see
2 the bottom of the core, the top of the core, and the
3 figure in black is the point -- is the collapsed
4 liquid level in the core up to the point that we
5 initiate recirculation.

6 We assume that recirculation would begin
7 at 1,200 seconds, which is just the arbitrary point
8 that we set.

9 MEMBER BANERJEE: This is the cold leg
10 break.

11 MR. LANDRY: Yeah, this is cold leg. This
12 was just we said 1,200 seconds. Okay. At this point
13 we're going to initiate the recirculation.

14 This is when it's easier to use a pointer.

15 The red curve shows the collapsed liquid
16 level in the core when there is no blockage. The
17 other two curves, the blue, green and brown show the
18 effect of blockage.

19 Now, you see a big dip at 1,200 seconds
20 when we initiate the blockage. That's because we
21 initiated the entire blockage instantaneously at 1,200
22 seconds. As you saw in the material that Steve was
23 just presenting, the test data all show that the
24 blockage builds up over time.

25 So you don't instantaneously have a 4.8

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 inch block at the inlet of the core. This is going to
2 build up over hours. Instead, because of the way we
3 had to model with the code, we assumed the entire
4 blockage occurred instantaneously. So --

5 MEMBER CORRADINI: So the core doesn't
6 uncover. It just gets shorter, water logged.

7 MR. LANDRY: Well, the collapsed liquid
8 level.

9 MEMBER BANERJEE: That's the collapse. He
10 hasn't shown us the temperature.

11 MR. LANDRY: You still have two phase flow
12 in the other half, and tests that have been done,
13 Thetis test and RDHT test, show that you can have
14 liquid to the top of the core, two phase liquid. You
15 don't uncover the core. As long as you have a
16 collapsed liquid level that's at least 50 percent or
17 above.

18 MEMBER BROWN: Right. If you get below 50
19 percent is when you get core uncovering.

20 MR. LANDRY: yes.

21 MEMBER BANERJEE: So you get core
22 uncovering.

23 MEMBER BROWN: Fifty percent of the core
24 height.

25 MEMBER BANERJEE: At that level you get

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 core uncovering.

2 MR. LANDRY: If we could just go to the
3 next one, now this plot shows the PCT, and you can see
4 that the temperature drops. This is in Kelvin. In
5 real units that would be -- 1,400 is about 2,050,
6 2,060 degrees, and the 400 degree is a little under
7 300 in Fahrenheit. It's around, I think, 263 --

8 MEMBER CORRADINI: The magical temperature
9 to worry about is 1,500 K.

10 MEMBER BANERJEE: No, it's 800.

11 MR. LANDRY: Well, 1,473 is 2,200 K.

12 MEMBER CORRADINI: Heat clad temperature,
13 yeah.

14 MEMBER BANERJEE: Yeah, but this, for
15 boil-off it's not Appendix K remember.

16 MEMBER CORRADINI: I understand.

17 MR. LANDRY: I will get to that, Sanjoy,
18 but thanks for the lead-in.

19 MEMBER BANERJEE: Okay.

20 MR. LANDRY: You can see, if I can get the
21 mouse pointer back, that 1,200 seconds is when we
22 initiate the blockage and three of the colors stay
23 right on the curve where they had been. They don't
24 show any increase in temperature.

25 The one case, the 4.8 inch blockage case,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 shows an increase in temperature that goes up to about
2 900, 950 degrees Fahrenheit. We have set an arbitrary
3 limit in these recirculation mode heat-ups of 800
4 degrees Fahrenheit. We're not allowing a limit of
5 2,200 as 50.46 allows, the acceptance criteria. We've
6 set the limit at 800 Fahrenheit because the zirconium
7 alloy cladding materials that have been heated to a
8 high temperature -- temperature is on the order of
9 2,000 and above -- cooled and then reheated have only
10 had data taken for a reheat to 800 degrees Fahrenheit
11 and still show that they maintain integrity.

12 MEMBER CORRADINI: So after that point
13 it's not clear.

14 MR. LANDRY: We don't know. They may.

15 MEMBER CORRADINI: But you don't know.

16 MR. LANDRY: There are only data in
17 existence for mutual heat-up, quench, and reheat to
18 800 Fahrenheit. So --

19 MEMBER BANERJEE: And the Germans don't
20 allow any increase.

21 MR. LANDRY: So this is why we have said a
22 reheat temperature limit of 800 degrees Fahrenheit is
23 being imposed because there are no data beyond that
24 point.

25 Now, if the industry wants to say they can

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 go back to 2,200 --

2 MEMBER CORRADINI: That's fine. I
3 understand.

4 MR. LANDRY: -- fine. Go get the data.

5 MEMBER CORRADINI: Okay. I see.

6 MR. LANDRY: But since Sanjoy gave me the
7 lead-in, this is the explanation of why we're saying
8 800. In this case the prediction is it goes to 950,
9 but so that we could say somewhere in this range with
10 this kind of debris bed, Nukon/Calsil only, somewhere
11 between 2.4 and 4.8 inches we would expect to see the
12 heat-up begin.

13 CHAIRMAN SHACK: But we really need to
14 calculate that.

15 MEMBER ARMIJO: Did you say temperature in
16 Kelvin?

17 MEMBER BANERJEE: Let's take one question
18 at a time.

19 MEMBER CORRADINI: I'm sorry.

20 MEMBER ARMIJO: What's that temperature in
21 Kelvin that you're trying to say it's a limit?

22 MEMBER CORRADINI: It's there.

23 MR. LANDRY: Eight hundred Fahrenheit.

24 MEMBER ARMIJO: Okay.

25 MR. LANDRY: And this goes up to 800

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Kelvin, which is about 950 Fahrenheit. So 800 --

2 MEMBER ARMIJO: Eight hundred Fahrenheit
3 is --

4 CHAIRMAN SHACK: Yeah, it's the head loss
5 you really need to look at here to compare with the
6 experiments because you don't really know what the
7 real beds are going to -- we're not going to see a
8 CalSil/Nukon four inch bed, but we'll measure a head
9 loss. So this is what head loss are we talking about
10 for this bed?

11 MR. LANDRY: I don't have the--

12 MEMBER BANERJEE: If I recall the numbers,
13 it's between 2.4 and four psi.

14 CHAIRMAN SHACK: So you can tolerate about
15 that much.

16 MEMBER BANERJEE: Somewhere between 2.4
17 and four.

18 CHAIRMAN SHACK: For the cold leg break.

19 MEMBER BANERJEE: The hand calculations,
20 if I remember, my memory, showed about four, and that
21 TRACE was somewhere between 2.4 and four, but we can
22 verify that later on.

23 MEMBER ABDEL-KHALIK: When the code was
24 re-initialized, that 1,200, what parameters, what kept
25 the same? All parameters?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. LANDRY: Except for the resistance --

2 MEMBER ABDEL-KHALIK: For the geometry?

3 MR. LANDRY: Except for the resistance,
4 yeah, but geometrically it was the same. What was
5 changed was the resistance at the core inlet.

6 MEMBER ABDEL-KHALIK: At the core inlet.

7 MR. LANDRY: So the flows stayed the same,
8 and then the flows suddenly saw a step increase in
9 resistance, and that's why you saw that sudden drop in
10 core collapsed liquid level, because the flow coming
11 into the bottom of the core suddenly saw an increase
12 in resistance.

13 MEMBER ABDEL-KHALIK: So you just added a
14 loss coefficient at the inlet.

15 MR. LANDRY: It was just a porous medium
16 loss coefficient.

17 MEMBER CORRADINI: Porous medium loss
18 coefficient. Just a K.

19 MR. LANDRY: Essentially, yeah.

20 MEMBER CORRADINI: Okay.

21 MR. LANDRY: Now, this is calculating.
22 The behavior of porous media is quite complicated.
23 There has been a lot of work done n this over the
24 years. Since back in the '30s porous media have been
25 studied. But there's a paper that just came out in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the Nuclear Engineering and Design Journal over the
2 summer written by a group in Germany in which they
3 looked at compressibility of porous media on
4 strainers. It's part of the strainers, the stuff
5 Steve was talking about, but the implications are the
6 same here.

7 And that is that while the work that we've
8 been doing is using the Darsey Law, in reality when
9 you start talking about these compressible media, the
10 Darsey Law does not apply. This is no longer a linear
11 -- the delta P is no longer a linear function of the
12 approach philosophy, but it's good enough for this
13 case because in this case we wanted to determine could
14 we find a point at which we could restrict the flow
15 enough to cause a heat-up.

16 MEMBER CORRADINI: So a squishy bed versus
17 a rigid bed.

18 MR. LANDRY: It becomes even more
19 complicated because work that was done back in the
20 '30s has been shown that it was based on granularity,
21 a granular bed, and today with the fibrous beds that
22 are much more squishy, the work that was done with
23 granularity does not apply to the bed that's
24 compressible with fibers.

25 But what we have is a bed that is both.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 When we look at the fiber being captured, the
2 particulate being captured, you're talking about a
3 granular substance and a fibrous substance together,
4 and then you have the chemical.

5 So --

6 MEMBER BANERJEE: Is it true that what
7 you --

8 MR. LANDRY: -- concerning the properties,
9 they may be very, very much more complex than we've
10 taken it.

11 MEMBER BANERJEE: Yeah, yeah. What you
12 really used here was the Crutiak had developed a model
13 which fitted the data, and he basically programmed
14 that model, right?

15 MR. LANDRY: That's right. That's why I
16 said this is very specific to the Nukon/CalSil.

17 MEMBER BANERJEE: To that specific bed.

18 MEMBER BANERJEE: But the first
19 approximation is the pressure losses are what really
20 matter. I mean, yes, it's true that the behavior is
21 more or less linear with bed thickness, pressure loss
22 in terms of velocity, but it's the pressure loss that
23 really matters, and was it between 2.4 and four psi?
24 Can you check that?

25 MR. BAJOREK: I can check, but I think

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that's about correct. Let me just clarify what we
2 actually did.

3 TRACE doesn't have a real porous media
4 pressure loss correlation. What Phil did is he went
5 back to the -- the data had been taken at LANL, and we
6 fitted curves to give us a loss coefficient K equal to
7 an A over V to a B that fitted the experimental data.

8 We took that correlation and for that specific
9 location in the TRACE model. We made the code use
10 that loss coefficient.

11 So as we turned on the debris at 1,200
12 seconds, instantaneously forming, as that velocity
13 changed with time, the K would adjust itself.

14 MEMBER BANERJEE: That's because your K is
15 a function of V in this case because it's more or less
16 linear, but let's not get into the argument right now.

17 So it's fine. I've looked at this, and I'm quite
18 happy with it. Okay?

19 MEMBER MAYNARD: What's the significance
20 of the drop in temperature at the tail end? Just
21 ending the program or is there something physically
22 going on that the temperature is dropping?

23 MR. LANDRY: It's re-liquenishing. There's
24 sufficient flow to bring the quench front back up and
25 bring -- the collapsed liquid level is coming back up,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and the core temperature is coming back down.

2 MEMBER BANERJEE: The thing of the time
3 constant because of the way the velocity is varying
4 with it and you get more flows. Anyway, that's fine.

5 MEMBER MAYNARD: I will just stop there.
6 I wanted to make sure.

7 MEMBER BANERJEE: I think we probably need
8 to.

9 MR. LANDRY: Okay. I'll do it real quick
10 now.

11 The hand calc model is really simply a
12 balance of heads and losses, and this was done as a
13 part of a spreadsheet at two points, at the 1,200
14 second point and at a 2,000 second point, and it was
15 done for the unblocked case and the 4.8 inch thickness
16 case.

17 And this is taking the plot that I showed
18 earlier of the collapsed liquid level. I'm taking out
19 the 1.2 and 2.4 inch thick beds and just showing the
20 unblocked case and the 4.8 inch block case. This is
21 simply to show that the hand calc shows with the red
22 diamonds for the unblocked and the brown triangles for
23 the 4.8 inch block, that the hand calc solution is
24 giving collapsed liquid levels within the bounds that
25 were calculated by TRACE.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 The purpose of this was not to get a
2 definitive analysis of the collapsed liquid level, but
3 simply as a sanity check. Since we're doing something
4 different with TRACE, let's do a simple hand calc and
5 use this as a sanity check to say do we believe what
6 TRACE is giving us, and when we look at this we say,
7 yeah, the hand calc numbers are coming in in the range
8 that we're seeing with the code calc. So it gives us
9 a much better feeling for what we're seeing with the
10 code.

11 MEMBER BANERJEE: Yeah, the hand calc is
12 with homogeneous. So it will be a little different.
13 TRACE has got that behavior because you've got
14 fluoridium transitions.

15 Okay, Ralph. Thank you. Very
16 interesting.

17 MR. HARRISON: And I'll just say in
18 conclusion that through the presentations hopefully
19 today you see that the staff has established a process
20 for being able to close the generic letter, recognize
21 licensees as significantly increased their -- made
22 significant modifications to prevent unacceptable
23 strain velocity that reached their strainers, but the
24 staff has developed guidance to insure there's
25 conservative test profiles and evaluations, and just

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 recognize that the in-vessel downstream effects
2 portion of our review will be addressed through our
3 review of the WCAP 16793.

4 So with that I --

5 MEMBER BANERJEE: Thanks, Donnie. I think
6 you've done a great job and progress is being made.
7 So you'll be available, of course, when we write the
8 letters to interact with us.

9 MEMBER CORRADINI: One thing I forgot to
10 ask Ralph, but I just did a calculation. You said two
11 to four psi was the equivalent delta P.

12 MEMBER BANERJEE: They're going to check
13 it. Steve will get back to us on that.

14 MEMBER CORRADINI: Okay. I was going to
15 ask about one or two meters -- that's about one or two
16 meters head height of water. So it's a very big delta
17 P.

18 MEMBER BANERJEE: Let's get back with
19 those numbers and then we can discuss it.

20 So when we start to write the letter or
21 even before that, we'll have access to that
22 information.

23 MEMBER ABDEL-KHALIK: It was also the
24 inconsistency between the industry calculation of the
25 delta P and the staff's calculation.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: Well, there is no
2 comparison. Staff has used TRACE. I mean, you know,
3 let's not worry --

4 MEMBER CORRADINI: They did a hand
5 calculation though. That I like.

6 MEMBER BANERJEE: Well, I think it's
7 always good to do a sanity check.

8 MEMBER ABDEL-KHALIK: So the industry
9 calculation was a bounding calculation the way you
10 would expect the delta P to be for a cold leg break
11 and a hot leg break, and I think it would be important
12 to sort of reconcile these two numbers.

13 MEMBER BANERJEE: Well, the industry, if
14 you recall, had a void fraction assumption in the
15 core, whereas this does avoid the fraction calculation
16 in the core.

17 MEMBER ABDEL-KHALIK: But it is 50
18 percent.

19 MR. DINGLER: Yeah, this is Mo Dinger.

20 MEMBER BANERJEE: But it's less than --

21 MR. DINGLER: In talking to Bill
22 afterwards, he had pipes, about 4.8, I believe. We
23 took and divided the -- took out the head loss through
24 the core, which was 1.7. So if you take out his 4.8
25 and put 1.7, we're at about 2.5. So we're about the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 same thing. So we were comparing apples and oranges
2 in that presentation because he had total psi, and we
3 separated the loss through the core, and that's how.

4 We talked to Bill afterwards, and we're
5 still checking the numbers, but initially that's what
6 we came away with on that. So there really wasn't
7 discrepancy. It was just how it was presented.

8 MEMBER BANERJEE: Anyway, let's not worry
9 about that right now. We have gone over TRACE with a
10 sufficiently fine tooth comb that we would want to
11 believe that it produces, whatever anybody else does.

12 Any other questions? Can we wrap it up
13 now?

14 I think the staff will be available when
15 we write the letter. So if anything arises, we can
16 interact with them. So I'm going to hand it back to
17 you and thank you for a nice presentation.

18 VICE CHAIRMAN BONACA: I guess I'm going
19 to recess for lunch.

20 (Whereupon, at 12:27 p.m., the meeting was
21 recessed for lunch, to reconvene at 1:30 p.m., the
22 same day.)

23 CHAIRMAN SHACK: I would like to come back
24 into session. Our next topic will be selected
25 chapters of the SER associated with the economic

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 simplified boiling water reactor design certification
2 application. And Mike will be leading us through this
3 discussion.

4 MEMBER CORRADINI: Okay. Thank you, Mr.
5 Chair. So welcome back, everybody. I'm sure you
6 remember this. This is like deja vu. We just keep on
7 -- so we're on to now Chapters 19 and 22. If you
8 remember that we are doing kind of a continuing look
9 at the SERs as the chapters are produced.

10 This, in particular, the topic today
11 will be the PRA and severe accident management. We
12 had a subcommittee meeting on June 3rd, and then a
13 subsequent subcommittee meeting on August 21st and
14 22nd, where GEH and the staff spoke to us about their
15 open items, the staff spoke to us about their open
16 items, and GEH explained specifics relative to the PRA
17 and their severe accident management work.

18 I don't really have much more to say,
19 other than I think we've converged, approaching some
20 current views on this. And so we asked the staff and
21 GEH to come today to kind of give us where they are
22 relative to Chapters 19 and 22. And I'll first turn
23 it over to Hossein Hamzehee --

24 MR. HAMZEHEE: Yes.

25 MEMBER CORRADINI: -- who will introduce

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the players in the game.

2 MR. HAMZEHEE: Thank you, Mike. Again, I
3 am Hossein Hamzehee, the Chief of the PRA Branch in
4 the Office of New Reactors. And I am mainly
5 responsible for the ABWR and ESBWR designs. And as
6 Mike mentioned, we had already made two presentations
7 in the last few months, and we are here today to
8 present a summary of those two presentations.

9 And I would also like to take advantage of
10 this presentation and mention to you that we, as part
11 of our review efforts, we planned two site visits in
12 order to get a little more familiar with the GEH PRA
13 models and some of the details. The first one we
14 completed late last year, and we have a second one,
15 which is -- we are planning to perform the second site
16 visit around November/December of this year. And as
17 part of that review, we also plan to cover those areas
18 that were identified by the SER Rev subcommittee
19 members at the August meeting.

20 And I would also like to mention that we
21 did also go to the BiMAC test area in Santa Barbara,
22 California, in August of 2007, and observed some of
23 the testing of that.

24 MEMBER CORRADINI: Not the beach.

25 (Laughter.)

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. HAMZEHEE: Very close. Very close,
2 but not the beach.

3 MEMBER CORRADINI: Just checking.

4 MEMBER BANERJEE: Where is this exactly?

5 (Laughter.)

6 MR. HAMZEHEE: Oh, stop it. Just --

7 (Laughter.)

8 MEMBER STETKAR: Because I have lost the
9 timeline on the revs of the PRA, this that you made
10 last year, was that Rev 2?

11 MR. HAMZEHEE: The first site visit that
12 we did on Rev 2.

13 MEMBER STETKAR: Was 2.

14 MR. HAMZEHEE: Yes.

15 MEMBER STETKAR: All right. Thanks.

16 MR. HAMZEHEE: Before we wrote our
17 preliminary SER.

18 MEMBER STETKAR: Okay.

19 MR. HAMZEHEE: Now, before we write the
20 final SER, we would like to perform the second site
21 visit review, and also cover the areas that you
22 brought up at your last meeting.

23 MEMBER STETKAR: Thank you.

24 MR. HAMZEHEE: And with that, I would like
25 -- what we plan to do is first turn to GEH, let them

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 present the status of their PRAs, and then we will
2 have the NRC staff to get up there and talk about the
3 status of our reviews. With that, I turn it to Rick.

4 MEMBER CORRADINI: Mr. Wachowiak, you're
5 going to be presenter and manipulator of the computer?

6 MR. WACHOWIAK: Presenter, manipulator,
7 and I have a laser pointer if I need it.

8 (Laughter.)

9 MEMBER BLEY: If you use the mouse, we can
10 see it on all the screens.

11 MEMBER CORRADINI: But it sometimes
12 doesn't work, so have a backup for --

13 MR. WACHOWIAK: Okay. So to introduce
14 myself again, Rick Wachowiak from GEH. And as we
15 said, I'll be presenting the ESBWR PRA and severe
16 accidents, and then we'll get into the regulatory
17 treatment of non-safety systems at the end.

18 The organization of my presentation today
19 is that I'm going to talk about what it is we are --
20 that we are certifying, and what the SER is about.
21 We'll then transition into a summary of where we are
22 on the ESBWR review, an overview of the meet -- then
23 an overview of the meetings that we had with the
24 subcommittee over the past approximately several
25 months. We've had several meetings.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Then, we'll talk about which items that we
2 still have open with the staff, and where we think
3 we're going with the different open items. Then, I'll
4 cover the purpose of the regulatory treatment of non-
5 safety systems, and where we are with that and discuss
6 those open items.

7 So with that, we will go ahead and start.

8 And if anybody has questions --

9 MEMBER CORRADINI: We're not shy.

10 MR. WACHOWIAK: -- don't be shy. Just
11 inject them whenever they seem appropriate.

12 So the first thing I wanted to talk about
13 is, what are the objectives of the Chapter 19 section
14 of the design of the DCD? There are several
15 objectives that have been published by the NRC that
16 cover this.

17 The first one is 10 CFR, the number here
18 50.34(f)(1)(i), basically states that all new reactors
19 for design certification need to have a PRA. And
20 then, there are other reg guides and other SRP
21 information for what that should contain.

22 The things that we are looking for here is
23 that we can identify vulnerabilities for the plant,
24 and vulnerabilities in this would be things that would
25 -- that are -- that could lead to an unacceptable core

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 damage or unacceptable release with very few failures
2 following the initiating event.

3 We are also supposed to demonstrate that
4 we meet the Commission's safety goals. Those are
5 numerical values that we've talked about here. They
6 are the same goals as the existing plants have. We
7 need to show that we meet them.

8 We're going to -- we need to look at
9 reducing and eliminating the risk contributors from
10 the existing plants. So where we started it with was
11 the issues that have come up in previous plants, and
12 we need to make sure that we handle things that have
13 been significant contributors to existing nuclear
14 plants and make sure that our design doesn't replicate
15 some of the things that there have been issues with in
16 the past.

17 Select amongst the severe accident
18 management design features. There is a report that
19 goes along with this. That is the Severe Accident
20 Mitigation Design Alternatives. It's the SAMDA, and I
21 think for many of you dealing with life extension
22 there is a similar thing, SAMA, which also includes
23 operator actions, procedures, things like that. But
24 here we are focused on the design.

25 We are supposed to be able to identify

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 risk-informed safety insights, and in Chapter 19 there
2 is a table that takes the highest level insights that
3 we came up with from the PRA, outlines them in the
4 plant's FSAR, and also will show where those different
5 things are addressed. If they are addressed by a
6 design, we have identified where is the design. If
7 they are identified as an operational program, then we
8 put in there a marker for the license applicant to
9 make sure they address that in the -- in their
10 program.

11 Other things in there are basically just
12 listed as insights, things that are important to know
13 about the risk profile of the ESBWR design. So we
14 have accomplished that.

15 We want to show a balance of severe
16 accident prevention and mitigation. Basically, that
17 goes back into the Commission's safety goals, where
18 we're looking at a low conditional containment failure
19 probability in this plant.

20 The last couple of things, we want to show
21 a reduction in risk comparison to the existing plants.

22 There is no numerical criteria required for this. It
23 goes back to reducing and eliminating the significant
24 risk contributors from the existing plants, and we
25 were looking to do that.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 And then, the last thing is to support
2 some design programs. And I know in the past we have
3 gotten into, well, can this PRA be used to support
4 other programs that are outside the design maintenance
5 rule or the MSPI, and things like that?

6 But the answer to that is that probably
7 not, that we are looking at supporting design programs
8 and identifying important components that would be
9 addressed in the design phase, and not things that are
10 necessarily associated with other programs that will
11 be put on later. And we'll talk, as we get through
12 this, how that folds in into the future.

13 So that was where we want to go. So far,
14 our interaction with the staff on this has been pretty
15 extensive, we think. Almost 450 RAIs have come in.
16 Just to keep a tally, that's about eight percent of
17 the total for the whole certification. So it's a
18 significant interaction.

19 We've resolved almost all of these issues.
20 There are some that are still out there that we are
21 waiting to see if the response is acceptable, and
22 there is an even smaller number that are still out
23 there that we have yet to respond to. But over the
24 last few years we've had extensive interaction with
25 the NRC on the PRA.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Hossein talked about the three onsite
2 audits. The two that have already occurred, and the
3 one that is upcoming in December -- expected to be in
4 December, we'll put it that way. We don't have a hard
5 schedule for it yet, but it's expected in December --
6 to review -- essentially, it's to do the final review
7 of the Rev 3 of the PRA.

8 What they will actually be looking at,
9 though, is Rev 4 of the PRA, because our purpose for
10 Rev 4 was to take the things that were in the addenda
11 chapter in Rev 3 and actually fold them into the
12 entire PRA, so they will be looking at the finished
13 product. And that was the plan from the beginning on
14 that. We've had several meetings and teleconferences
15 over this.

16 MR. HAMZEHEE: But, Rick, there are no
17 major technical changes in Rev 4. It's basically the
18 documentation of Rev 3.

19 MR. WACHOWIAK: It's the documentation of
20 what was in Rev 3.

21 MR. HAMZEHEE: Yes.

22 MR. WACHOWIAK: We do not have any --
23 other than specific RAI responses that the staff has
24 already seen --

25 MR. HAMZEHEE: Or findings of the site

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 visit that we may come up with.

2 MR. WACHOWIAK: If we find some at that
3 point, yes. So, but the intention was not to have it
4 as an upgrade to the PRA. It's shifting what we've
5 already told the staff into the final document, so
6 that they could see the thing in total, what they have
7 reviewed in pieces up through now.

8 You know, and I had the -- this on here as
9 three onsite audits, and I noticed that I had the
10 fourth one here. We actually did have a fourth one,
11 but it was a while back, and it was covering the
12 seismic and severe accidents. We -- the audit that
13 was out in San Jose, oh, what, it was probably two
14 years ago now for that one. So that -- I didn't want
15 to forget that.

16 MR. HAMZEHEE: Yes.

17 MR. WACHOWIAK: It was mainly a seismic
18 audit, but there was a significant severe accident
19 portion to that audit, where we looked at the
20 containment performance and the fragility of the
21 containment and the parameters that we would need to
22 put into the containment fragility. It was a
23 significant -- significant audit.

24 Once again, all of the interaction that
25 we've had with the staff on this has focused on the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 objectives that I had on the previous page. And the
2 focus was looking at, what is it that we need to meet
3 those published requirements with the PRA that we have
4 in hand? And it will be for a later phase when we
5 will do more.

6 So I mentioned this before, and I want to
7 emphasize it now, because it's -- I think it's
8 important for your review in the letter that you're
9 writing and what you are saying that you are agreeing
10 with -- with the staff.

11 This PRA is not the last PRA that is going
12 to happen for the ESBWR. Okay? 10 CFR Part 70 --
13 Part 70 -- 10 CFR 50.71 has a new requirement for new
14 plants that they have a revised PRA covering Level 1,
15 Level 2, basically all initiating events, and it -- it
16 has got to be completed prior to fuel load, and it
17 needs to cover all of the standards that have been
18 endorsed on -- in the PRA area up to one year prior to
19 that scheduled review date.

20 So the current ASME standards for PRA
21 quality is covered. The upcoming fire PRA standard,
22 which we expect to be endorsed, will be in that mix.
23 There are some external events standards that are in
24 the wings of being released, and we expect by the time
25 the first plant is operating that those will be in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 place.

2 So it is at that point where these --
3 where the ESBWR PRA would be brought up to speed with
4 the things that you are used to seeing for some of the
5 more complex risk-informed applications. So there
6 wasn't ever any intention that the design
7 certification PRA would satisfy all of those
8 requirements. They were looking at satisfying the
9 things that I had on the first page.

10 MR. HAMZEHEE: Now, Rick, I -- let me just
11 clarify that that rule requirement is not for just
12 risk-informed application. That is a rule requirement
13 for any COL holder one year initial to the -- prior to
14 the initial fuel load that they must have Level 1,
15 Level 2, all initiators, for those that industry
16 standard, endorsed by NRC, exist, regardless of
17 whether or not they would like to apply for any risk-
18 informed applications.

19 MR. WACHOWIAK: That's correct.

20 MR. HAMZEHEE: Yes.

21 MR. WACHOWIAK: And included in all of the
22 endorsed standards so far is the requirement for the
23 industry peer review.

24 MR. HAMZEHEE: Correct.

25 MR. WACHOWIAK: So this would also be a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 peer-reviewed PRA that would be required for the site.
2 Now, what I have on here is that the site maintains
3 that PRA. They are required to maintain that PRA.
4 But the only time it would be submitted to the NRC is
5 in the context of a risk-informed application.

6 MR. HAMZEHEE: Correct.

7 MR. WACHOWIAK: That's the only
8 requirement for submittal there. So it's a question
9 of: where does this reside? It resides at the
10 licensee, unless they are using it for a risk-informed
11 application. But they must have it. By regulation,
12 they must have that PRA.

13 MR. HAMZEHEE: Correct.

14 MEMBER CORRADINI: Just for my
15 clarification, from my understanding. When you say
16 "risk-informed application," somewhere during their
17 life, for some purpose.

18 MR. WACHOWIAK: Risk-informed ISI or --

19 MEMBER CORRADINI: Whatever.

20 MR. WACHOWIAK: -- risk-informed tech
21 spec, something --

22 MEMBER CORRADINI: Okay.

23 MR. WACHOWIAK: -- something like that,
24 some major application that typically results in a
25 submittal of portions or --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: And then, one other
2 clarification. You said the peer review occurs when?
3 You said, and I didn't hear.

4 MR. WACHOWIAK: The peer review -- the
5 rule says they have to have the PRA by the time they
6 load fuel, before they load fuel. So the way that
7 that has been treated in the past with MSPI and other
8 things is that the peer review must exist, must have
9 been completed prior to the PRA being done.

10 So the peer review must happen before --

11 MEMBER CORRADINI: And if we --

12 MR. WACHOWIAK: -- apply the similar --

13 MR. HAMZEHEE: Correct. And also, when
14 they say that the COL holder shall satisfy the
15 standards, the standards currently, like Reg.
16 Guide 1.200 and ASME, already have requirements for
17 peer reviews.

18 MEMBER CORRADINI: Okay.

19 MEMBER STETKAR: Let me make sure I
20 understand the process, because it's important. If
21 you have 10 COL applicants, you know, you sell 10 of
22 these things, at that point, the --

23 MR. WACHOWIAK: Can I sign you up?

24 (Laughter.)

25 MEMBER STETKAR: Sure. I'll liquidate

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 some of my money in the 401(k) and, you know, get back
2 to you.

3 (Laughter.)

4 PARTICIPANT: It has already been
5 liquidated.

6 (Laughter.)

7 MEMBER STETKAR: If I -- what we have now
8 is the ESBWR PRA, and let's say you have 10 COL
9 applicants that load fuel, you know, in 10 successive
10 years, let's say. At that point in time, the ESBWR
11 PRA splits into 10 COL applicant-specific PRAs for
12 which there is no further requirement of staff review,
13 unless applicant number 1, for example, comes in and
14 says, "I want to use my PRA for this risk-informed
15 application." Is that correct?

16 MR. WACHOWIAK: That's --

17 MEMBER STETKAR: I don't know if I've
18 characterized that correctly.

19 MR. WACHOWIAK: That's not exactly
20 correct, and I'll weigh in first, and then we'll let
21 Hossein give some idea on that, too. That is one way
22 that that could go; you'd have 10 successive
23 applicants that would come online, and you would have
24 10 successive plant-specific PRAs.

25 Now, the types of things that -- or one

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 way that it could play out is that everyone would do
2 that on their own. Other ways that it could play out
3 is that the utilities could get together and decide,
4 since we have standardized this plant, maybe we can
5 have a standard PRA with some things in there.

6 Some of the things that we don't know are
7 standard yet are things like the procedures and
8 training and other plant -- you know, other things
9 associated with what actually happens on that site.
10 So we'll have to talk about how that goes in the
11 future. How does plant-specific data fall into an
12 overall PRA scheme for this?

13 But the expectation there is that -- that
14 a major risk-informed submittal would be -- you would
15 submit something to do with the PRA, but there are
16 other things that already happen. When you start up a
17 plant, the maintenance rule is applicable to the
18 plant. The maintenance rule, as part of the baseline
19 inspection, includes an inspection of the PRA that was
20 used to develop the lists of things that are used in
21 the maintenance rule program itself.

22 So, in the past, everyone who has had a
23 maintenance rule baseline inspection has had an
24 inspection of their onsite PRA. We expect that that
25 would go into the future the same sort of way is that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 when you start your plant up you are going to have a
2 maintenance rule baseline inspection. So at least at
3 that point it would be an onsite audit, but it would
4 be a look at the plant-specific PRA without a
5 submittal.

6 MEMBER STETKAR: Without a submittal.

7 MR. HAMZEHEE: No, I think -- let me just
8 clarify what you said, John, in a nutshell was
9 correct. Right now, Part 52 rule says you shall have
10 Level 1, Level 2, all initiating events, one year
11 prior to the initial fuel load for all those that the
12 consensus standards exist, endorsed by NRC.

13 So that is a rule that says all these
14 potential licensees have to comply with the standards,
15 and they don't have to submit it to the NRC. However,
16 if there is a reason for us, we can always for a
17 specific purpose go and audit and review their PRAs.

18 On the other hand, if one of these
19 licensees select to apply for a risk-informed
20 application, then we have to make sure that for that
21 specific application that PRA is adequate, and then we
22 do a detailed review for that specific application.

23 MEMBER STETKAR: So not a detailed review
24 of the PRA --

25 MR. HAMZEHEE: Because by rule they are

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 supposed to comply with the standards. And if they
2 don't, they are violating the rule. And at some point
3 -- because right now, for existing plants, there is no
4 rule. The operating plants, there are no rules that say
5 you shall do PRAs. They only do it when either they
6 apply for risk-informed applications or because of all
7 the benefits they get from it.

8 MEMBER APOSTOLAKIS: Now, Hossein, you
9 said one year before --

10 MR. HAMZEHEE: Initial fuel load, yes.

11 MEMBER APOSTOLAKIS: -- initial fuel load,
12 they have to have the PRA. I thought they had to have
13 the PRA before fuel loading, complying with standards
14 in --

15 MR. HAMZEHEE: That's what I meant, yes.

16 MEMBER APOSTOLAKIS: Okay. Not the PRA
17 itself.

18 MR. HAMZEHEE: No. It says that if one
19 year prior to the fuel load the standards exist --

20 MEMBER APOSTOLAKIS: Right.

21 MR. HAMZEHEE: -- then before they start
22 the operation, and start in the plant, the PRAs must
23 be completed.

24 MEMBER APOSTOLAKIS: Right. But not one
25 year.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. HAMZEHEE: Correct, yes.

2 MR. WACHOWIAK: There's a one-year
3 window --

4 MEMBER APOSTOLAKIS: One-year window.

5 MR. WACHOWIAK: -- to complete that PRA.

6 MR. HAMZEHEE: And then, there were
7 some --

8 MEMBER APOSTOLAKIS: By which time you
9 have the right to audit it.

10 MR. HAMZEHEE: Correct. Oh, yes,
11 definitely.

12 MEMBER CORRADINI: I am glad we are
13 getting all the rules of the game settled. But you
14 said something, as you were going back and forth. So
15 that one-year window between the standards you must
16 comply with is where you do the peer review, I assume.

17 MR. WACHOWIAK: The peer review is
18 typically done following the completion of the PRA.
19 So when the PRA -- so the PRA would have to be
20 scheduled so that it's completed, including the peer
21 review, prior to fuel load, but everything that needs
22 to be in the PRA, and the subject of the peer review,
23 would be the standards, endorsed standards, that are
24 in effect one year prior to the initial scheduled fuel
25 load date.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: Okay. Thank you.

2 MEMBER BLEY: Just one minor point on
3 that. Assuming the peer review identifies a number of
4 inadequacies, would they have to be addressed before
5 you could call it complete to go to fuel load?

6 MR. HAMZEHEE: Well, the way the rule is
7 right now, that PRA, before they start the plant, has
8 to be completed. And the answer is, yes, if there are
9 findings from the peer reviews, they have to be
10 incorporated into their PRAs.

11 MEMBER APOSTOLAKIS: Yes. But the peer
12 review usually addresses --

13 MR. HAMZEHEE: Because peer review is part
14 of the PRA. In other words, PRA is not complete until
15 the peer review is done, and the insights and
16 vulnerabilities are incorporated.

17 Now, if there are things that they cannot
18 do, or there are ways to show that it's okay, then
19 that's a different scenario. But peer review is an
20 integrated part of a PRA. It's not a separate
21 activity.

22 MEMBER APOSTOLAKIS: So you are referring
23 to the peer review, according to the standards.

24 MR. HAMZEHEE: Exactly.

25 MR. WACHOWIAK: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: Not the NEI review.

2 MR. HAMZEHEE: No, no, no. It's part of
3 the standard that says you do your PRA, then you have
4 to have an independent review, you have to have peer
5 review, and these are the capabilities, these are the
6 requirements of the qualifications of the reviewers,
7 and all those things.

8 MR. WACHOWIAK: And the one thing -- to
9 get back to the specific question is -- the way that
10 the peer reviews at least are currently formulated is
11 that if the review team has findings and suggestions
12 -- and they all have different levels of severity, if
13 you will, and the -- when you have your review done,
14 you have these findings and you need to assess whether
15 the finding affects what you are using the PRA for.

16 So prior to fuel load, if you have a
17 finding that affects your maintenance rule, then that
18 probably needs to be fixed prior to maintenance --
19 prior to continuing. If you have a finding that
20 affects your MSPI, maybe that would also have to be
21 fixed. But if there's findings that wouldn't affect
22 that specific thing, but would be some other use
23 later, then that would fall into this next part of the
24 rule, which is the requirements for when you have to
25 do maintenance and update of the PRA.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 And so typically what happens with these
2 other findings is they get schedule sometime into the
3 future, just like in a corrective action program you
4 get -- you schedule when you are going to update those
5 things based on how you're going to use the PRA.

6 MR. HAMZEHEE: That's correct.

7 MR. WACHOWIAK: In this particular case
8 now, the rule says that at least every four years you
9 have to do a maintenance/upgrade PRA revision.

10 MEMBER APOSTOLAKIS: But there is another
11 aspect of this that makes it, you know, a completed
12 PRA to be to everybody's advantage. I assume that you
13 will -- the agency or its contractors will put a PRA
14 on the SPAR models, right?

15 MR. HAMZEHEE: We have --

16 MEMBER APOSTOLAKIS: Because these are an
17 integral part of the reactor oversight process.

18 MR. HAMZEHEE: Right now, all I can tell
19 you is that for the operating plant, as part of the
20 ROP and significance determination process, the agency
21 has SPAR models for all of them, and that's how we do
22 the SDPs.

23 MEMBER APOSTOLAKIS: Okay.

24 MR. HAMZEHEE: Once these new reactors
25 become operating reactors, then we may have to follow

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the same rules and regulations.

2 MEMBER APOSTOLAKIS: It seems to me you
3 will.

4 MR. HAMZEHEE: Yes.

5 MEMBER APOSTOLAKIS: So this is another
6 forcing function here, that you really want to have a
7 good tool for the significance determination process.

8 MR. HAMZEHEE: Yes.

9 MEMBER APOSTOLAKIS: So it's not just a
10 risk-informed application that will force people to
11 look at the PRA.

12 MR. WACHOWIAK: That's right.

13 MEMBER APOSTOLAKIS: I mean, the SDP
14 itself is important.

15 MR. WACHOWIAK: And that's why I said that
16 the two -- the maintenance rule and the SDP are --
17 which I think NSI is part of the ROP.

18 MEMBER APOSTOLAKIS: Yes.

19 MR. WACHOWIAK: Those two things we know
20 are coming, and the PRA that is done for fuel load is
21 expected to support those. The other thing that we
22 have in the -- written into the design -- into the DCD
23 is that that PRA would be used to verify the
24 components that are in the D-RAP list.

25 MR. HAMZEHEE: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: The most important
2 question last night about the subcommittee meeting
3 was, okay, there will be all these many opportunities
4 to work on the PRA and bring it up to date. But in
5 doing that, would things that are not really changed
6 in terms of COLA, could the applicant say, "You guys
7 have already approved this during the certification
8 process, don't ask anymore questions"? Or is it a new
9 game all together?

10 In particular -- in particular, some of
11 the stuff you are doing now in digital I&C, three
12 years, four years down the line, whenever you sell 10
13 reactors, we may have new members. And you come back
14 and say, "Oh, well, you guys approved it."

15 MR. WACHOWIAK: My opinion -- I'll start,
16 and then we will --

17 MR. HAMZEHEE: We will start with Rick's
18 opinion.

19 MR. WACHOWIAK: -- and then we'll move to
20 the maintenance issue.

21 The rule talks about the updated PRA
22 associated with the endorsed standards. The current
23 ASME standard for Level 1 PRAs doesn't have anything
24 in there that says you don't have a finding if it was
25 in the -- if it was in the DCD PRA. If there is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 something wrong, it's written up as a finding. There
2 is no out in the current standard.

3 So I would expect that if they revised the
4 standard to say just what you're doing, that if it was
5 something that was certified, you don't make up --
6 that review team doesn't make a finding about it, then
7 Hossein will probably stand up and say, "We won't
8 endorse that statement. We'll modify it."

9 So my -- my opinion on this is that that
10 would not be a valid reason for saying you don't have
11 to put something in the final PRA, because, remember,
12 this PRA was built to support the design certification
13 decision.

14 MR. HAMZEHEE: That's right.

15 MR. WACHOWIAK: And it is not expected to
16 be capable of supporting all future decisions. The
17 PRA that you have in the future needs to be able to
18 support the decisions that you are going to make using
19 that PRA. So it will --

20 MEMBER APOSTOLAKIS: Even if it requires a
21 revision of some of the things you are doing now.

22 MR. WACHOWIAK: Exactly. So if we have --
23 if we have an I&C standard that is endorsed, that says
24 to do something, it's endorsed prior to that, it has
25 to be upgraded to that. There is no shield from a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 design certification PRA. A design certification PRA
2 answers the question, "Should the plant be certified?"

3 MR. HAMZEHEE: And that was the reason
4 that the Commission put in the rule specifically that
5 once you're done, you're not done for the life of the
6 plant. Every four years you have to go back and
7 upgrade it. And upgrade means if all of a sudden we
8 have new ways of doing the modeling of digital I&C,
9 because we learn more about how the software can fail,
10 we have more information on common cause failure
11 events, then we go back and say, "Guys, you all have
12 to go back and upgrade your PRA," because now we know
13 more about digital I&C. Ten years ago we didn't have
14 enough information.

15 MEMBER CORRADINI: Okay. Have we gotten
16 the ground rules set?

17 PARTICIPANT: I think so.

18 CHAIRMAN SHACK: Move on.

19 MR. WACHOWIAK: Okay. Well, and I think
20 these are important ground rules, because there has
21 been confusion about this all throughout our
22 discussions over the last year.

23 I want to put my pitch up here. The ESBWR
24 design certification PRA does meet the scope and
25 quality necessary for certification. And as long as a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 COL applicant doesn't take any departures from things
2 that are modeled in the PRA, then theirs is -- then
3 the design certification PRA is sufficient for a COL
4 at that point, to grab a COL.

5 And we did this because we drew the
6 boundary around what we were going to model in the
7 PRA, sufficient so that we could make this statement.

8 And we expanded some things, we put some things into
9 the standard design that originally had been planned
10 to be site-specific work, conceptual design in the
11 design certification. We expanded that boundary, so
12 we could make this statement.

13 Once again, it provides a -- it is
14 intended to provide a starting point for the operating
15 plant PRA. It is not the operating plant PRA.

16 MEMBER BLEY: I'm -- if the COL -- I
17 thought we have to have all initiating events
18 included, and you don't have all the initiating events
19 included at this time. The externals aren't there, to
20 some extent.

21 MR. WACHOWIAK: The externals are there.

22 MEMBER BLEY: Well, not in -- plant-
23 specific enough to stand up for the COL?

24 MR. HAMZEHEE: Well, when they submitted
25 COL application, the external events must be included.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 However, they don't have to be, for instance, fire
2 PRA. There are other methods that have been allowed
3 for the COL application phase, such as fire
4 methodology --

5 MEMBER BLEY: But that's not in the
6 current --

7 MR. HAMZEHEE: I'm sorry.

8 MEMBER BLEY: It doesn't exist for the
9 current PRA.

10 MR. WACHOWIAK: Yes. Yes, it does.

11 MR. HAMZEHEE: No. They have to address
12 all of them also.

13 MR. WACHOWIAK: A modified fire PRA.

14 MEMBER APOSTOLAKIS: The seismic is the
15 margins.

16 MR. WACHOWIAK: Seismic margins, and then
17 there's a section where we discuss other types of
18 external events, like nearby facilities and --

19 MEMBER BLEY: For seismic, all they'd have
20 to show is that they are bounded by the source term
21 you have considered. I mean, they -- I don't mean
22 source term, I mean hazard.

23 MR. HAMZEHEE: Also, for seismic they can
24 either do seismic PRA or they can do seismic margin
25 analysis to show that there are no vulnerabilities due

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to seismic.

2 MEMBER APOSTOLAKIS: And you assume a .3g
3 that --

4 MR. HAMZEHEE: Whatever -- well, then,
5 they either have that --

6 MR. WACHOWIAK: We can talk about that
7 when we get to that --

8 MR. HAMZEHEE: Yes.

9 MR. WACHOWIAK: -- that piece of it.

10 MEMBER APOSTOLAKIS: Anyway, they --

11 MR. WACHOWIAK: That one is -- that's an
12 interesting thing. We tried to look at something that
13 would be more site specific, but it turns out it
14 didn't work out that well for the certification. So
15 it's a bounding seismic PRA.

16 But, remember, the question that we're
17 answering at the DCD stage, and at the COL stage, is:
18 is this plant imposing undue risk? And if you do a
19 bounding external hazards, you can answer that
20 question in a positive way, that it doesn't pose undue
21 risk. You may not be able to take it and say that I
22 get all the same insights that I need for things like
23 maintenance rule and MSPI from that. And that would
24 happen in the future for --

25 MR. HAMZEHEE: And let me just make a

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 quick clarification. Also, let's say GE decides to do
2 the seismic risk assessment at the .3g, and let's say
3 Diablo Canyon decides to use an ESBWR, build it in
4 California. And they have a much higher earthquake --
5 design basis earthquake level. Then, they have to do
6 a site-specific seismic analysis, because .3g is not
7 adequate for them.

8 MR. WACHOWIAK: Exactly. And that's where
9 it comes into given no significant departures. If you
10 go into the COL, and you look at their list of
11 departures, if they --

12 MEMBER BLEY: Fair enough.

13 MR. WACHOWIAK: -- a departure from the
14 hazard curve, then you need a site-specific COL PRA.

15 MEMBER STETKAR: To make sure that I --
16 this is COL application, not --

17 MR. WACHOWIAK: Application.

18 MEMBER STETKAR: -- fuel load.

19 MR. HAMZEHEE: No, no, no, no. That's
20 right.

21 MEMBER STETKAR: Okay.

22 MR. HAMZEHEE: This is the transition
23 period from the design certification phase to the COL
24 holder.

25 MR. WACHOWIAK: Yes. Operating plant is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 what I meant by fuel load.

2 MEMBER STETKAR: Okay.

3 MEMBER APOSTOLAKIS: We are not deciding
4 right now whether this plan poses undue risk. These
5 words are not used anywhere. We are decided that it
6 is consistent with the Commission's goals, and
7 everything else you have on your slide.

8 MR. HAMZEHEE: Correct.

9 MEMBER APOSTOLAKIS: The undue risk is for
10 the future.

11 MR. WACHOWIAK: I stand corrected. That
12 is -- we are reviewing what I did on Slide -- meant on
13 Slide 2.

14 MEMBER POWERS: But if we find undue risk
15 here --

16 MEMBER APOSTOLAKIS: It's a problem.

17 MR. WACHOWIAK: I tried to use some
18 shorthand, and I --

19 MEMBER APOSTOLAKIS: No, no, no, no.
20 That's okay.

21 MR. WACHOWIAK: So now I want to get into
22 what it is that has been reviewed and the documents
23 that you would be looking at. So our PRA -- the
24 submitted part of the PRA is in several pieces. We
25 have DCD Chapter 19, and it's -- it describes the PRA

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and lists the key insights.

2 If you want to get into what is in the PRA
3 itself, you'd need to go into the NEDO document 33201.

4 That's the report of the PRA itself, and many of you
5 have looked at various revs of this. Rev 3 is the
6 current revision.

7 We also have a NEDO 33289, which is our
8 reliability assurance program, and it contains a
9 description of how the PRA is used for the reliability
10 assurance program.

11 33306 is the severe accident mitigation
12 design alternatives, the SAMDA that we talked about.
13 I know somebody was looking for a copy of that before.

14 This is the number that you had looked for. And
15 currently Rev 1 is out there, and that matches Rev 2
16 of the PRA. As you read through there, you will
17 probably see why we don't think we need to update that
18 particular document, at least in this -- right now.

19 We have a combination NEDO and NEDE. That
20 is our document or our naming for things that have
21 public and redacted pieces. The NEDE is the full
22 document. It describes the flood zone drawings and
23 fire zone drawings, other information that was needed
24 for pieces of the PRA.

25 And it needed to be done this way because

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 we wanted the -- we did not want the PRA to have
2 redacted pieces all over the place for the SUNCI
3 material, the sensitive unclassified, whatever. We
4 didn't want any of that in the PRA document. So what
5 we did was we just moved all of that information into
6 this separate document, which its purpose is to
7 contain -- is to hold that sensitive information.

8 So if you want a quick read, you can read
9 the public version of that document. I think it's a
10 cover page, and then 450 blank pages after that.

11 (Laughter.)

12 But that was the purpose of that document
13 was to -- is to be a container for things that we
14 would redact from the PRA.

15 The next one is another document that is
16 part public and part proprietary -- the MAC
17 experiments which were done to -- to demonstrate the
18 capability and also fine-tune the design of the BiMAC.

19 Rev 0 is the current one. And then,
20 finally, the 33411, which is the first implementation
21 of the D-RAP categorization criteria. And that I
22 guess has recently been submitted and is going to be
23 used some -- to some degree in the prioritization of
24 inspections of mechanical equipment.

25 Go ahead.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: That last one is the one
2 that I have a hang up on, because that actually is an
3 application of the design cert PRA. It's the only
4 application that I can divine from this, other than
5 the general -- this is a specific application. It's
6 being used to make decisions about these.

7 Now, I'm troubled because, you know, if I
8 bring up -- those of you who haven't been in the
9 subcommittee meetings, if I bring up my favorite
10 valves that I know about --

11 (Laughter.)

12 -- these are not in the PRA. It's
13 difficult for me to understand how that PRA satisfies
14 the quality requirements to make decisions about
15 pieces of the plant that may be important to risk when
16 I don't have all of those pieces of the plant in
17 there.

18 MR. HAMZEHEE: Let me --

19 MR. WACHOWIAK: We'll let Hossein start --

20 MR. HAMZEHEE: Let me take a crack at it,
21 because I have been working on this in the last six,
22 seven months, and there are some ideas and concerns.

23 D-RAP is almost like the way -- design
24 reliability assurance program is almost like the PRA
25 phases. We have design certification phase of D-RAP

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 that the purpose of design reliability assurance
2 program is, based on the available information, at the
3 design stage make your first attempt to identify risk-
4 significant SSCs that you think are -- that based on
5 your design information are risk significant, and then
6 there is a process that says how you have to identify
7 dose, how you take PRA information, as well as some
8 deterministic information, some expert panels, all
9 those things, and how to include all the risk elements
10 into your consideration.

11 So when the design is certified, they have
12 that D-RAP, but when the COL application comes in,
13 then they have to take that D-RAP and say, "All right.

14 Now, I'm going to have more information." And as
15 they go closer to the COL holder, then that
16 prioritization list is going to change probably, based
17 on the new information and more detailed information
18 that they have.

19 MEMBER STETKAR: Except if I do not have a
20 valve in the model, and I do not change the plant
21 design from the design cert stage to the COL stage,
22 there is no requirement for me to put that valve in
23 the model. I do not have the volume control, if you
24 will, to try to adjust to determine whether or not I
25 need to change my surveillance interval.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 For example, if I have the valve in the
2 model today, and the best I know is that today there
3 is a functional test that is performed once every 10
4 years to verify flow for that -- through that valve,
5 the combination of the valve failure mode and that
6 functional test interval, the best I know today, would
7 give that valve some ranking in terms of risk
8 significance.

9 MR. HAMZEHEE: Right.

10 MEMBER STETKAR: I don't know what it is.

11 MR. HAMZEHEE: Correct.

12 MEMBER STETKAR: At the COL stage, I might
13 decide to change that test interval, for whatever
14 reason. Might -- instead of 10 years, it might be
15 five years, or I might make it 40 years. I don't
16 know. I could then measure the change in importance
17 of that valve based on a decision that I made from the
18 design certification stage to the COL stage.

19 If the valve isn't in the model, I can't
20 investigate that change.

21 MR. HAMZEHEE: Now, are you saying --

22 MEMBER STETKAR: And I can't -- I can't
23 measure its impact on the risk, even today, because
24 it's not in there.

25 MR. HAMZEHEE: Now, are you --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: That's my concern.

2 MR. HAMZEHEE: Yes, I understand. And are
3 you saying that that valve is not included by mistake
4 or intentionally?

5 MEMBER STETKAR: At the moment, I know
6 it's intentionally not included.

7 MEMBER CORRADINI: We're clear by the
8 discussions in the subcommittee that you felt there
9 wasn't a large risk contributor. Therefore, you did
10 not specifically model it.

11 MR. WACHOWIAK: Using the rules that we
12 had when we originally put that model together, it did
13 not make the cut for going into the model. We
14 revisited that, because we've done some additional
15 modeling in the BiMAC, and it -- and it doesn't quite
16 meet those rules anymore.

17 So one of the things that we have to do is
18 make sure that -- that that's correct, and that's one
19 of the things that we now know about. And it's not
20 just those valves, it's the class of valves that we
21 had excluded from the model.

22 MEMBER STETKAR: I was going to say, I
23 only used this -- this one valve as a --

24 MR. WACHOWIAK: We understand that, and
25 when we go and look at these things we typically don't

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 look at them one component at a time. We have to look
2 at the -- at, what is your broad question?

3 So getting back to your original question
4 on this, using this initial set of risk-significant
5 components, what is the purpose of this? We have had
6 extensive dialogue back and forth with the staff on
7 how this list should be used.

8 And in the D-RAP program what we have
9 decided is it should be used as an initial list to
10 demonstrate that we know how to create these lists and
11 then -- and how to move forward from when we actually
12 use these things in a maintenance rule and such.

13 It has now also been asked to use -- and
14 we think that that's an okay way to use the list,
15 because, really, our PRA is built more to identify
16 importance at the system train level rather than at
17 the component level. And that's what we thought we
18 had to do. But there's a requirement for this list,
19 and it's a component-level list. So we've got the
20 ground rules down for how we think that list should be
21 used.

22 Now, we have other areas in the NRC that
23 are -- that want to use this list to try to prioritize
24 certain inspections. And we're just in the beginning
25 of that discussion right now and how to understand how

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to use this list to prioritize inspections.

2 And if -- when we're -- when we get to the
3 end of this discussion, that we can come to an
4 understanding with everyone that you should use it --
5 even though it's got components listed, you should use
6 the list as a system-level importance and prioritize
7 your inspections on a system basis, which is what I
8 believe they are going to do anyway, because I don't
9 think the database for inspections goes to a component
10 level. I think it's more of a -- I think we'll be in
11 the ballpark for what we need to do.

12 But this document is written such that
13 this is identified as a preliminary list based on the
14 information that we know now, and that it is intended
15 to be updated as more information becomes available.

16 MR. HAMZEHEE: So if a valve is by mistake
17 not included, or intentionally, that these are two
18 different cases, John, right? Because if they are
19 intentionally not included, it is based on some
20 evaluation, some analysis.

21 MR. WACHOWIAK: This is one of the things
22 -- and it gets back to maybe the PRA standard
23 committee, because we thought about this since --
24 since then, and I have also participated in a peer
25 review for a utility since then, and the question

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 comes down to this completeness.

2 And I think you pointed out which
3 statement it is you need to be complete, and the
4 instructions that we -- that the industry has been
5 given is that if -- it's complete, as long as it
6 doesn't change the results by too much. Whatever the
7 too much is, okay, that's up for debate right now.
8 But until you know the application, you don't know how
9 much it changes the results. You only know with
10 respect to the base model.

11 So your particular question there would
12 come into play for any PRA that, by intention,
13 excludes or screens things --

14 MEMBER STETKAR: That's right.

15 MR. WACHOWIAK: -- based on some set of
16 rules, and then you -- later you use it for an
17 application where that screening set of rules may not
18 be correct. So I think this is --

19 MEMBER STETKAR: That's correct.

20 MR. WACHOWIAK: -- bigger than just the
21 ESBWR PRA.

22 MEMBER STETKAR: No, it's -- that's --
23 you're absolutely right, Rick. That's fair.

24 My -- I think that's true, and I think you
25 have to be a little bit careful about speaking in the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 context of existing PRAs and whatever they are --
2 whatever form they are for the existing operating
3 fleet of plants, and however those PRAs are or are not
4 being used, versus where we are today in 2008, looking
5 forward to the future, for PRAs for the new plant
6 designs, and how will they be used, either in a
7 regulatory sense or by the licensees.

8 And, as a practical matter, the pragmatism
9 of putting things into a model today in 2008, as
10 compared to 25 years ago when a lot of these judgments
11 were made about how you can screen things out to keep
12 the model small enough so that, a) your software could
13 solve the model, and b) solve the model in a time that
14 was not geological.

15 MR. WACHOWIAK: And I think, though -- you
16 missed one thing, though, for where we are today.

17 MEMBER CORRADINI: After this one thing,
18 we must move on.

19 MR. WACHOWIAK: And we --

20 MEMBER CORRADINI: I think you guys are on
21 the philosophical same plane, so --

22 MR. WACHOWIAK: Yes. I think the thing
23 that you missed was Reg. Guide 1.200 was released
24 about a year and a half ago, and all the existing PRAs
25 have to be brought up to that standard if you're going

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 to use them for --

2 MEMBER STETKAR: If they're going to use
3 it.

4 MR. WACHOWIAK: And MSPI, if you're going
5 to change data in your MSPI, that's using them.

6 MR. HAMZEHEE: Go on with --

7 MR. WACHOWIAK: All right. So done with
8 -- we'll go through most of these, because I think
9 most of us have seen this before, talk about the key
10 features of ESBWR risk management. We know we're a
11 passive plant. But, once again, we want to use active
12 systems to back those things up.

13 And our design philosophy is you have --
14 for every -- for every function you have some passive
15 way of doing it, backed up by one or more active ways,
16 and you have multiple diverse support systems. And in
17 that way, just before you model anything, designing
18 the plant is going to end up with something that has a
19 risk profile that is going to be found acceptable to
20 us. Then, we have the other words on there that we've
21 talked about before.

22 To go back to what we have included in our
23 PRA, it's a fault tree/event tree model. It covers
24 Level 1, 2, and 3. Level 3 is using the generic site.

25 Once again, that was determined to be okay for the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 COL as well.

2 Internal and external events we have
3 covered. All modes -- we've done it in a bounding way
4 where we've subsumed some low power modes into our
5 full power mode, and we've addressed why that is okay.

6 Seismic margins for seismic -- we used
7 generic data, historical initiating event frequencies,
8 and screened for -- for things that are no longer in
9 the plant. So we only removed things that are no
10 longer in the plant.

11 We do parametric uncertainty, and we have
12 -- this is the key to some of these other things -- a
13 systematic search for modeling uncertainties. The way
14 that we went through this in our models was we had all
15 of the engineers that created a model write down a
16 list. What are all your assumptions? And in a new
17 plant PRA that the plant has not been built everything
18 is an assumption. Okay? Write them all down,
19 including what you put in the model and what you
20 excluded from the model.

21 Then, we screen all those, and some of
22 them make it into the PRA report as important
23 insights, and then they are screened again with
24 respect to the things from page 2, to see if they make
25 it into the key insights table there.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 But in our -- in our documentation, we
2 have the list of all the things that we didn't model
3 in the plant. That is already on our list of
4 assumptions that we have there.

5 We did an internal review for compliance
6 with the ASME standard, and I guess I should say
7 "slash Reg. Guide 1.200." At the time, Reg. Guide
8 1.200 wasn't the -- wasn't required -- a requirement
9 at the time. So we used the -- at least in its
10 incarnation we used this, and the interim staff
11 guidance says that an internal review by the vendor is
12 sufficient for design certification. So that's where
13 we are with that.

14 Risk profile -- as we said before, we
15 won't get into the details of this. It's a nice,
16 balanced profile. There isn't any one particular
17 initiator type that dominates risk. We did that by
18 design.

19 MEMBER POWERS: Can we go back to the
20 previous slide? Did the subcommittee explore your
21 parametric uncertainty analysis?

22 MR. WACHOWIAK: There have been some
23 questions about that in some of the previous
24 presentations.

25 MEMBER CORRADINI: Dana, can you -- can

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 you expand on what your question is? I'm sorry, I
2 don't --

3 MEMBER POWERS: I'm trying to find out --
4 it is apparent you are not going to go into that
5 parametric uncertainty here.

6 MEMBER CORRADINI: No.

7 MEMBER POWERS: I'm trying to find out if
8 the subcommittee explored this with you.

9 MEMBER CORRADINI: We're talking about --
10 but I'm still -- I'm sorry that I'm still not clear
11 what you are thinking of when you say this. I'm
12 sorry. Can you expand a bit more?

13 MEMBER POWERS: What I want to know is,
14 did they address correlations among parameters? How
15 did they set distributions for parametric values? How
16 did they set the --

17 MEMBER APOSTOLAKIS: They used -- I
18 believe there was some discussion -- I'm not sure
19 about the correlation --

20 MEMBER STETKAR: There wasn't a lot.

21 MEMBER APOSTOLAKIS: -- the correlations,
22 we -- would you use a 100 percent correlation, state
23 correlation for similar components?

24 MR. WACHOWIAK: Yes.

25 MEMBER STETKAR: We looked at high-level

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 things like that. I know we looked at the failure
2 rate distribution and how it was derived for a couple
3 of -- some interesting pieces of equipment. But in
4 terms of in-depth examination of the parametric
5 distributions themselves, and how the uncertainties
6 were actually propagated through, I certainly didn't
7 look at that.

8 MEMBER CORRADINI: Well, I was going to
9 say, I'm not sure -- I'm still not sure if I'm --
10 we're answering your question. Are you more
11 interested in the modeling uncertainties of -- for
12 example, in BiMAC operation, or are you interested
13 more in terms of passive system reliability? They did
14 do -- they did do MAAP. We saw -- we asked for and
15 got MAAP versus TRACG calculations and the effect of
16 modeling uncertainty between those, but not a full
17 uncertainty analysis. Is that -- are we getting
18 closer to what you're interested in?

19 MEMBER POWERS: I am interested in the
20 mechanics and the details of how they did the
21 parametric -- their parameter uncertainties.

22 MEMBER APOSTOLAKIS: They assumed 100
23 percent correlation for similar components. But the
24 distributions -- 99 percent of them are log normal,
25 right? And it was Monte Carlo propagation. This is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the -- what people do more or less routinely for PRA.

2 Some of the issues that you raised on Tuesday I don't
3 think they addressed, but they did what you would
4 expect to see in a standard PRA.

5 MR. WACHOWIAK: And the only thing that
6 remains open in my mind from the Rev 3 that you may
7 have looked at is that the database that we had in the
8 report needed to be modified with additional
9 distributions in order to complete this analysis. And
10 that -- and that set may not have been the one that
11 was in the report.

12 I think for the -- since that came up,
13 we're making sure that the -- the UNSR database is the
14 one that we actually put in the report. It was a
15 timing thing. We had the -- that section of the
16 report done before we did the other one.

17 MEMBER BLEY: There was -- since I heard
18 yesterday that -- or the day before that all of these
19 are parametric, I guess there's one area I'd like to
20 add in. We -- Rick described to us how they tried to
21 address new initiating events that might exist for
22 this kind of plant, through a systematic process, and
23 yet I still haven't found the documentation of that.
24 The description was good.

25 MR. WACHOWIAK: You've seen our internal

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 -- it didn't make the report. The question could come
2 out, and we could move that forward. But, once again,
3 not 100 percent of the things made --

4 MEMBER POWERS: I guess it bothers me to
5 hear that 99 percent of your distributions are log
6 normal. I would have expected -- but there surely
7 must be a reason.

8 MEMBER BLEY: I think tradition is
9 probably -- the database that we picked for our
10 generic data came from the EPRI URD and the
11 distributions they have in there.

12 MEMBER APOSTOLAKIS: Are these results
13 point estimates?

14 MR. WACHOWIAK: Point estimates. It says
15 on the bottom, "Point estimate" --

16 MEMBER APOSTOLAKIS: It says that. Okay.

17 MR. WACHOWIAK: -- "UNSR for calendar
18 year" --

19 MEMBER APOSTOLAKIS: Because I remember
20 when I read the report that the mean value I believe
21 -- after you do the parametric uncertainty
22 propagation, seven 10^{-8} , or something like that. So
23 it's higher. Not an order of magnitude, but it is six
24 or seven 10^{-8} . It's on that order, Rick.

25 MR. WACHOWIAK: I think one of the earlier

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 versions had that, and in Rev 3 it was nearly the
2 same --

3 MEMBER APOSTOLAKIS: Really?

4 MR. WACHOWIAK: -- as this one.

5 MEMBER APOSTOLAKIS: I would expect it to
6 be higher.

7 MR. WACHOWIAK: It would. But, remember,
8 we do have a balanced risk profile, and there are --

9 MEMBER APOSTOLAKIS: So when you --

10 MR. WACHOWIAK: -- contribute evenly.

11 MEMBER APOSTOLAKIS: So the point
12 estimates you inserted into the calculation, what the
13 mean values of the underlying distribution --

14 MR. WACHOWIAK: Yes.

15 MEMBER POWERS: You conclude from this
16 slide that the only time I worry about your plant is
17 when you're shut down.

18 MR. WACHOWIAK: The time -- well, let's
19 back this up another way. Based on this, you should
20 conclude that you don't have to worry about this
21 plant.

22 (Laughter.)

23 But if you were going to worry, then the
24 shutdown is more important, mainly because one of our
25 key features is taken away in this assumption, or in

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 this particular model for shutdown we model a
2 refueling outage, and we take away the containment.
3 When we take away the containment, we take away some
4 of our past features. So this -- this distribution is
5 completely expected.

6 MEMBER CORRADINI: So you have a pretty
7 open -- in fact, that was the key thing, if I
8 remember, when you were describing this at the
9 subcommittee.

10 MR. WACHOWIAK: The LERF is the same.

11 MEMBER POWERS: That's remarkable, because
12 your most hazardous configuration is a fire during
13 shutdown --

14 MR. WACHOWIAK: And we explained that --

15 MEMBER POWERS: -- containment.

16 MR. WACHOWIAK: And because the systems
17 that would mitigate a transient induced by the fire
18 are taken away by the containment not being there.
19 And we also describe in the report that due to many of
20 the bounding assumptions in the fire PRA, for example,
21 there is no mitigation -- or there is no fire
22 suppression modeled, either automatic or manual,
23 that's not modeled, and we also don't do specific
24 target set fire modeling.

25 So a fire -- any fire in any area is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 assumed to affect everything in the area. So we
2 believe that's a bounding number for fire, explained
3 that in the report, and you're correct, it is the
4 highest number on the --

5 MEMBER APOSTOLAKIS: You did do some --

6 MEMBER POWERS: What we want to do is have
7 fully enriched fuel here, so you never shut down.

8 MEMBER APOSTOLAKIS: Can you remind us
9 real quick, because I remember there was --

10 MR. WACHOWIAK: We did several sensitivity
11 analyses on these various things, and we looked -- in
12 the fire area, in particular, we looked at things
13 like, is it important to maintain the fire barriers
14 during shutdown? The answer turned out to be yes.

15 And other things that we looked at were
16 sensitivities to where we would place equipment. I'll
17 get to that in another slide, hopefully in the next
18 few minutes here.

19 MR. HAMZEHEE: We still have the staff's
20 presentation.

21 MR. WACHOWIAK: Right.

22 MEMBER CORRADINI: He is going to get
23 there.

24 MR. WACHOWIAK: I still have 15 minutes,
25 according to -- because we have to factor in the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 questions.

2 MEMBER CORRADINI: We started 15 minutes
3 late, so keep on going.

4 MR. WACHOWIAK: Okay. In the severe
5 accident analysis, the scope, we have discussed this
6 before. There are things in the rule that says you
7 have to discuss prevention. That's the Level 1
8 essentially. And then, you discuss mitigation. The
9 things that we looked at -- hydrogen control, debris
10 coolability, high pressure melting -- those types of
11 things, and then the SAMDAs.

12 This information is contained in DCD
13 Chapter 19, and then also in the NEDO in Section 21,
14 and then in the BiMAC report. Or, I'm sorry, this is
15 I believe the SAMDA report.

16 Okay. One of the things that I wanted to
17 point out was that the PRA was a major influence on
18 the design. It was a good thing to do while we were
19 designing the plant. Some examples -- even though we
20 can't fully model the digital I&C, we still had a
21 major impact on using our information in the model for
22 how we would set up the interface between the digital
23 and the mechanical equipment, so that we can minimize
24 things like spurious actuations due to fire. And we
25 -- we added features to the digital I&C system so that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 it would specifically perform this.

2 Selection of diverse components -- when we
3 looked at how we wanted a system to -- to behave, one
4 of the things that the PRA always looked at is, okay,
5 you put in the system, so where is the diversity, so
6 that we can -- so that we minimize the impact of the
7 common cause in specific systems.

8 Added redundancy to the reactor water
9 cleanup isolation valve. There was a specific outside
10 containment that basically was -- would have been high
11 on the risk meter, if you will, when we finished the
12 results. And it also resulted in the containment
13 bypass, so we added features to try to minimize that.

14 Added the BiMAC to add additional protection to just
15 the spreading area on the floor for the ESBWR.

16 MEMBER ABDEL-KHALIK: There were some
17 questions regarding the thermal hydraulic performance
18 of the BiMAC. Are we going to address those at some
19 time in the future, Mr. Chairman?

20 MR. HAMZEHEE: I think the -- also, NRC
21 staff has some RAI on it and will talk about it.

22 MR. WACHOWIAK: We still have open RAIs on
23 that.

24 MEMBER CORRADINI: So the answer to your
25 question is yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER ABDEL-KHALIK: Okay. Thank you.

2 MEMBER CORRADINI: We have to come back
3 and hear their responses. They still are working on
4 responses to staff.

5 MEMBER ABDEL-KHALIK: Thank you.

6 MEMBER APOSTOLAKIS: Which one of these
7 are purely or almost purely defense-in-depth measures?

8 MR. WACHOWIAK: Which ones are purely
9 defense-in-depth measures?

10 MEMBER APOSTOLAKIS: In other words, you
11 are pretty confident you have a safe plant, but you
12 are going to do some of these as extra defense-in-
13 depth.

14 MR. WACHOWIAK: The BiMAC is certainly one
15 of those.

16 MEMBER APOSTOLAKIS: Okay. Go even if it
17 doesn't work very well --

18 MR. WACHOWIAK: We are no worse off
19 than --

20 MEMBER APOSTOLAKIS: -- you are no worse
21 off.

22 MR. WACHOWIAK: -- than ABWR.

23 MEMBER CORRADINI: Now, since you said --

24 (Laughter.)

25 -- since you said that, and he was my

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 straight man for this, is there analysis that shows
2 that?

3 MR. WACHOWIAK: There was an RAI where we
4 were asked that particular question.

5 MEMBER CORRADINI: And so it's still being
6 developed.

7 MR. WACHOWIAK: And we -- no, we answered
8 that RAI.

9 MEMBER CORRADINI: Oh.

10 MR. WACHOWIAK: And the question there is
11 is I don't know exactly how -- how -- if that's in the
12 final report, or if it was covered in the audit, or
13 where that ended up. I -- I probably should have
14 looked that up to see where that ended up, but we
15 did --

16 MEMBER CORRADINI: We'll save that.

17 MR. WACHOWIAK: -- the analysis, and it
18 was given to the staff and they reviewed it.

19 MEMBER CORRADINI: Okay. That's fine.

20 MR. WACHOWIAK: In addition, in a severe
21 accident, water injection pump is another thing that
22 it was -- basically came in from the PRA. That's
23 another defense-in-depth measure there. And we have
24 identified enhancements that will be resolved during
25 procedure development, and in the Chapter 19 set of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 insights there are several of these that say, "When
2 you write your operating procedures, consider this
3 insight and various other things." But there are more
4 insights that came from the PRA that will be done in a
5 later phase, but they are just not done now.

6 MEMBER APOSTOLAKIS: Let me ask you this,
7 though. The first bullet, okay, what exactly does
8 that mean? You said you wanted to prevent spurious
9 actuation.

10 MR. WACHOWIAK: Yes.

11 MEMBER BLEY: It says eliminate. This is
12 not prevent; this is eliminate.

13 MEMBER APOSTOLAKIS: Limit it. Okay. So
14 how --

15 MR. WACHOWIAK: The goal is to eliminate
16 it.

17 MEMBER APOSTOLAKIS: Can you explain, how
18 does that work?

19 MR. WACHOWIAK: Yes. The --

20 MEMBER APOSTOLAKIS: Don't worry about
21 that.

22 MR. WACHOWIAK: The way that it works is
23 our -- first off, our I&C -- the communications
24 amongst the I&C systems is all by fiber. So that's
25 the first thing. We don't have a long wire that is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 running from the control building over to the cabinet
2 for the actuator that is susceptible to some sort of
3 an impact there. That is all done by fiber.

4 Then, once we get into -- we recognize
5 that once we get into the cabinet, though, if the
6 control cabinet itself has an issue due to fire, the
7 control cabinet could send the signal out to actuate
8 one of the squib valves, or more of the squib valves,
9 something like that.

10 So instead of just taking the power from
11 that room in the cabinet and running it to the device,
12 we put two cabinets in separate fire zones on separate
13 floors of the building. So the power comes in from
14 here, has to go through this cabinet, then through
15 this cabinet, and then out to the field. That way,
16 you have to have a simultaneous fire in two different
17 fire zones before it is even possible to get a hot
18 short that would actuate the device.

19 And we are also now in the process -- you
20 know, that was -- that was originally the goal, to
21 eliminate -- there is one last thing that we need to
22 address with that, and it's being addressed right now,
23 is the smoke propagation that could potentially cause
24 those actuations, and that's something that we have
25 answered to the staff, we think we have the answer.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER APOSTOLAKIS: And you left it at
2 that. You just did that. You didn't attempt to
3 probabilistically -- which is fine with me, if you --

4 MR. WACHOWIAK: What we did was we assumed
5 -- we made a deterministic, we thought bounding
6 assumption, was that if the fire barrier failed, then
7 it -- we would have spurious actuations. So that's
8 how it got into the probabilistic portion was that if
9 the fire -- if the fire barriers work, we calculated
10 those probabilistically -- the failure rate of the --
11 failure probability of the fire barriers. If they
12 worked, no spurious actuation. If the fire barrier
13 fails, spurious actuation.

14 MEMBER APOSTOLAKIS: It seems to me that
15 that would be an acceptable approach to the whole
16 issue of digital I&C systems.

17 MR. WACHOWIAK: We think so.

18 MEMBER APOSTOLAKIS: Rather than saying
19 that there is a probability of six times 10^{-4} of a
20 common cause failure. This would be perfectly fine
21 with me.

22 MEMBER CORRADINI: Move on, please.

23 MR. WACHOWIAK: Okay. The other piece of
24 this is we had -- we had the extensive review with the
25 staff, and their review also influenced what the PRA

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 actually ended up looking like. Originally, our
2 Level 3 was only -- was only internal events, and
3 questions about, well, how does it affect external
4 events, we extended the model to include that.

5 The enhanced documentation of assumptions
6 that we talked about earlier basically started out
7 from questions that came from the staff over and over
8 again about how we did -- how we addressed certain
9 assumptions, and finally we ended up coming up with
10 this systematic process for documenting the
11 assumptions.

12 Question earlier, did we -- I think zero
13 and one, used five methodology for fire, and when we
14 went to Rev 2 we went to a fire PRA in accordance with
15 the new NUREG that's out, to the extent possible.
16 There are still some things we can't do there.

17 And then, other things, this review --
18 systematic review of the PRA with respect to the
19 standard was a question that came from the staff. We
20 had done it piecemeal, and then after that question we
21 went ahead and did a systematic review. So we think
22 that that helped enhance our final product.

23 Okay. Now, getting to open items, and
24 Hossein is going to talk more in detail about what
25 these open items are. But there is really four or

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 five areas here. That's this quality assessment that
2 we talked about. We have submitted the results of
3 that. We think we are on a path to success there.
4 And, once again, the audit is supposed to close that
5 out.

6 Seismic margins analysis -- we -- last
7 time we met with the subcommittee in June we -- we
8 said that there was a problem associated with seismic
9 margins and which hazard curves we used for the
10 seismic margins. Right now, where I -- we think we're
11 on a path to success here using the certified design
12 response spectrum.

13 Since we talked, Hossein, I have seen the
14 results from our most-limiting building, and we are
15 okay on the most-limiting building. We just need to
16 expand that now to all the rest of the components that
17 were done there. So it looks like we're on a path to
18 success for the seismic margins, using the response
19 spectrum that was requested.

20 In the high winds analysis, there is still
21 an open item here on the assumptions of the building
22 capabilities and extremely high winds, and whether we
23 should treat it probabilistically or
24 deterministically.

25 We are working on the response for that,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and when we know the answer then we will -- we will
2 come back. But this is a problem that I haven't seen
3 addressed in PRAs before, so it's a -- the question
4 that came from the staff is: do you have a building
5 fragility associated with the failure of the buildings
6 during the high wind events? And, once again, there
7 may be something out there for that, but it's not
8 something that I have encountered, how you generate
9 those fragility --

10 MEMBER BLEY: Yes, people have them. Yes.

11 MR. WACHOWIAK: So, great. If you could
12 send me a reference, then I'll --

13 MEMBER POWERS: When you think about high
14 winds, you're thinking in terms of hurricanes and
15 tornadoes?

16 MR. WACHOWIAK: Yes.

17 MEMBER POWERS: And since you are
18 designing this plant for many years of operation,
19 maybe 80 years of operation, do you have to think
20 about for the -- how often we would get high winds in
21 various parts of the country? How do you think about
22 that?

23 MR. WACHOWIAK: We did a couple of
24 different things. The first thing that we did is for
25 hurricanes the data that we used was only the coastal

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 data. So we think we -- for the hurricane type winds,
2 we didn't average in all the different sites. We
3 tried to use the coastal sites.

4 Then, we also looked at --

5 MEMBER POWERS: So it would be different
6 than for Gulf of Mexico versus the Atlantic or --

7 MR. WACHOWIAK: Yes. And we looked at the
8 data that we had there for -- for trends like that,
9 and the Gulf -- I think it's the Florida peninsula and
10 the Gulf of Mexico is where the concentration of the
11 data was.

12 So if we -- by the way we applied this, we
13 think we set up a bounding -- questions yet that were
14 out there, are these frequencies going to change going
15 into the future? We did some sensitivity analyses to
16 address that, but we think we have got that set up
17 correctly.

18 The other thing -- for tornadoes now we
19 used -- okay. You're mainly interested in the
20 hurricanes, then.

21 MEMBER POWERS: Now, you're a little bit
22 too glib there. You say you think you've got it set
23 up. I mean, do you -- you prognosticated about the
24 future. I mean, how do you do that? I think you may
25 be wrong about that. I think the richer data set is

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the Atlantic coast, and the poorer data set is the
2 Gulf of Mexico data set.

3 MR. WACHOWIAK: I probably didn't explain
4 exactly how we did this in enough detail to get that.

5 The data that we used for the -- for the hurricanes
6 was based on the coast to determine what the fraction
7 of Category 1, 2, 3, 4, 5 hurricanes would be.

8 But the data -- but the frequency itself
9 of the upset condition at the plant was based on the
10 upset conditions at actual coastal plants. And the
11 plants that had hurricane-related disruptions were
12 Florida and then the Gulf Coast. So to determine what
13 the fractions of the different hurricanes are, we used
14 the NOAA data. But to get the frequency at a site
15 that there would be an upset, we used site-specific
16 data from upsets.

17 MEMBER POWERS: You've just got a lot more
18 plants in Florida, so, yes, you obviously used that.

19 MR. WACHOWIAK: And, actually, I think if
20 you go through and look at the data, you might even
21 screen two of the three events out, because they
22 weren't necessarily associated with the high winds.
23 They were associated with something else other than
24 that. So --

25 MEMBER POWERS: But now, how did you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 prognosticate to the future? Who is to say that
2 historically that is the same as going to be -- what
3 we saw in the past is what we're going to see in the
4 future?

5 MR. WACHOWIAK: For the base frequency,
6 that's what we did, and then we did a sensitivity
7 analysis by increasing those frequencies to see where
8 the break point would be, where it would become a
9 significant contributor.

10 MEMBER CORRADINI: Can you remind --
11 before we move on, can you remind Dana what you found
12 by that sensitivity?

13 MR. WACHOWIAK: If I remember correctly,
14 and it's something that we're going to have to go back
15 and look at, I think that we found that even a factor
16 of 10 increase didn't make hurricanes a significant
17 contributor.

18 MEMBER POWERS: Using the same
19 distribution of one to five categories.

20 MR. WACHOWIAK: Yes.

21 MEMBER POWERS: I can find people that say
22 that that distribution is going to change in the
23 future.

24 MR. WACHOWIAK: That's true. You can find
25 people that will say that.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 (Laughter.)

2 And you -- that -- we think that the
3 sensitivity that we looked at there is the appropriate
4 one, mainly because we raised everything together. So
5 the frequency of the -- of the higher would be also
6 increased, as well as the frequency of the lower.

7 The complement of equipment that we use to
8 address the higher wind speeds is greatly reduced
9 compared to the complement of equipment that we use
10 for the lower wind speeds, because the buildings are
11 designed for up to the -- I think the site wind speed
12 is 155 mile an hour hurricane. So --

13 MEMBER BLEY: I'm not sure I understood
14 what you just said, that sentence.

15 MR. WACHOWIAK: Okay. The buildings that
16 we have -- the buildings part or why I think that the
17 distribution is --

18 MEMBER CORRADINI: Just say it again
19 slower.

20 MEMBER BLEY: Say the whole thing again
21 slower.

22 (Laughter.)

23 MR. WACHOWIAK: When we looked at the
24 sensitivity, we increased all the frequencies --

25 MEMBER BLEY: That part again.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. WACHOWIAK: -- one, two, three, four
2 all together. And we looked at the overall effect.
3 The model looks at all the different distributions.
4 So the -- what we wouldn't expect is to see a factor
5 of 100 increase in Category 5 hurricanes with a factor
6 of zero increase in the Category 3. So I think that's
7 part of what the question is, is did you vary the
8 distributions between those?

9 MEMBER BLEY: What I really wanted you to
10 say over again was the part about the set of equipment
11 that you looked at for different --

12 MR. WACHOWIAK: Okay. The set of
13 equipment that we used is reduced in the higher wind
14 speeds, because as you get to the different wind
15 speeds, when we move outside the envelope of design
16 for a certain non-safety-related building, we no
17 longer take credit for any of the equipment in that
18 building.

19 MEMBER BLEY: Okay. That's what I didn't
20 follow when you said it the first time. Okay.

21 MEMBER POWERS: But you did -- just did a
22 sensitivity study. You didn't -- and you jacked it up
23 by some factor of 10? Okay.

24 MR. WACHOWIAK: Yes.

25 MEMBER POWERS: I mean, I don't know of

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 anybody that's proposing a factor of 10 increase, so I
2 certainly --

3 MR. WACHOWIAK: And, once again, we will
4 need to check on exactly how that sensitivity was,
5 since I didn't review that just before I came in this
6 morning, but it was -- it was on that order. And
7 then, remember, what we're doing here is we're looking
8 to see, for that particular thing is, are there any
9 key insights that come from that that we would put in
10 Chapter 19?

11 So, once again, if you went to a factor of
12 10, and it didn't encroach on any of the safety goals
13 or the other parameters with the -- in the -- that we
14 looked for with the PRA, then we can say confidently
15 that it's not going to generate anything different
16 with the design.

17 So we do know the exact number for every
18 site? No. But we think that we know enough for every
19 site that high winds is not going to be a way that you
20 could push the plant to a point where it wouldn't meet
21 the Commission's safety goals.

22 MEMBER BLEY: I hate to admit there is a
23 hole in my reading, but was this described in the PRA,
24 the sensitivity studies?

25 MR. WACHOWIAK: The sensitivity, I -- we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 had some of the sensitivities in Rev 3, but there were
2 still open RAIs at the time we wrote Rev 3.

3 MEMBER BLEY: Oh, okay.

4 MR. WACHOWIAK: And I think a couple of
5 these other sensitivities -- but I think they are more
6 building-related sensitivities are in the -- in the
7 RAIs.

8 MEMBER CORRADINI: I don't think we
9 dwelled -- I think we're going to have to move on, but
10 I don't think we dwelled on it as much as knowing that
11 the responses are on their way to coming or have come.

12 So --

13 MR. WACHOWIAK: Yes. For the -- there are
14 some four open items yet in shutdown event, in the
15 details of how those are modeled. Two of the answers
16 are -- have been responded to. Matter of fact, I
17 think the letters came out today, and we are still
18 working on the other two issues. So those -- we
19 looked -- it looks like we're on a path to resolution
20 for those.

21 And then, in the severe accident area, we
22 have I believe 21 documented questions on the BiMAC
23 right now. Is that not right?

24 MR. HAMZEHEE: 28.

25 MR. WACHOWIAK: 28 questions on BiMAC.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 That's our most significant area to answer. Those --

2 MEMBER CORRADINI: We're just very
3 curious.

4 MR. WACHOWIAK: And the reason that those
5 -- there's those that are left out is the BiMAC test
6 report is a recent submittal to the staff, and we're
7 getting to that point in the review right now. So
8 those are all under development and don't have any
9 reason to expect why they would be -- or would miss
10 the scheduled dates for that. So that's in the PRA
11 area.

12 Now, I want to get into RTNSS briefly,
13 because this is some --

14 MEMBER CORRADINI: Very briefly.

15 MR. WACHOWIAK: I have the different ways
16 that things can become RTNSS. The top two -- A and B
17 -- are deterministic. C and D -- C is definitely a
18 probabilistic thing. D is somewhat probabilistic,
19 somewhat deterministic. And then, E is another
20 deterministic thing, where -- so everybody thinks that
21 RTNSS is all probabilistic stuff, where you find the
22 important equipment and you put it in this program.
23 Most of the ways to get something in the RTNSS is
24 deterministic and are associated with other issues,
25 other things.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 The main thing that we focus on in RTNSS
2 with the staff are the quality levels for the Class B
3 and what we call Class C RTNSS equipment. So those
4 are there. You can read those.

5 The design treatment, which is basically
6 what do you do with the RTNSS equipment once you've
7 identified it, we have certain design requirements for
8 these. These are in our design specifications, and
9 there is some description of this in the BCE as well.

10 If it's active components that you're
11 looking for in this, we have redundant active
12 components. So if we have a RTNSS function, we'll
13 have redundant active components, which means we can
14 share passive components like buildings, pipes, tanks,
15 things like that.

16 The RTNSS equipment needs to be fire- and
17 flood-protected. So where you might have a non-
18 safety-related component that used to be combined with
19 other things in a single flood area, what we've
20 identified is that there needs to be some flood
21 protection for these things.

22 Hurricane Category 5 missile protection is
23 what we're looking at there. This -- so if it's in a
24 building -- if it's in -- what's that? You want me to
25 go back? Okay.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: He reads slowly. He
2 has a quick question.

3 MEMBER APOSTOLAKIS: C.

4 MR. WACHOWIAK: C.

5 MEMBER APOSTOLAKIS: I thought that under
6 -- the components that you needed, you need the
7 Commission -- they were automatically safety-related.

8 MR. WACHOWIAK: No.

9 MEMBER APOSTOLAKIS: No?

10 MR. HAMZEHEE: I'm sorry. What was the
11 question, George?

12 MEMBER APOSTOLAKIS: The focused PRA says
13 do a PRA only with safety-related SSCs, and show that
14 you meet the goals, right? You have to meet the
15 goals --

16 MR. HAMZEHEE: Yes.

17 MEMBER APOSTOLAKIS: -- with the safety-
18 related.

19 MR. WACHOWIAK: No. It's --

20 MR. HAMZEHEE: It's not safety-related.
21 It says that, first, do your PRAs without the RTNSS
22 systems and see --

23 MEMBER APOSTOLAKIS: No, forget about the
24 RTNSS. Is it true that if you need something to meet
25 the Commission goals, it becomes safety-related?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. HAMZEHEE: Not necessarily, because
2 Rick had the existing PRAs and the PRA safety goals.
3 They take credit for safety systems as well as non-
4 safety systems.

5 CHAIRMAN SHACK: No, no. But this is for
6 advanced reactors. Clearly, that's not true for
7 current reactors.

8 MR. WACHOWIAK: The way that this is --
9 was set up is you do the focused PRA with only the
10 safety-related components.

11 MEMBER APOSTOLAKIS: Right.

12 MR. WACHOWIAK: Okay? If you meet the
13 Commission's safety goals with only the safety-related
14 components, then you are done. If you don't, then you
15 add non-safety components until you do meet the goals,
16 and all of those non-safety components must be RTNSS.
17 That's what C is.

18 MR. HAMZEHEE: I think that he is mostly
19 -- yes, he is correct.

20 CHAIRMAN SHACK: The answer is that you
21 have regulatory control over all equipment needed to
22 meet --

23 MR. HAMZEHEE: Because I think that --
24 remember, George, the purpose of RTNSS is to make sure
25 that those systems that are not safety-related, but

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 are important to safety, are being taken credit, that
2 the risk assessments are going to go through some
3 regulatory treatment, so that they don't become
4 unavailable when they are needed. That's really the
5 purpose. And to ensure that those components are
6 captured, then we do two or three different PRA
7 analysis under C category to capture all those
8 components and systems.

9 MEMBER APOSTOLAKIS: So how do you
10 determine safety-related? Through some other method?

11 MR. HAMZEHEE: Chapter 15. There is a
12 Chapter 15 analysis that anything you take credit for
13 in your design basis accidents by definition are --

14 MEMBER APOSTOLAKIS: They're
15 deterministic.

16 MR. WACHOWIAK: Correct.

17 MEMBER APOSTOLAKIS: Sorry. I wasn't
18 there.

19 PARTICIPANT: I knew you weren't.

20 MR. WACHOWIAK: Our stuff is actually in
21 Chapter 6.

22 So what some of -- what our treatment that
23 we have here -- this is our design treatment, and then
24 regulatory -- these things could be -- would be
25 inspected, designed for the environment they're in.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 We use quality suppliers. They don't have to be
2 Appendix B suppliers, but they do have to have a
3 quality program; ISO 9001 are examples for -- given in
4 the SRP.

5 For the RTNSS B functions, the things that
6 are required to achieve or maintain safe shutdown
7 following 72 hours, we have made those seismic
8 Category 2. For other RTNSS functions, they don't
9 necessarily have a specific seismic category.

10 We do use technical specifications for
11 components that are needed to meet the CDF and LERF
12 goals, and it's not quite as simple as saying the
13 things that you put in RTNSS C go into tech specs.
14 There is a description in there where we added things
15 into RTNSS.

16 And then, to determine if it needed
17 technical specifications, we did an importance on
18 those things that we added. If they turned out to be
19 important, and the criterion is in the report, then it
20 would have technical specifications. The diverse --
21 many of the functions of the diverse protection system
22 or diverse digital I&C system ended up in tech specs.

23 For everything else, it's addressed in
24 what we call the availability controls manual. It
25 looks like tech specs, but it's not. But it's for

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 non-safety components, and it's there to assure that
2 the plant is controlling the availability of the other
3 RTNSS components.

4 I say here for front-line systems it's
5 because the way we treat support systems in the ACM is
6 that their availability is tied to the front line
7 systems, so that they don't explicitly cull out the
8 support systems.

9 MEMBER ABDEL-KHALIK: Just an order of
10 magnitude, how many SSCs are there in the RTNSS C
11 category?

12 MR. WACHOWIAK: A lot.

13 (Laughter.)

14 MEMBER ABDEL-KHALIK: It's alarming.

15 PARTICIPANT: C?

16 MEMBER ABDEL-KHALIK: C, yes.

17 MEMBER APOSTOLAKIS: You mean the
18 probabilistic.

19 MEMBER ABDEL-KHALIK: Right.

20 MR. WACHOWIAK: Probabilistic. And the
21 reason that it came out that way is associated with
22 how we put the support systems for the plant together.

23 So the system that we wanted to have in RTNSS for C,
24 to address the goals, is the fuel and aux pool cooling
25 system. So it acts like a suppression pool cooling

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and LPCI system, as an active system for our plant.

2 That's the system that we needed to have
3 in RTNSS. But that system needs closed cooling water,
4 it needs HVAC, it needs instrumentation, it needs
5 electricity, it needs service water. It needs all the
6 different support systems.

7 So once we say we want to use that
8 particular system, by definition we drag in all the
9 support systems that are needed to run that particular
10 system.

11 MEMBER APOSTOLAKIS: And a related
12 question is: how many of the safety-related SSCs will
13 end up being not risk significant? You're not going
14 to do that, but I -- somebody in the future might do
15 it.

16 MR. WACHOWIAK: That's a different --

17 MEMBER APOSTOLAKIS: That's a very high
18 percentage.

19 MR. WACHOWIAK: That's a different
20 question completely.

21 MEMBER APOSTOLAKIS: Completely.

22 MR. WACHOWIAK: And it would be -- it
23 would be nice to do that, to see if we could move some
24 things out of safety-related. But in this particular
25 plant, there is really not that many safety-related

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 components, because of the -- there's safety-related
2 structures, but not a lot of safety-related
3 components.

4 MEMBER APOSTOLAKIS: But did you say that
5 once you decide to use it on a system you bring all
6 these other systems -- don't the deterministic
7 requirements --

8 MR. WACHOWIAK: For the active systems.
9 For the passive systems, remember, you have a valve,
10 you've got the I&C system, you've got a battery.
11 There's not really a lot of components there.

12 So for ESBWR, going through that exercise
13 may not get us much in terms of reduction.

14 MEMBER CORRADINI: We're going to have to
15 have the staff, so I --

16 MR. HAMZEHEE: Mark has some
17 statistical --

18 MR. CARUSO: Yes, this is Mark Caruso. I
19 just thought I'd try to be helpful on this question
20 about how many were in C, because there's a handy-
21 dandy list that is in the DCD, and I just happen to
22 have it with me. So I counted them, and there's 22.

23 MR. WACHOWIAK: Systems.

24 MR. CARUSO: I don't know if I -- I mean,
25 there's -- it somewhere between -- I mean, it's MSIVs,

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 it's valves, it's systems, it's -- this is a list of
2 22 things, some of which are components, some of which
3 may be --

4 MR. WACHOWIAK: They're systems.

5 MR. CARUSO: 22 particular SSCs that
6 contribute to satisfying certain functions from that
7 category.

8 MEMBER APOSTOLAKIS: Do you always carry
9 that with you, Mark?

10 (Laughter.)

11 MR. CARUSO: Only when I come and visit
12 with the Committee.

13 MEMBER CORRADINI: Keep on going, please.

14 We need to --

15 MR. WACHOWIAK: So we do have some open
16 items left in the RTNSS area. On availability
17 controls, what should be in the manual versus what
18 shouldn't be in the manual. And there are some
19 specific questions on that. And I think Hossein is
20 going to cover these in more detail in his
21 presentation, so I won't dwell on them here. I'll
22 just say there are some open issues for how we put
23 that in there.

24 We had a question before on the design
25 standards for the RTNSS B or the post-72-hour

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 functions. We think that that's a resolved issue now
2 with our latest set of RAIs on that issue.

3 The augmented design protection, design
4 standards for flood protection, we -- the staff went
5 back and looked at those RAIs. We think that that's a
6 resolved issue now, even though it may have been
7 listed as an open item before.

8 And then, the status -- RTNSS status of
9 some of the active systems that -- there are some
10 questions about those, and we've got responses in
11 development for those.

12 Conclusions -- here we go, get me off of
13 here. We think that the ESBWR chapters on this area
14 met the requirements for the certifications. There is
15 very limited open items that need to be resolved, and
16 for those we are pretty much at a -- on a path to
17 resolution on these.

18 And the review that we've had, and RAIs,
19 and questions/answers, audits, the whole body of
20 things -- of things that we have done I think will
21 confirm that we have met the required objectives with
22 our set of PRA documentation.

23 MEMBER CORRADINI: Thank you.

24 MR. WACHOWIAK: All right.

25 MEMBER ABDEL-KHALIK: Does it give you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 pause that there are 22 RTNSS C systems that can push
2 your CDF from about 10^{-8} to greater than 10^{-4} .

3 MR. WACHOWIAK: We weren't limited by the
4 10^{-4} criteria. It's the LERF of 10^{-6} .

5 MEMBER ABDEL-KHALIK: Well, okay.

6 MR. WACHOWIAK: So it's -- there are
7 things that are backups that end up pushing us over 10^{-6}
8 for CDF cases where there is no containment.

9 MEMBER ABDEL-KHALIK: But, again, you
10 know, it would push you from 10^{-9} LERF to the minus --
11 to greater than 10^{-6} . Doesn't it bother you design-
12 wise?

13 MR. WACHOWIAK: No. Because in a -- in
14 nuclear powerplants, we use a combination of safety-
15 related and non-safety-related equipment to affect the
16 overall risk significance. And there is no reason to
17 believe that only safety-related functions in the
18 ESBWR would be sufficient to drive the core damage
19 frequency and release frequency down into very low
20 ranges.

21 Remember, deterministically, the safety-
22 related case just shows you have -- just requires you
23 to be one redundant component deep to meet all of the
24 safety functions. And it doesn't even need to be a
25 diverse component to do that. It just needs to be

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 redundant.

2 So following the rules for what makes
3 things safety-related, I would be surprised if you
4 didn't need anything non-safety-related to meet all of
5 those goals, especially on the LERF side, since that's
6 a fairly low number as well.

7 MEMBER ABDEL-KHALIK: I understand
8 conceptually. But what surprises me is the magnitude
9 of the change, given the difference --

10 MR. WACHOWIAK: Three orders of magnitude
11 sounds about right for an active system for me. The
12 reliability of an active system, dual-train active
13 system, tends to be about -- or unreliability tends to
14 be about .001. That's -- so if you -- you pull out
15 some of the ones that we have, the CDF would go up by
16 about that much. And we have other active systems
17 that we didn't count in to RTNSS, so it's the -- it's
18 the reliability of those systems that are being pulled
19 out of the mix.

20 MEMBER MAYNARD: Is the biggest impact on
21 the shutdown sequences there, while you're shut down,
22 or is it while you're operating?

23 MR. WACHOWIAK: Those are while we're
24 operating. The -- we took a look at the initiators
25 for shutdown to see if there was anything else that

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 needed to be added from RTNSS, and we didn't have any
2 there. And the rules that were agreed on for the
3 focused PRA, I remember that they were done using the
4 full power PRA, instructions in the agreement, in the
5 SECY.

6 So, but remember, these components that
7 are supporting the things needed for shutdown -- as we
8 said, we've got 22 of those functions. Most of them
9 are in there already, and they have performed those
10 functions. The system -- front line system that we
11 picked, the FAPCS, is also used as a system in the
12 shutdown as well.

13 And it's also -- and for the spent fuel
14 pool. That's mainly why -- the main reason we picked
15 that system, was because -- one of the reasons was
16 because it not only protected the core, but it also
17 could be used to protect the spent fuel pool. So we
18 thought it was a good system to put into the pre-
19 treatment.

20 MEMBER CORRADINI: Other questions for
21 Rick?

22 (No response.)

23 Okay.

24 MEMBER APOSTOLAKIS: There is a big
25 question in my mind, but I don't know that he can

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 answer it.

2 MEMBER CORRADINI: Can we wait until we
3 have the staff up there?

4 MEMBER APOSTOLAKIS: Oh, we can wait. We
5 will never get the answer, so --

6 MEMBER CORRADINI: So I'll thank you for
7 the moment. Don't --

8 CHAIRMAN SHACK: Let's finish the
9 presentations, then, first.

10 MEMBER CORRADINI: Let's don't go far,
11 then. And I'll ask the staff to --

12 MR. WACHOWIAK: I need an escort to go
13 farther than the door anyway.

14 (Laughter.)

15 MEMBER CORRADINI: So then we won't give
16 you an escort for a while, good.

17 MR. WACHOWIAK: I'll be here.

18 MEMBER CORRADINI: Thank you.

19 MR. HAMZEHEE: I think now we have three
20 people from the NRC staff that are going to give you a
21 summary of what we already presented to the
22 subcommittees in the last few months. And we have
23 Mark Caruso, who has the lead for the review of the
24 PRA, we have Marie Pohida, who has the lead for
25 shutdown portion of the PRA, and then Ed Fuller, who

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 is responsible for Level 2 and severe accidents.

2 MEMBER CORRADINI: So who is going to kick
3 off? Mark is going to kick off?

4 MR. HAMZEHEE: Mark is going to take the
5 lead, yes.

6 MR. CARUSO: Okay. As Hossein said, our
7 purpose here is to brief the Committee on the status
8 of our review. The crux of it is really focused on
9 the open items. So if you want to -- if you want to
10 cut right to the open items, we can get to that. I
11 just have a few introductory slides before that.

12 Slide 3 shows the folks that were involved
13 in the review of Chapter 19. Myself focused mostly on
14 the Level 1. I'm sort of overall coordinator. Ed
15 Fuller here on my left worked -- go to 6? Ed worked
16 on severe accidents. He is our shutdown expert. John
17 Lai, who is here, worked on fire; and Glenn Kelly
18 worked on high winds.

19 Objectives of the staff's review --

20 CHAIRMAN SHACK: And your structural
21 engineer does seismic margins?

22 MR. CARUSO: Jimmy Xu is here. He is
23 not --

24 (Laughter.)

25 Our objectives are the Commission's

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 objectives, and they were also GE's objectives. So
2 we're all -- we're all on the same page, and I think
3 Rick went through these.

4 MEMBER APOSTOLAKIS: Is that a
5 coincidence?

6 MR. CARUSO: No, it's not. Not at all.
7 Not at all.

8 Okay. So --

9 MEMBER APOSTOLAKIS: Can we see those?

10 MR. CARUSO: Yes. They look very
11 familiar. We have a different order, though. I'm
12 already on the next slide.

13 MEMBER APOSTOLAKIS: Oh, okay.

14 MR. CARUSO: I'm on the next slide.

15 Areas of review with open items. We have
16 a few open items left, as Rick mentioned, and they
17 fall in these areas -- in the PRA quality area,
18 there's seismic margins, high winds, shutdown on power
19 operations, and the severe accident area.

20 So the next slide in the quality area, and
21 we've actually beat this one I think quite a bit
22 today, the issue -- as Rick said, we had -- we have
23 gotten the DCD Rev 4, and there wasn't much in there
24 about what they had done to sort of assure quality, a
25 level -- some level of quality for the design PRA.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 And as Rick said, there really -- there is
2 no regulation here, there is guidance that says an
3 internal level review on the part of the vendor is
4 sufficient. We didn't know what they had done. They
5 had said that they had attempted to try and meet as
6 many capability Category 2 attributes as they could.
7 So we asked them to describe in detail what they had
8 done, which prompted them to do a little bit more
9 formal in-house sort of self-assessment peer review.

10 They have done that. They submitted the
11 results and RAI response. They did a systematic look
12 at the standard, comparing what they had done with the
13 standards with the capability Category 2 attributes.
14 They identified which of the attributes they felt did
15 not apply to the design PRA, which were -- mostly had
16 to do with things that are plant-specific, procedural
17 stuff, things that, you know, are hard to capture now
18 at this stage.

19 And then, they identified the few areas
20 where they didn't meet the Category 2, and explained
21 why there was small impact. We were satisfied with
22 their response, but I believe you'd have to say that
23 after our discussion with the subcommittee that there
24 are questions about the effectiveness of what was
25 done.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 So we're -- you know, our follow up -- the
2 next step closure on this is for our follow up onsite
3 at GE to take a close look at Rev 3 and make sure that
4 -- that the Rev 3 is robust. So we're going to go
5 there in November and look at the PRA.

6 When we spoke to the subcommittee in June,
7 the other item that was on this slide was on the
8 success criteria for passive systems, and we had an
9 RAI asking GE to give us some more confidence that the
10 analysis techniques they had used to justify the
11 success criteria that they had selected for passive
12 systems was robust. And they have since done that.

13 They, in fact, presented that to the
14 subcommittee in August, and we all listened, and we're
15 fairly satisfied with that. So --

16 MEMBER ABDEL-KHALIK: Now, this dealt
17 primarily of, you know, how many of which widget would
18 you need.

19 MR. CARUSO: Right.

20 MEMBER ABDEL-KHALIK: But there are some
21 other things that were sort of pushed into ITAAC
22 category, like tilt of pipes to make sure that gas
23 accumulation doesn't happen. How do you capture
24 errors in that process in your PRA space?

25 MR. CARUSO: Well, I don't know about

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 tilted pipes, but, I mean, things like errors in pipe
2 diameters, friction factors, heat transfer
3 coefficients and condenser tubes, all those things are
4 factored into a thermal hydraulic calculation. The
5 things that are not factored into a thermal hydraulic
6 calculation, you know, if they're important, then
7 that's a problem.

8 But I think, you know, that particular
9 issue on gas is -- you know, it's -- in terms of non-
10 condensables and, you know, the I&C system, the
11 passive containment cooling system, you know, those
12 are treated in the thermal hydraulic analysis.

13 Now, gas accumulation in ECCS systems, I
14 know an operating plant is not treated very well in
15 PRAs. And so, you know, those kinds of issues -- I
16 mean, a lot of those issues are being looked at in the
17 design reviews. I mean, gas accumulation in ECCS
18 systems is a design issue. It's hard to capture in
19 PRAs. I mean, if you have, you know, things -- you
20 have events and --

21 MS. CUBBAGE: I think you hit the nail on
22 the head when you mentioned -- when you say "pushed to
23 ITAAC," actually I would say -- contrary, I would say,
24 you know, it's going to be verified by ITAAC that it
25 has been installed as designed. And then, the design

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 is what's modeled in the PRA. So the assumptions of
2 the PRA are validated by the ITAAC verification. You
3 have to make certain design assumptions when you make
4 a PRA.

5 MR. CARUSO: Well, the PRA does its best
6 to capture the design and model the design and capture
7 the phenomena in terms of barriers. And then, the
8 ITAAC process is to ensure that the design -- the as-
9 built plant recent design, so it's --

10 MS. CUBBAGE: Right. In fact, the
11 selection --

12 MR. CARUSO: -- sort of a cascade.

13 MS. CUBBAGE: The selection criteria for
14 what is included in ITAAC does have a component
15 verifying the significant assumptions in the PRA.

16 MEMBER ABDEL-KHALIK: Thank you.

17 MR. CARUSO: Yes. Now, I do know that in
18 one sense in the PCC that there -- you know, in the
19 PRA there is an assumption that you will always get
20 gas up there. And there is in the model -- it is
21 treated in the model that if the gas vents -- if the
22 vents for non-condensables don't work, you fail it.

23 So there's no probability of will you not
24 get gas or get gas. It always assumes that there's
25 gas, but it assumes that the system will work as

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 designed, which is the vents will open and it will
2 vent if you don't get rid of the gas. So in that
3 particular system, I think they are on pretty good
4 ground.

5 All right. Slide 8, the open issue on
6 seismic margins analysis. I think Rick went over this
7 one, too, in some detail, which is we had questioned
8 their choice -- their use of a spectrum shape
9 different than the certified design response spectrum.

10 And we are still waiting for their response on that.

11 Slide 9 is in the high winds area. These
12 are just some questions -- outstanding questions on
13 their assessment that Rick also went through. And I
14 don't have much more to say on these. We are waiting
15 for their -- for their responses.

16 Slide 10 is the open items on shutdown and
17 operational modes, and Marie is going to go through
18 these for us.

19 MS. POHIDA: Okay. Thank you.

20 The first one has to do with a diverse
21 protection system. Okay? And this has to do with
22 assessing breaks outside of containment. Breaks
23 outside of containment were not quantitatively
24 analyzed. Okay? And in the PRA, GE states that they
25 weren't analyzed because you had the safety-related

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 leakage detection system that will be operable, you
2 know, as directed by tech specs, and the non-safety-
3 related leakage detection system will be available.

4 But when you go review tech specs, the
5 non-safety-related leakage detection system is not
6 required to be operable in tech specs. So what we're
7 asking GE to do is to either consider adding the
8 operability of these non-safety-related systems in
9 Modes 5 and 6, or to go back and assess the risk of
10 RWCU breaks and operator-induced leaks outside of
11 containment. So that's open item number 1.

12 Okay. Open item number 2 has to do with
13 operator-induced leaks. In general, they were not
14 quantitatively analyzed in the PRA. GE's position was
15 that operator-induced leaks downstream of the
16 containment isolation valves and the RWCU system would
17 effectively mitigate those types of losses.

18 What we're concerned about is what's going
19 on upstream of the containment isolation valves. What
20 are the sizes of piping penetrations? What are the
21 associated alarms and position indication? That if
22 the operator were to have -- induce a leak in these
23 piping penetrations, what would happen to the system?

24 Is it something that we need to be concerned with?
25 So that's open item number 2.

NEAL R. GROSS

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

1 Open item number 3 has to do with the
2 isolation condensers. The isolation condensers at
3 shutdown are very risk significant. They
4 significantly reduce the loss of RHR events from
5 internal events and external events during Mode 5,
6 okay?

7 And what we're concerned about is, are
8 there going to be some regimes during Mode 5 operation
9 from which the isolation condensers will not function?

10 And what we're concerned about is levels being raised
11 to remove the head. And once that IC inlet sub-tube
12 gets flooded, will the ICs be able to work? So we
13 have some RAIs on that to GE.

14 We are also concerned about -- since the
15 isolation condensers are credited with working from a
16 loss of RHR initiating from Mode 5 conditions, how
17 does the venting process work? You know, when are the
18 vent valves supposed to open? Are there any special
19 conditions, you know, involved -- in Mode 5 that would
20 not be necessarily bounded by Mode 1 conditions? So
21 that's open item number 3.

22 Open item number 4, on Slide 11, this is
23 an RAI that we've developed with Reactor Systems
24 Branch. And what we need more information on is the
25 range of conditions -- and that is both temperature

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 and level -- for which the RWCU system can adequately
2 remove decay heat in Modes 4, 5, and 6.

3 And what we're concerned about is adequate
4 vessel circulation from inside the shroud and outside
5 the shroud, and we are still looking for information
6 about, what is that minimum level? What is that, you
7 know, minimum vessel level to assure, you know,
8 adequate circulation between what's in the shroud and
9 what's outside the shroud?

10 And what we're also concerned about is
11 that RWCU injection, it may bypass the core, and we're
12 concerned that there might be inadequate mixing in the
13 downcomer. So that's --

14 MR. HAMZEHEE: Marie, which one -- are we
15 also planning to do some in-house confirmatory
16 analysis?

17 MS. POHIDA: On the isolation condensers.
18 What we have asked the Office of Research to assist
19 us with is, given various vessel levels in the core,
20 to provide some confirmatory calculations that the ICs
21 will work, initiating from a Mode 5 condition.

22 CHAIRMAN SHACK: Okay. GE already assumes
23 that.

24 MS. POHIDA: They assume that. We have
25 asked for confirmatory calculations. We didn't

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 receive any. Their contention was that this operation
2 is bounded by Mode 1 conditions, and we need some
3 calculations just to confirm that.

4 The total LERF risk in this design is
5 primarily driven by events at shutdown. You know, 74
6 percent of the total LERF risk is driven by external
7 events at shutdown, with another, you know, portion
8 driven by internal events. So, you know,
9 functionality of the ICs is important.

10 MR. CARUSO: This is a little like, you
11 know, the idea -- I think what we've been told is,
12 well, you'll use RHR, and you'll lose the first system
13 you have, and so the system would just go from heat up
14 from low pressure all the way up to 1087, and then go
15 right back to Mode 1 and you'll be a boiling water
16 reactor, and the system will come on and just work.

17 And it's a little like your BiMAC
18 question, which is that you've told me not to worry
19 when I get to the steady-state condition where I am
20 removing heat. And I -- if you get there, I believe
21 the isolation condenser will do its job. But, you
22 know, is it -- you can, convince us that you're going
23 to -- this is all going to happen without any
24 operators doing whatever they do.

25 We feel a little uncomfortable that we

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 don't have that sort of like sequence of analysis that
2 takes you from Mode 5, what I meant -- you know, less
3 than 200 degrees and low pressure, all the way back
4 up. I mean, it's kind of like the same way in PWR,
5 steam generators, you know, the shutdown strategy --
6 the shutdown strategy of -- I knew you were in 5, but
7 if I keep my generators full of water and ready to go,
8 I can just go back up to Mode 4 and get on the
9 generators.

10 We don't have a lot of analysis here, any
11 analysis here that -- in this. You know, shutdown is
12 not a design basis. Anyway --

13 MS. POHIDA: So while we're waiting for
14 responses, we have asked the Office of Research to
15 help us to provide confirmatory calculations.

16 MR. HAMZEHEE: John has a question.

17 MEMBER STETKAR: Marie?

18 MS. POHIDA: Yes.

19 MEMBER STETKAR: I have to admit complete
20 ignorance about the shutdown PRA.

21 MS. POHIDA: Okay.

22 MEMBER STETKAR: So maybe you can ask a
23 quick -- answer a quick one for me. And I haven't
24 asked GE this.

25 How did they treat -- I see how they

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 parsed things up into the different operating modes --

2 MS. POHIDA: Yes.

3 MEMBER STETKAR: -- according to the tech
4 specs. How did they treat typical equipment
5 unavailabilities during shutdown? You know, outage
6 unavailabilities of equipment, stuff that is out of
7 service for maintenance, for example. That's one of
8 the big challenges of doing a shutdown risk
9 assessment. Did they assume that everything was
10 normally available?

11 MS. POHIDA: There's two parts. There are
12 systems that are required to be operable according to
13 tech specs.

14 MEMBER STETKAR: Okay.

15 MS. POHIDA: Okay. So, of course, that
16 was handled as --

17 MEMBER STETKAR: Sure, sure.

18 MS. POHIDA: -- being available. Those
19 include the isolation condensers, the DPVs that are
20 needed for gravity injection to work, and things
21 associated with the gravity injection system. Okay?

22 The non-safety-related systems were also
23 credited as being available and functional in the
24 shutdown PRA. We did ask GE for --

25 MEMBER STETKAR: Except for forced

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 maintenance unavailability, you know, repair of a pump
2 failure or stuff like that, the standard --

3 MS. POHIDA: I need to go back and check.

4 What we --

5 MEMBER STETKAR: Okay.

6 MS. POHIDA: What we do is -- this is my,
7 you know, third advanced -- you know, advanced reactor
8 review. We ask for sensitivity studies saying if --
9 if a licensee were to choose to adhere to minimal
10 compliance to tech specs, what would the increase in
11 risk be? Just to make sure there is no --

12 MEMBER STETKAR: Well, minimal compliance
13 to tech -- okay, minimal compliance to tech specs.

14 MS. POHIDA: In other words, is -- you
15 know, if --

16 MEMBER STETKAR: Assuming that all non-
17 tech spec required equipment is out of service, you
18 mean?

19 MS. POHIDA: That is correct. And also,
20 you know, for example, if they -- the DPV valves. If
21 there are eight and only four required to be operable,
22 what happens to the rest? That's a sensitivity study
23 that we do.

24 MEMBER STETKAR: They've done that?

25 MS. POHIDA: Yes.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: Okay.

2 MR. CARUSO: We are also raising this
3 question on the COLs by saying, you know, we are --

4 MEMBER STETKAR: It is really important.
5 We're saying -- you're referencing in a doctrine the
6 design PRA, but is there something about the way you
7 do shutdown, the way you take systems out of service,
8 that might be outside what was in the PRA. So --

9 MR. CARUSO: Typically, shutdown risk is
10 dominated not -- not necessarily how the plant is
11 designed. It's how people do business.

12 MR. HAMZEHEE: It is configuration-
13 specific.

14 MEMBER STETKAR: It is configuration-
15 specific, and that's how people manage their outages,
16 which is not --

17 MEMBER MAYNARD: Most of the current
18 plants today during shutdown, you do credit non-safety
19 equipment. You have controls in place to make sure
20 that that's available, if you're crediting that.

21 MEMBER STETKAR: Right. That's the reason
22 I was asking.

23 MEMBER MAYNARD: Yes.

24 MEMBER STETKAR: Go on. I'm sorry.

25 MS. POHIDA: Oh, that's it. That's my

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 four open items.

2 MR. WACHOWIAK: This is Rick Wachowiak
3 from GE. To get back to your question, we also have
4 to remember with this plant there is really no reason
5 to put those maintenance activities for the non-safety
6 systems into the shutdown.

7 MEMBER STETKAR: That's true. But don't
8 dig yourself a hole, because I'm going to ask you how
9 you counted the planned maintenance during power
10 operations.

11 MR. WACHOWIAK: Right.

12 MR. CARUSO: All right. If there's no
13 questions for Marie, we'll move on to the severe
14 accident mitigation area. And Ed is going to go
15 through the few open items we have there.

16 MR. FULLER: Basically, at this juncture,
17 it has come down to two significant open items. The
18 first one has to do with the performance of the BiMAC.
19 And in this one, to give you a little background,
20 leading up to the time when we went to visit the test
21 facility a year ago, we had some open RAIs pertaining
22 to whatever the test program might be.

23 We had asked GE to provide that
24 information to us, so that by the time we got to Santa
25 Barbara that we would at least have some feeling for

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 what we were looking at. And that event came and went
2 without the questions being adequately answered.
3 However, shortly thereafter, they produced a test
4 report, which we received in the springtime of this
5 year.

6 And the test report came in as a topical
7 report, and so we had to review it as a topical
8 report, and, in so doing, generated 20-some-odd RAIs,
9 27 RAIs.

10 I would say they came into the five basic
11 areas. Some pertained to the adequacy of the facility
12 scale for applicability to the ESBWR configuration.
13 And some questions related to the range of measured
14 test data compared with what one would expect during
15 severe accident loadings.

16 And we had concerns about the adequacy of
17 the theoretical predictions as compared to the data,
18 and we had quite a few questions pertaining to the
19 implications of their design on ESBWR operational
20 safety and how the tests might address those. And
21 some of the RAIs were just simply for clarification
22 and additional design details.

23 We presented -- made this presentation to
24 the subcommittee in August, and by and large the
25 questions that were raised have been subsumed already

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 in the RAIs that we had prepared, except for one
2 significant question. We forgot to ask GE to provide
3 basically how one would get from the time of vessel
4 breach, if you will, until when the BiMAC would be
5 operating in a steady state, you know, as it was
6 designed to operate.

7 So what happened when you got from here to
8 there? So since then we have -- we have prepared that
9 RAI and sent it to GE. And so now we have 28 RAIs,
10 none of which have been responded to as of today.

11 MEMBER CORRADINI: I had a question, if I
12 might, for you. Rick said something -- instead of
13 going and getting details, I guess I'd ask the staff
14 -- so if I understand correctly, there was a request
15 about an analysis that in the absence of the BiMAC
16 would -- would the design essentially be equivalent to
17 the ABWR in terms of how it attended to the severe
18 accident management scheme?

19 And I thought I heard you say -- and I
20 guess I'll address this to Rick -- that you sent
21 something to staff about an analysis in the absence of
22 the BiMAC.

23 MR. WACHOWIAK: This is Rick Wachowiak.
24 Yes.

25 MEMBER CORRADINI: So did I miss it? Did

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 you guys pass this on to us, or did I just forget to
2 ask, since the August meeting? Because I think in the
3 August timeframe it was in preparation, and it hadn't
4 -- or did I misunderstand?

5 MR. WACHOWIAK: You misunderstood. That
6 was sent some time -- oh, I'm trying to remember which
7 trailer my office was in when we sent that to get a
8 gauge of the time. But it was more than a year ago
9 when we sent this in.

10 MEMBER CORRADINI: Oh, excuse me. So I
11 guess just for a matter of -- just in order to
12 understand it, I'd like to see that analysis, so that
13 the subcommittee can just see. So just to do a
14 comparison point. Because as you -- as Rick answered,
15 you view BiMAC as a defense-in-depth measure, which
16 means in its absence I ought to see similar behavior
17 in this design. I'd like to just look through that if
18 I could.

19 CHAIRMAN SHACK: That seems peculiar,
20 because at that time, I mean, you still hadn't settled
21 on the top material in the BiMAC. Even at the last
22 meeting you were -- you know, you were changing the
23 design of that. So, you know, the ablating material
24 -- I'm not sure how you could demonstrate that it was
25 equivalent to the ABWR. Yes, I know you said you

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 weren't convinced it was going to be low -- you know,
2 low-gas concrete at that time.

3 MR. WACHOWIAK: What we did in that
4 sensitivity was we assumed that the BiMAC and its
5 coating material would be --

6 CHAIRMAN SHACK: Gone.

7 MR. WACHOWIAK: -- gone. And we did the
8 calculation with both limestone and the low-gas
9 concrete. So the results that were presented to the
10 staff were both sets of results.

11 CHAIRMAN SHACK: Just for that portion of
12 the base mat, then, below the BiMAC.

13 MR. WACHOWIAK: Yes.

14 MEMBER CORRADINI: So it's as if the BiMAC
15 weren't in existence is the way you did the analysis.

16 MR. WACHOWIAK: That's the way we did the
17 analysis.

18 MEMBER CORRADINI: Let me ask one last
19 question, just to -- so I get a frame, because we'll
20 get the memo. Was it -- well, first of all, was it a
21 topical report by you all, or a memo to staff?

22 MR. FULLER: It was a response to the RAI.

23 MEMBER CORRADINI: Oh, an RAI. Excuse me.
24 Is the square footage in the lower pit, cavity,
25 whatever you call this thing below the vessel, meet

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 the utility design --

2 MR. WACHOWIAK: The URD spreading
3 criteria?

4 MEMBER CORRADINI: Yes. Thank you.

5 MR. WACHOWIAK: Yes.

6 MEMBER CORRADINI: Okay.

7 MR. FULLER: Okay. Are there any other
8 questions on the BiMAC open item?

9 (No response.)

10 Okay. The second one has to do with the
11 process of developing severe accident management
12 guidelines. And we have been asking questions all
13 along, how they were going to do this, and kept that
14 -- creating supplements as we got answers that didn't
15 quite get to what we thought the question was.

16 And, finally, in the spring we got -- we
17 got additional information on the process that they
18 would be using to develop the guidelines. However, we
19 have also been asking for what we would be calling the
20 technical basis for severe accident management for the
21 ESBWR, recognizing that we've got a very -- a design
22 which has quite a few significant differences from the
23 existing BWR fleet.

24 And so we would expect that -- that
25 certain phenomena would unfold in different

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 timeframes, and other phenomena that you might not
2 have been -- that were expected in existing BWRs may
3 not arise in the ESBWR.

4 So we wanted to see how GE was putting
5 together the information from their severe accident
6 analyses and Level 2 analyses to present to the COL
7 applicants, so that the applicants could go ahead and
8 develop their procedures and training, etcetera.

9 So this technical basis generally takes
10 the form of candidate actions, high-level actions,
11 strategies, and relationships to the timing of the
12 phenomena. And that's what we're asking for, and at
13 this point we're awaiting the response to that
14 particular request.

15 MEMBER CORRADINI: So can I understand
16 what this means? I guess I'm listening to you
17 describe it. I'm not sure if I completely appreciate
18 it.

19 So are you saying, for example -- I'll
20 give you for example, and you tell me if I'm off base.

21 For example, what's the basis in which the BiMAC --
22 what's the -- I'll use the BiMAC, just to stick with
23 one topic. What's the operational -- not the
24 operational condition, but what is the acceptability
25 criteria for the BiMAC operation?

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MR. FULLER: No. That's not what we're
2 looking for.

3 MEMBER CORRADINI: Okay. So --

4 MR. FULLER: Let me get --

5 MEMBER CORRADINI: Yes.

6 MR. FULLER: What is your -- an example,
7 what is -- for example, what is your strategy for
8 preventing vessel breach? What is your strategy for
9 assuring debris coolability for X number of hours?
10 What is your strategy for preventing containment
11 failure for X number of hours, whether it be 24 or 72,
12 or whatever their guidelines might come up with?

13 So what is your strategy? What are the --
14 the high level type actions that you would be taking
15 to carry out these intentions?

16 MEMBER CORRADINI: So these are more
17 severe accident procedural guidelines for various
18 objectives.

19 MR. FULLER: Yes.

20 MEMBER CORRADINI: Okay. All right.

21 MR. FULLER: They are guidelines to
22 develop the procedures.

23 MEMBER CORRADINI: Okay. Thank you.

24 MR. FULLER: Okay?

25 MEMBER ARMIJO: When do you line up fire

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 water?

2 MEMBER CORRADINI: Okay. Thank you.

3 MEMBER ARMIJO: And why?

4 MR. FULLER: Okay. Anybody else on this?

5 (No response.)

6 Okay.

7 MR. CARUSO: Okay. Let's move on to
8 Chapter 22, which is regulatory treatment of non-
9 safety systems. Format here is the same. The
10 objectives of the staff review went through sort of
11 the RTNSS in a nutshell, which is what -- what stuff
12 is in scope? Did they get that right?

13 For the active systems, have they
14 identified the reliability and availability issues
15 consistent with what PRA assumes? Are those two
16 consistent? And when they have identified treatment
17 for those active systems, does it make sense? Is the
18 treatment consistent with what the reliability --
19 reliability and availability issues?

20 We just have a few open items left in this
21 area. There has been a lot of work done in this area
22 by GE since we met with the subcommittee. The biggest
23 issue I think we had back in June in this area had to
24 do with the Category B items, which are the items --
25 this is a deterministic category, which, you know, how

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 do I ensure safety functions for containment -- or for
2 control room habitability?

3 In that period beyond the 72 hours -- you
4 know, the passive systems will work for 72 hours with
5 hands off, and then at that point you've got to do
6 some stuff. You've got to use your non-safety systems
7 to refill tanks and do other things.

8 And the biggest problem we had was that a
9 lot of the equipment that they were relying on to take
10 care of those functions was housed in buildings which
11 were meeting National Building Code standards. They
12 weren't even meeting seismic Category 2. And our
13 structural people had a big problem with this, and we
14 pretty much felt it was outside what the Commission
15 had sort of scoped out in their policy papers and
16 stuff.

17 Well, since that time, there was a lot of
18 thinking that went on about how to treat these
19 Category B functions, and GE made a number of changes.

20 They incorporated some additional diesel generators
21 in seismic Category 2 buildings that would power a lot
22 of stuff that they could use to take care of these
23 things.

24 In a nutshell, they are now at a point
25 where they need nothing -- nothing to satisfy the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 Category B functions that's in a building other than
2 seismic Category 2 or seismic Category 1. So all of
3 the issues that we had in that area are pretty much --
4 pretty much resolved.

5 So that's probably the biggest change
6 since June. So what we're left with in this area is
7 we still have one I would say minor issue in this
8 area, which has to do with treatment of how you
9 protect against flooding and missiles. And we are --
10 we've got to the point where we're happy with the
11 response on, you know, that the design provisions that
12 we -- the design specifications that they are going to
13 incorporate are, you know, consistent with the
14 standards and are good enough to do it.

15 That we understand what they're going to
16 do and we believe it's good enough, and it's -- you
17 know, it meets standards. But we want them to put in
18 Tier 1 in an ITAAC something that makes sure that the
19 as-built protections are consistent with what is in
20 the design. So we have raised that with them. They
21 haven't actually seen this one yet. This is --

22 (Laughter.)

23 We're happy with the reactors about the
24 design, but we're not quite finished yet.

25 (Laughter.)

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 So that RAI has just gone out, so I -- so
2 Rick has not -- so don't ask Rick anything about it,
3 because he hasn't seen it yet.

4 And while we have -- just in the area of
5 regulatory treatment, we had a couple of issues with
6 -- that came out of a review of DCD Rev 5, and I'm
7 going to be putting some -- putting the systems either
8 -- either treating them with availability controls or
9 simply relying on the controls that are inherent in
10 the maintenance rule.

11 And the issue was we had systems and it
12 was -- there was discussion in the DCD about, well,
13 you know, we are basing this on the -- on the risk
14 achievement worths and the Fussell-Vesely, and, you
15 know, how important is it to risk. And so we looked
16 at some of these systems. I think we're looking at
17 the FAPCS compared to some of the -- just support
18 systems -- turbine-building, closed cooling water,
19 reactor building cooling water. And we're seeing the
20 numbers to be identical.

21 And we're going -- well, why aren't these
22 in the same category as these? So that's one
23 question.

24 Another question has to do with the
25 inclusion of FAPCS in RTNSS. There has been a -- sort

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 of an addition I think to the FAPCS system, which is a
2 -- there's a fire pump that's now being dedicated to
3 low pressure injection. It's not being dedicated to
4 fire any more. It is a fire pump, but it -- it takes
5 suction from the fire tank. But it's dedicated to
6 putting water in the vessel, and it's using the FAPCS
7 piping.

8 And so it appears to be sort of a third
9 FAPCS train, and it does -- we're not quite sure if
10 it's in RTNSS or not. And if it's not, we're not
11 quite sure why it's not. So we did ask these
12 questions.

13 And the last issue we have is a number of
14 -- these are some questions about the availability
15 controls, and these questions -- we did discuss it
16 with the subcommittee in June. They are still out
17 there, and GE is preparing a response to these. These
18 are just a number of issues that came up in our review
19 of the availability controls manual -- a number of
20 issues, the clarity of the controls as written, and
21 some inconsistencies on the treatment in the controls
22 compared to how systems were treated in the PRA.

23 For example, I think the controls -- there
24 was a control that said, well, you only need to have
25 one train of FAPCS available, and in the PRA they had

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 assumed they had two trains. So they said, "Well, how
2 does that compute?" So we're still waiting for
3 answers in these areas. So that's pretty much it in
4 the area of RTNSS.

5 I might want to say one other thing.
6 Going back to that discussion at the end of Rick's
7 presentation about the 22 items, I think, you know,
8 when you look at this list, I think it's to note that
9 most of those items are related to functions in the
10 diverse protection system, which affect all kinds of
11 stuff -- scram, MSIV closure, SRV actuation, bi-modal
12 control rod actuation.

13 And these -- the reason that the DPS --
14 these functions are in there is that -- it has to do
15 with the treatment of the common cause failure in the
16 safety part of the digital protection system, and that
17 this non-safety part is a backup to that. And so
18 because of the -- you know, the assumptions, if you
19 will, about common cause failure and software and
20 stuff, the DPS is showing up as very important.

21 And so it is -- I guess my point is that
22 it's not a whole lot of separate -- you know, I
23 probably said valves and things like that. It's
24 really the functions, the protective system functions,
25 non-safety protected system functions, back up the

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 safety functions for a lot of these things.

2 And so when you add up all those things,
3 you get a large number. So it's -- the 22 I guess is
4 probably a little bit misleading. I think there is --
5 you know, I thought I would shed some light on that.

6 Any questions based on that?

7 MR. WACHOWIAK: No. But that was a pretty
8 good characterization. It -- I've got a couple of
9 things on the RTNSS. The assumptions on the common
10 cause for the digital I&C is what pushes a lot of
11 things across the threshold. And the FAPCS in RTNSS
12 -- basically, the focused PRA says you look at these
13 things with point estimates, and then you also have to
14 consider uncertainty for adding additional things.

15 The FAPCS system was added based on the
16 uncertainty or the sensitivity analyses to address
17 uncertainty. So that is why the third FAPCS pump
18 didn't make it. We only needed the two FAPCS pumps to
19 get us through the uncertainty issue. We didn't need
20 to add the third train to get us past the uncertainty.

21 It wasn't the mean values that got FAPCS in.

22 A couple other things that I want to
23 clarify -- that one -- one is something where I may
24 have led to something on the BiMAC, this separate
25 calculation without the BiMAC, that in my mind it's

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 clear, but I don't think it would be clear in yours
2 right now. When we did this calculation, we didn't
3 assume the -- we assumed that the BiMAC wasn't there,
4 which is the pipes and the covering material.

5 There still is underlying structural
6 concrete that has a shape to it. We considered that
7 shape in the calculation. It wasn't a flat floor,
8 like ABWR. The shape was considered. So when you see
9 it, you'll tell that.

10 The other thing -- and -- well, I won't
11 get into it now, because the -- we'd have to go to
12 closed session. So -- but anyway, the shape was
13 considered with the information we had at the time.

14 The other thing that came up here in the
15 discussion of the open item for RTNSS, it's a
16 historical thing, since we've changed some things, but
17 I think Mark led you to believe that we didn't have
18 seismic protection on things needs to refill pools and
19 to keep the plant in the safe condition. And that is
20 not the case.

21 The equipment needed to refill the pools
22 and to keep the core covered was in seismic
23 structures. It was the power to run the
24 instrumentation for monitoring of level, pressure, and
25 things like that, the monitoring parameters, that was

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 not in the seismic structure at the time. We didn't
2 have a way to power those, so it wasn't what was
3 needed for core cooling or containment integrity that
4 was non-seismic, but it was the post-accident
5 monitoring function that was non-seismic. But that
6 has all been fixed now.

7 We -- for other reasons, we added the
8 generators, the new, smaller diesel generators, and
9 when we did that we happened to find an easy way to
10 address this monitoring open issue by just using those
11 diesel generators to power the monitoring equipment.

12 MEMBER CORRADINI: Bill, you had a
13 question?

14 CHAIRMAN SHACK: Well, there was just an
15 issue that came up when we looked at the BiMAC in the
16 subcommittee meeting that I didn't see addressed in
17 Ed's discussion of the open items. And this was the
18 crimping of the pipes by an explosion and whether that
19 would inhibit the operation of the BiMAC.

20 MR. CARUSO: We asked if -- have you asked
21 anything like that?

22 MR. FULLER: No.

23 MEMBER CORRADINI: Okay. Do you know what
24 we're talking about? Do you want me to repeat what we
25 had said at that time? I can --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 CHAIRMAN SHACK: GE planning to address it
2 to us at any rate. It's not --

3 MEMBER CORRADINI: Rick, do you remember
4 the question?

5 MR. WACHOWIAK: Yes, and I think the way
6 we answered it was is that's answered in our report.
7 That's -- the steam explosion impulse/impact on the
8 BiMAC pipes was one of the criteria for the BiMAC.

9 MEMBER CORRADINI: But I guess maybe I
10 remember that it was still an open issue from the
11 standpoint that I thought you addressed it in terms of
12 dynamic loads on the piping that is buried, but not
13 dynamic loads on the downcomer piping that is exposed
14 within the water pool.

15 MR. WACHOWIAK: Okay. Yes, that's --

16 MEMBER CORRADINI: To put it -- let me put
17 it differently. When you guys are in steady state
18 mode, the water somehow has got to get back from the
19 upper pool and flow down and things -- that means it
20 has got to be an open -- some sort of way in which the
21 water gets into the piping and comes down, which means
22 the piping is exposed to the water pool where you say
23 you continue to have melt coming in, which means if
24 you have some sort of FCI that piping is exposed to
25 any dynamic pressures. And I didn't see that analysis

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 in the appendix of 34, something or other, 32.411.

2 MR. WACHOWIAK: Okay. A couple of things
3 on that, and I think it is addressed in the report,
4 but maybe not -- not explicitly for some of this.

5 Now, the lower pipes were considered,
6 definitely --

7 MEMBER CORRADINI: Right.

8 MR. WACHOWIAK: -- in the steam explosion.

9 MEMBER CORRADINI: Right.

10 MR. WACHOWIAK: The vertical portions of
11 the pipe were not considered in there, because they
12 are covered with the -- at the time, the zirconium
13 material, but now our floor material. So they are not
14 going to be exposed to the impulse. There is
15 intervening material there that is going to deflect
16 that impulse. And if that's still a question about
17 exactly how we can get -- we can get an answer to that
18 -- that one.

19 Now, and there's a third set of pipes,
20 it's the ones coming from upper -- the upper area down
21 to fill the BiMAC. If the water is high enough to be
22 in contact with those pipes, a significant part of
23 those pipes, then, number one, we have already assumed
24 that the containment is going to fail with a water
25 pool that deep. So crimping the pipe is just --

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 MEMBER CORRADINI: I don't understand
2 that. Can you say it again? I'm sorry.

3 MR. WACHOWIAK: Okay. If the water itself
4 is significant depth within the lower drywell --

5 MEMBER CORRADINI: Right.

6 MR. WACHOWIAK: -- so let's say two meters
7 deep --

8 MEMBER CORRADINI: Right.

9 MR. WACHOWIAK: -- we are already assuming
10 that the containment is going to fail with a steam
11 explosion from that depth of pool. So the containment
12 failing and the BiMAC pipe crimping kind of subsume
13 each other.

14 MEMBER CORRADINI: I missed that. That
15 was in the appendix? I guess I missed that.

16 MR. WACHOWIAK: No, that's the one part
17 where we -- we assume that the way it was designed
18 would have handled that question. It's -- the question
19 is explicitly on the table, what about those pipes?

20 And so for water pools, that's the one
21 thing -- the pipe is not really going to be subject to
22 that. The other thing is that we have answered in
23 RAIs before that those pipes will be protected somehow
24 from melt interacting with those pipes themselves,
25 whether you put a shield on them or if you -- or if

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

1 you do something like that. But part of the design
2 criteria for those pipes is that they need to remain
3 an open path in the environment where you have core
4 material coming out of the vessel.

5 MEMBER CORRADINI: Okay.

6 MR. WACHOWIAK: So we expect some kind of
7 -- in the detailed design some kind of shielding on
8 those pipes.

9 MEMBER CORRADINI: Thank you.

10 Other questions?

11 (No response.)

12 Well, let me thank the staff and GEH and
13 turn it back over to our Chairman, on time, on budget.

14 CHAIRMAN SHACK: We're 45 minutes behind
15 schedule.

16 MEMBER CORRADINI: We started 20 minutes
17 late.

18 MEMBER POWERS: Did that change the
19 requirements on you?

20 MEMBER CORRADINI: No. It wasn't in my
21 performance --

22 CHAIRMAN SHACK: Let's try to get back at
23 4:10.

24 (Whereupon, at 3:55 p.m., the proceedings in the
25 foregoing matter went off the record.)

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

Harris Nuclear Plant



ACRS License Renewal Presentation
October 2, 2008



Shearon Harris Nuclear Plant License Renewal Representatives

- Mike Heath – License Renewal Supervisor
- Dave Corlett – Licensing/Regulatory Programs Supervisor
- Matt Denny – Equipment Performance Supervisor
- Chris Mallner – License Renewal Mechanical Lead

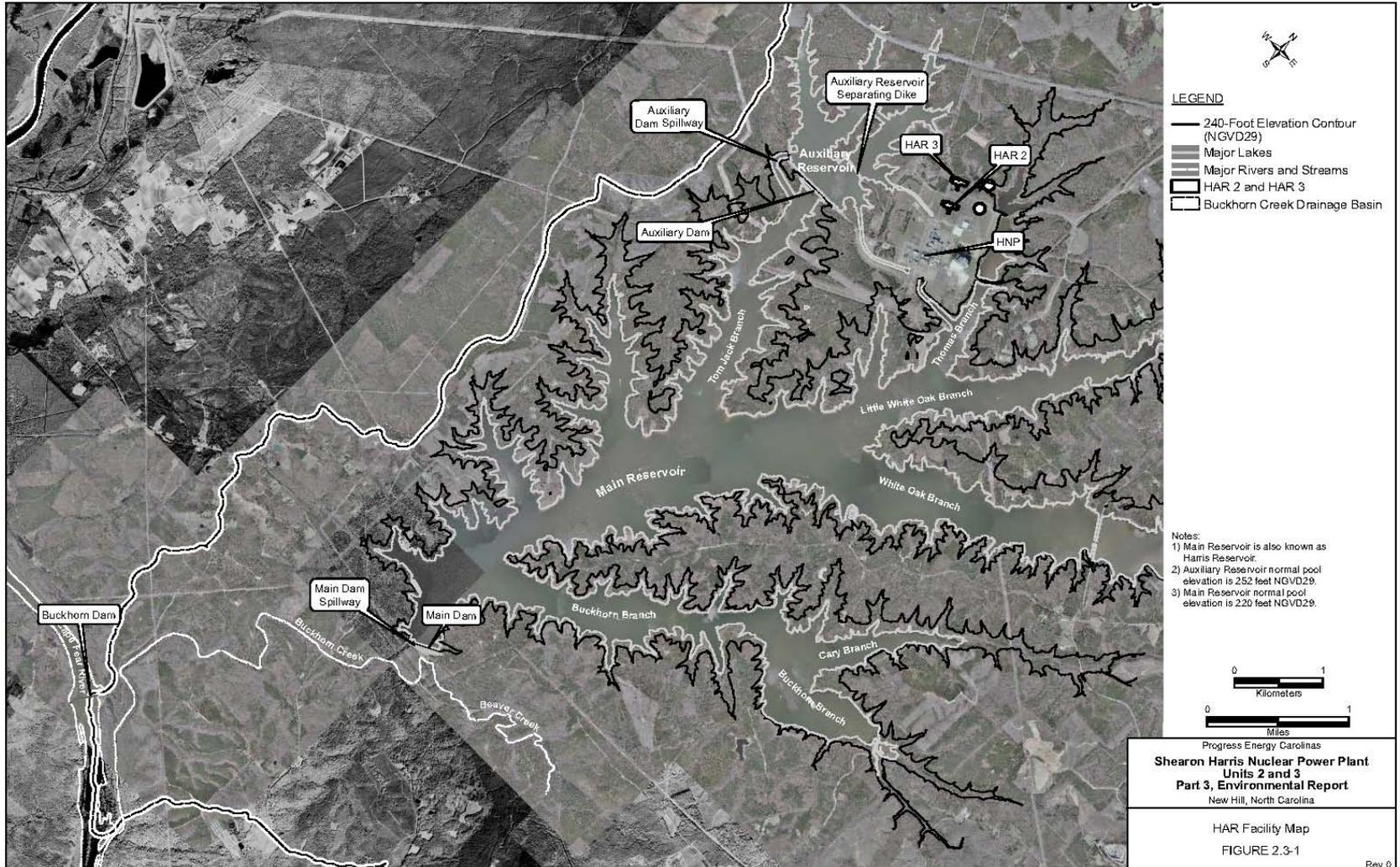
Agenda

- Introductions – Mike Heath
- Harris Plant Information – Dave Corlett
- HNP Water Sources – Dave Corlett
- Feedwater Regulating Valves Open Item – Dave Corlett
- Status of Electrical Manholes – Mike Heath
- Containment Valve Chamber External/Internal Corrosion – Matt Denny

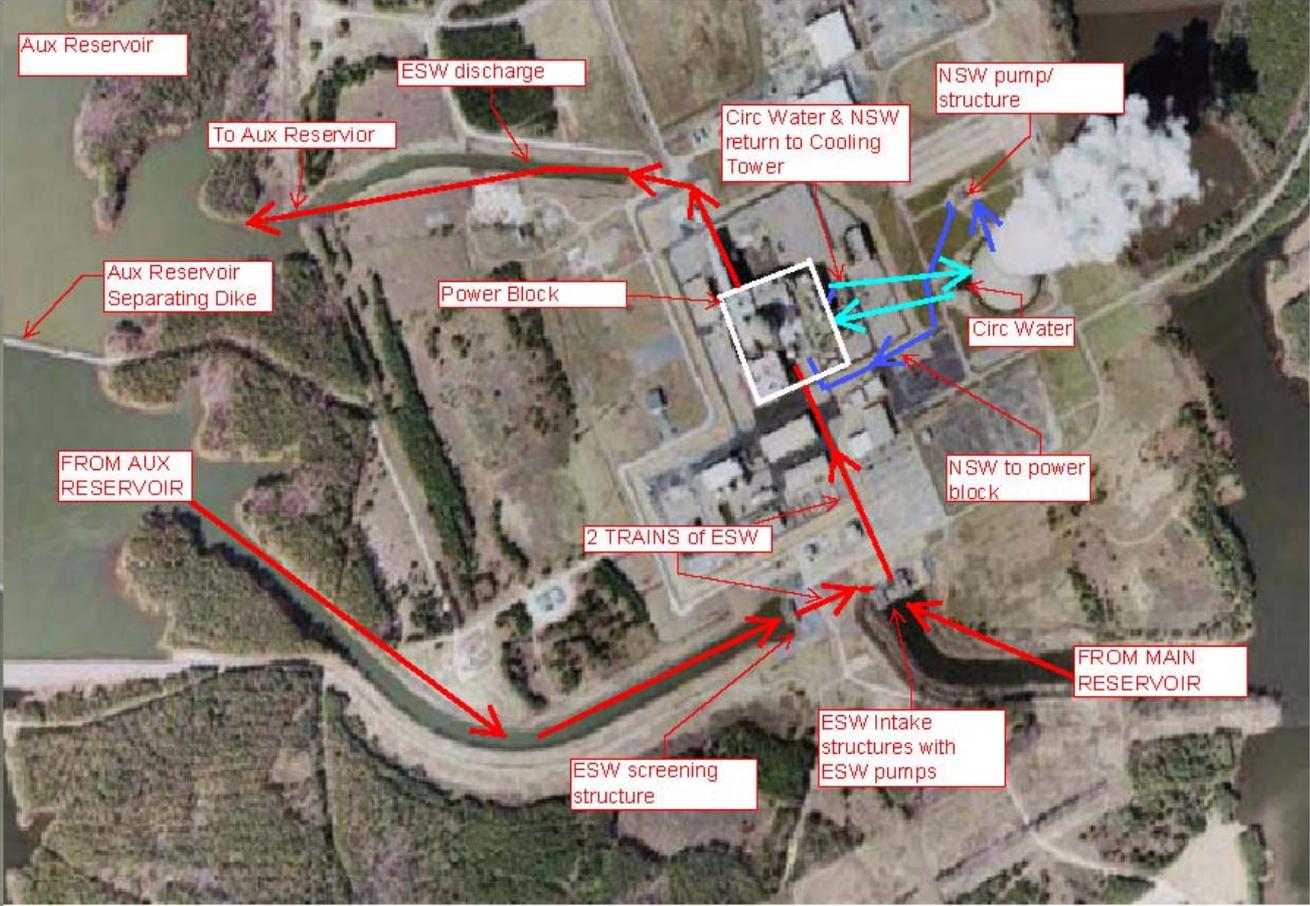
Shearon Harris Plant

- Located South of Raleigh, NC on Harris Lake
- Facility License Issued October 24, 1986
- Westinghouse 3 Loop PWR
 - 2900 MWt; 900 MWe(net)
 - Steel lined, reinforced concrete containment
 - UHS - Cooling via lake with Cooling Tower

HNP Water Sources



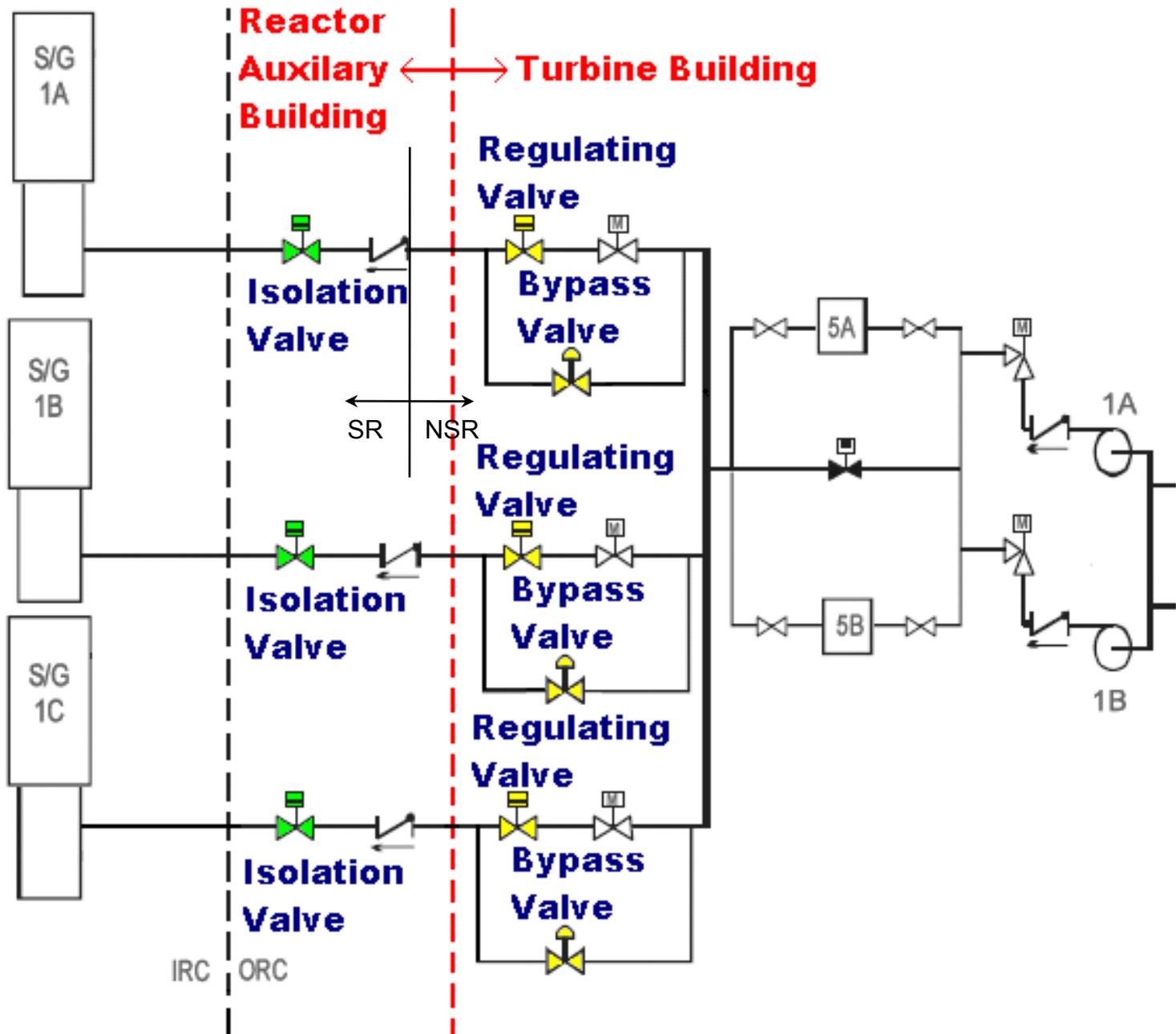
HNP Water Sources & Flow Diagram



Feedwater Regulating Valve Open Item Discussion

➤ Scoping

- The Feedwater Regulating Valves Scoped Per 10 CFR 54.4(a)(2) versus (a)(1)



Feedwater Regulating Valve Open Item Discussion

- Feedwater Regulating Valves and Bypass Valves are nonsafety-related
 - Not Protected From Hazards per CLB
- Safety Function Accomplished by Feedwater Isolation Valves
- Consistent with NUREG-0138, Issue 1, “Treatment of Non-Safety Grade Equipment in Evaluation of Postulated Steam Line Break Accidents.”

Feedwater Regulating Valve Open Item Discussion

- Feedwater Regulating Valves and Bypass Valves Safety Factors
 - Valves close on
 - Main Feedwater Isolation Signal
 - Loss of Instrument Air System
 - Loss of power from Engineered Safety Features Actuation System
 - Loss of DC electric power to solenoids
 - Designed to ASME Section III, Class 3 and Seismic Category 1

Electrical Manholes

- HNP has had two 6.9 kV cable failures:
 - ❖ Cable 11525A – MCC 1-4A101 Feeder failed on December 11, 2002 after approximately 15 years in service.
 - ❖ Cable 11882A – 1&2X CTMU Pump failed on January 12, 2006 after approximately 19 years in service.

Electrical Manholes

- Base line inspections of all manholes were completed in 2003
- Manholes are pumped down every 90 days
 - SR manhole M505B-SB is pumped down every 45 days
- Water levels trended
 - Some water levels over cables

SR Manhole M523D-SB



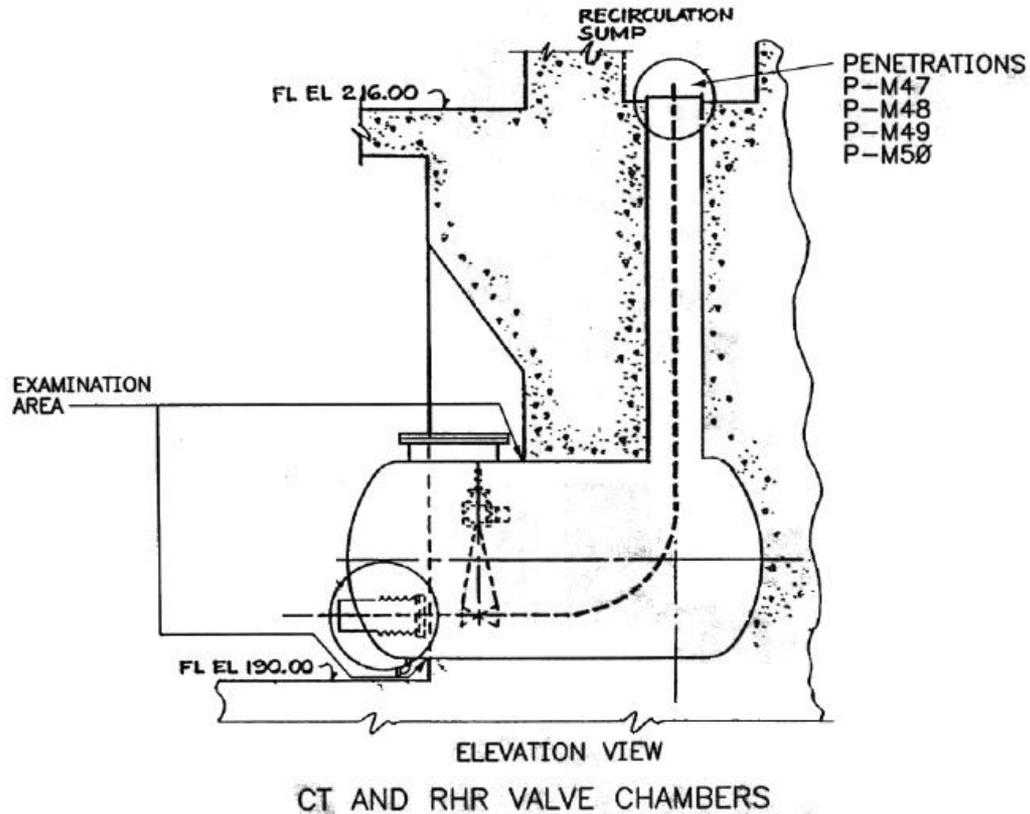
Electrical Manholes

- Medium voltage wetted cables are tested every 6 years
 - Use High Voltage - Very Low Frequency Tan Delta Testing
 - Total of 17 cables
 - Normal Service Water Pump 'B', Emergency Service Water Pump 'A', and Circulating Water Pump 'C' cables tested satisfactorily
 - Maintenance shop feeder cable tested unsatisfactorily

Containment Valve Chamber Corrosion



Containment Valve Chamber Corrosion



Containment Valve Chamber External Corrosion

- Ground Water Intrusion EL 190' & 216' RAB
- Detected as early as the 1980's
- 1984 - Pressure grouting
- Later other techniques used
 - e.g. sealant injection (floors & exterior walls)

Containment Valve Chamber External Corrosion

- Water In-leakage Action Plan (1996)
- 15 general areas in several structures
- Corrective actions include:
 - Channeling water in-leakage to floor drains
 - Design changes to core bore drain holes
 - Sump Pumps installed
- Continuing to monitor in-leakage locations

Containment Valve Chamber External Corrosion

- Structures Monitoring Program
 - Engineering personnel inspect SSCs for in-leakage impacts
 - RAB every 6 years
 - FHB and WPB every 7 years
- QC personnel inspect per IWE every ISI period
- HNP Maintenance maintains water control measures
- External surfaces recoated to prevent corrosion

Containment Valve Chamber Internal Corrosion

- RFO10 (2000)
 - Some small blisters on floors of chambers – found acceptable
 - Apparent cause was condensation
- RFO12 (2004)
 - Corrosion under blisters on floor of chambers
 - UT showed wall thickness were above nominal thickness
 - Cause was degraded coatings

Containment Valve Chamber Internal Corrosion

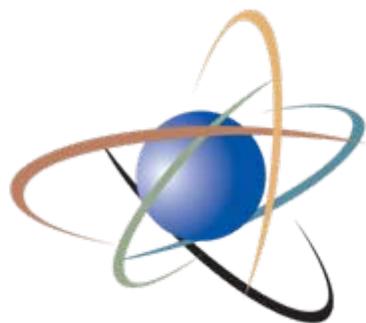
- RFO13 (2006)
 - Coatings were repaired with improved material
- RFO14 (2007)
 - No indications
- QC inspects per IWE every ISI period

Containment Valve Chamber Corrosion

- Conclusion
 - Valve chamber integrity maintained by routine inspections and maintenance

Questions





U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Advisory Committee on Reactor Safeguards (ACRS) License Renewal Full Committee

Shearon Harris Nuclear Power Plant Unit 1

Safety Evaluation Report

October 2, 2008

Maurice Heath, Project Manager
Office of Nuclear Reactor Regulation

Introduction

- Overview
- Resolution of Open Item 2.2
- Resolution Confirmatory Item 3.4-1
- Resolution Confirmatory Item 4.3

Overview

- License Renewal Application submitted by letter dated November 14, 2006
- Single Unit, Westinghouse 3-Loop - PWR
- 2900 megawatt thermal, 900 megawatt electric
- Operating license NPF-63 expires October 24, 2026
- Location is approximately 20 miles SW of Raleigh, NC

Overview

- Safety Evaluation Report with Open Item was issued March 18, 2008
 - One (1) open item
 - Two (2) confirmatory items
- 346 Audit Questions
- 75 RAIs Issued
- 35 Commitments

Overview

- SER issued August 21, 2008
- Resolution of Open Item (OI) 2.2
- Resolution of Confirmatory Items (CI) 3.4-1 and CI 4.3
- 2 additional commitments added, which were added to resolve the two confirmatory items

Section 2.2: Plant Level Scoping

OI - 2.2

- HNP FSAR credits feedwater regulating and bypass valves for redundant isolation function following a main steam line break. Feedwater isolation is not listed as a function of the feedwater system in the LRA
- The LRA states that the feedwater regulating and bypass valves are non-safety related (NSR), per the CLB and are in scope per 10 CFR 54.4(a)(2)

Section 2.2: Plant Level Scoping

OI - 2.2

- In addressing this OI the staff identified the following:
 - 54.4(a)(1) specifies that safety-related SSCs should be included in scope if they meet 54.4(a)(1)(i), (ii), or (iii)
 - The criteria in 54.4(a)(1)(i-iii) agrees with the definition of safety-related specified in 10 CFR 50.2

Section 2.2: Plant Level Scoping

OI - 2.2

- If the applicants definition of safety-related (SR) differs from 54.4(a), then NEI 95-10 states that applicants should use the criteria of 54.4(a)(1)(i-iii) to determine what SSCs to include in scope.
- If an applicant has CLB documentation indicating the NRC has approved specific SSCs that to be classified as NSR, which would otherwise meet the applicants definition of SR or the 54.4(a)(1) criteria, these SSCs are not required to be within scope in accordance with 54.4(a)(1)

Section 2.2: Plant Level Scoping

OI - 2.2

- If SSCs, classified NSR in accordance with CLB, have the potential to affect the functions described in 54.4(a)(1) they should be included within scope in accordance with 54.4(a)(2) – nonsafety-related affecting safety-related.

Section 2.2: Plant Level Scoping

OI - 2.2

➤ Resolution

- LRA Amendment 8, dated May 30, 2008, revised Section 2.3.4.6 to add feedwater isolation as an intended function in the Feedwater System
- HNP has CLB documentation indicating the NRC has approved classifying these valves as NSR
- LRA Amendment 8, HNP took exception to scoping methodology in NEI 95-10 and used the CLB and scoping definition in 54.4 to determine the valves are in scope per 54.4(a)(2)
- The staff agrees with the this position as it is consistent with the CLB and scoping definition in 10 CFR 54.4

Section 3: Aging Management Review Results

➤ Confirmatory Item 3.4-1

- Applicant credits managing changes in materials and cracking of elastomeric and other plastic components with External Surfaces Monitoring Program
- GALL AMP XI.M36 recommends visual inspection for carbon steel components but does not address elastomeric and other plastic components

➤ Resolution

- Applicant will use the preventative maintenance program, which will periodically replace these components based on site and industry operating experience, equipment history, and vendor recommendations

Section 4: Time-Limited Aging Analysis

➤ Confirmatory Item 4.3

- Applicant used WESTEMS™ special purpose computer code in calculating stresses from thermal transients
- The code is bench marked for pressure, external moments, and thermal transients
- 60-year fatigue reanalyses were completed for all NUREG/CR 6260 components with two (2) components having 60-year CUF_{en}>1.0
- CI 4.3 was issued to ensure consistency between reanalysis and original design specification

Section 4: Time-Limited Aging Analysis

CI - 4.3

➤ Resolution

- HNP committed to update the design specification to reflect the revised design basis operating transients (Commitment 37)
- The FSAR supplement was updated to reflect HNP's crediting of the fatigue monitoring program to manage aging for reactor coolant pressure boundary components according to 10 CFR 54.21(c)(1)(iii)

Conclusion

On the basis of its review, the staff determines that the requirements of 10 CFR 54.29(a) have been met.



QUESTIONS



Presentation to the ACRS Full Committee

ESBWR Design Certification Review
Chapter 19 & 19A

Presented by
NRO/DNRL/NGE1 and NRO/SPLB

October 2, 2008

ACRS Full Committee Presentation

ESBWR Design Certification Review

Chapter 19

Purpose:

- Brief the Committee on the status of the staff's review of the ESBWR DCD application, Chapter 19 and 19A (RTNSS)

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19**

Review Team for Chapter 19:

- Lead Technical Reviewer
 - Mark Caruso, Sr. Risk & Reliability Engineer
- Technical Reviewers
 - Edward Fuller, Sr. Risk & Reliability Engineer
 - Marie Pohida, Sr. Risk & Reliability Engineer
 - Glenn Kelly, Sr. Risk & Reliability Engineer
 - John Lai, Risk & Reliability Engineer
 - Jim Xu, Sr. Structural Engineer

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19**

Outline of Presentation:

- Objectives of Staff's review
- Summary of Staff's review
- Open Items

ACRS Full Committee Presentation

ESBWR Design Certification Review

Chapter 19

Commission's Objectives:

- Use the PRA to identify and address potential design features and plant operational vulnerabilities.
- Use the PRA to reduce or eliminate the significant risk contributors
- Use the PRA to select among alternative features and design options.
- Identify risk-informed safety insights
- Determine how the risk associated with the design compares against the Commission's goals of less than $1 \times 10^{-4}/\text{yr}$ for CDF and less than $1 \times 10^{-6}/\text{yr}$ for LRF and containment performance goals
- Assess the balance between severe accident prevention and mitigation.
- Determine whether the plant design represents a reduction in risk compared to existing operating plants
- Demonstrate compliance with 10 CFR 50.34(f)(1)(i) (i.e., perform a PRA)
- Use PRA in support of programs and processes (e.g., RTNSS, RAP)

ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19

Areas of Review with Open Items

- PRA Quality
- Seismic Margins Analysis
- High Winds Analysis
- PRA for Non-power Operational Modes
- Severe Accident Mitigation
- Severe Accident Management

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19**

**Open Items
PRA Quality**

- Applicant's basis for stating PRA quality is adequate for design certification not provided in DCD
 - GEH response to RAI 19.1-155 acceptable
 - Staff will confirm quality, including completeness, of PRA Rev. 3 in site audit
- Concerns with success criteria for passive systems resolved

ACRS Full Committee Presentation

ESBWR Design Certification Review

Chapter 19

Open Items

Seismic Margins Analysis

- GEH used a spectrum shape different from the Certified Seismic Design Response Spectra (CSDRS) for HCLPF* estimates in Seismic Margins Analysis (SMA)
- Majority of SSCs treated in SMA assume a HCLPF equal to the limit of $1.67 \times \text{SSE}$; however, the SSE has not been defined as CSDRS in the DCD.
- Staff requested that GEH include an ITACC for verification of the assumed seismic capacity for differential building displacements of $1.67 \times \text{CSDRS}$. Staff is awaiting response to RAI from GEH.

*High Confidence of Low Probability of Failure defined as: Earthquake level at which, with high confidence (95 percent), it is unlikely (probability less than 5×10^{-2}) that failure of the SSC will occur.

**ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 19**

**Open Items
High Winds Analysis**

- Assumed conditional probability that Category 4 or 5 hurricanes will damage structures not justified
 - Awaiting GEH response to RAI
- Not clear whether credit was taken for equipment in Seismic Category II structures hit by tornado missiles
 - Awaiting GEH Response to RAI

ACRS Subcommittee Presentation

ESBWR Design Certification Review

Chapter 19

Open Items

PRA for Other Operational Modes

- Staff requests GE to add DPS operability to TS for Modes 5 and 6 or assess risk of RWCU/SDC breaks outside of containment (RAI 19.1.-178)
- Staff requests GE to document sizes of piping penetrations and associated alarm/position indication upstream of RWCU/SDC isolation valves or assess operator induced leaks (RAI 19.1.0-4 Supplement 2)
- Staff questions ability of Isolation Condenser to function effectively for some operational conditions in Mode 5 (RAI 19.1-144 Supplement 2)

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 19

Open Items
PRA for Other Operational Modes

- GEH must determine range of conditions (temperature and level) for which the RWCU/SDC can adequately remove decay heat in Modes 4, 5, and 6 (RAI 5.4-59 Supplement 1)
 - Staff concerned about inadequate vessel circulation between inside and outside shroud
 - Staff concerned that RWCU/SDC injection may bypass the core due to inadequate mixing in downcomer.

ACRS Subcommittee Presentation

ESBWR Design Certification Review

Chapter 19

Open Items

Severe Accident Mitigation

- BiMAC performance test report
 - Response to RAIs 19.2-23 S02 and 19.2-25 S02 included a topical report documenting the results of the BiMAC tests.
 - Topical report NEDE-33392 has been reviewed and 27 RAIs prepared.
- Sent a new RAI to GEH asking for transient analyses of BiMAC behavior during severe accidents for both high and low RCS pressure scenarios.

**ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 19**

**Open Items
Accident Management**

- Description of the process for developing Severe Accident Guidelines
 - The staff requested additional information on the process that will be used by GEH to develop the Severe Accident Guidelines (SAGs) in RAI 19.2.4-1 and its supplements.
 - A new supplemental RAI has been issued, asking for the technical basis for ESBWR severe accident management.

ACRS Full Committee Presentation ESBWR Design Certification Review Chapter 19A (SER Chap. 22)

Review Team for Chapter 19A (SER Chap. 22):

- Lead Technical Reviewer
 - Mark Caruso, Sr. Risk & Reliability Engineer
- Technical Reviewers
 - Eugene Eagle, Instrumentation and Controls Engineer
 - Craig Harbuck, Sr. Operations Engineer
 - Thomas Scarbrough, Sr. Mechanical Engineer
 - Mohamed Shams, Structural Engineer
 - David Shum, Sr. Reactor Systems Engineer
 - George Thomas, Sr. Reactor Systems Engineer
 - Harry Wagage, Sr. Reactor Engineer

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19A (SER Chap. 22)**

Outline of Presentation:

- Objectives of Staff's review
- Summary of Staff's review
- Open Items

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19A (SER Chap. 22)**

**Regulatory Treatment of Non-Safety
Systems (RTNSS)**

Objectives of Staff's Review

- Confirm all non-safety SSCs requiring treatment are identified
- Confirm reliability and availability (R/A) missions for active systems are consistent with risk assessment
- Confirm level of treatment is based on ability to meet R/A missions (i.e., TS, Availability Controls Manual, Maintenance Rule program)

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19A (SER Chap. 22)**

Areas of Review with Open Items

- Augmented Design Standards for Post-72 hour equipment
- Regulatory Treatment of Active Systems
- Availability Controls

ACRS Full Committee Presentation

ESBWR Design Certification Review

Chapter 19A (SER Chap. 22)

Open Items

Augmented Design Standards for Post-72 Hours Equipment

- Staff is satisfied that RTNSS systems can be adequately protected from flood-related effects associated with both natural phenomena and system and component failures (design meets standards).
- Staff wants GEH to propose an ITAAC to ensure as-built plant implements the design properly.

**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19A (SER Chap. 22)**

**Open Items
Regulatory Treatment**

- Risk significance criteria for determining treatment level of active systems applied inconsistently
 - Awaiting GEH response to RAI 22.5-26
- Treatment of electric fire pump dedicated to low pressure injection needs to be clarified.
 - Awaiting GEH response to RAI 22.5-27

ACRS Full Committee Presentation

ESBWR Design Certification Review

Chapter 19A (SER Chap. 22)

Open Items

Availability Controls (AC)

- ACs did not state the associated instrumentation functions and the number of required divisions in the AC LCOs for some functions
 - Awaiting GEH response to RAI 22.5-22
- AC bases do not explicitly state the minimum level of system degradation that corresponds to a function being unavailable, or the number of divisions used to determine the test interval for each required division (or component) for AC surveillance requirements
 - Awaiting GEH response to RAI 22.5-22
- No AC Surveillance Requirements provided for FAPCS pumps
 - Awaiting GEH response to RAI 22.5-23
- AC LCOs for FAPCS and EDGs inconsistent with PRA assumptions
 - Awaiting GEH response to RAI 22.5-24

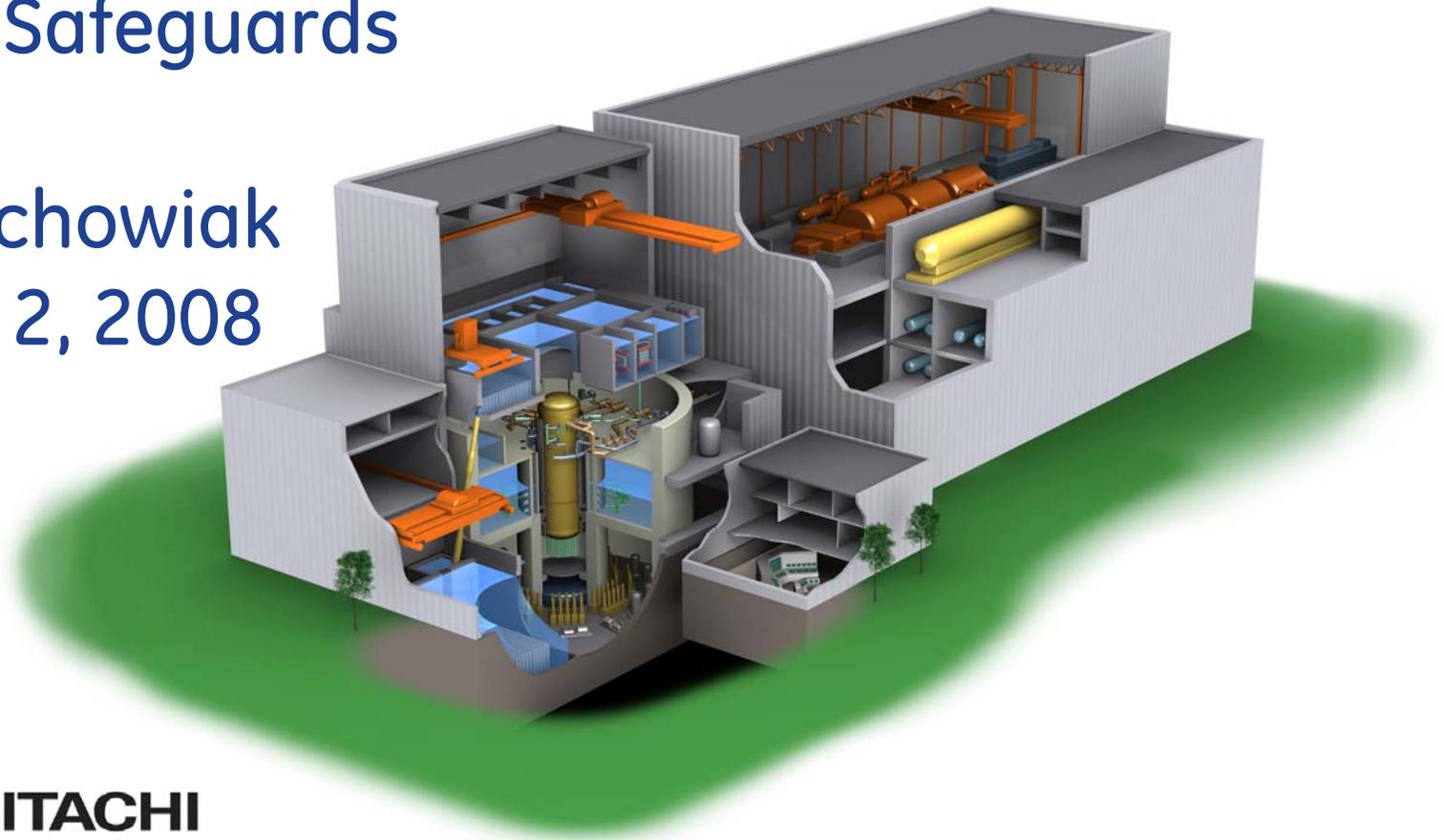
**ACRS Full Committee Presentation
ESBWR Design Certification Review
Chapter 19A (SER Chap. 22)**

Discussion / Questions

ESBWR PRA and Severe Accidents

Presented to the
Advisory Committee on
Reactor Safeguards

Rick Wachowiak
October 2, 2008



HITACHI

Design Certification PRA Objectives

10 CFR 50.34(f)(1)(i) requires a Design Certification PRA to address known design issues with respect to core and containment heat removal systems

Identify vulnerabilities

Demonstrate that the plant meets the Commission's safety goals

Reduce/eliminate risk contributors in existing plants

Select among SAM design features

Identify risk-informed safety insights

Show a balance of severe accident prevention and mitigation

Show a reduction in risk in comparison to existing plants

Support design programs such as RTNSS and D-RAP



HITACHI

Interaction With NRC Staff On ESBWR PRA

Nearly 450 RAIs (almost 8% of total for certification)

- 386 resolved

Three on-site audits

Several meetings and teleconferences

Audit of revision 4 PRA expected in the first week of December

Focused on the design certification PRA objectives



Design Certification Not the Last ESBWR PRA

Revised PRA required by 10 CFR 50.71(h)(1)

- Level 1 and Level 2
- Prior to initial fuel load
- Must meet all endorsed standards

No intention that the DC PRA must satisfy this requirement

Maintained by the licensee for NRC inspection

Need for submittal to NRC based on each specific risk informed application requirements



Ongoing PRA Upgrade Requirements

10 CFR 50.71(h)(2) requires PRA maintenance or upgrade as new standards are endorsed

- 4 year periodicity
- PRA maintenance and PRA upgrade consistent with definition in ASME “Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications”

ESBWR Design Certification PRA

Meets the scope and quality for certification

Meets the scope and quality for COL given no significant departures from the certified design

Provides a starting point for operating plant PRA



HITACHI

Organization of ESBWR PRA Reports

DCD Chapter 19 describes the PRA and lists key insights

NEDO 33201 ESBWR Certification Probabilistic Risk Assessment, R3 May 2008

NEDO 33289 ESBWR Reliability Assurance Program, R2 September 2008

NEDO 33306 ESBWR Severe Accident Mitigation Design Alternatives, R1 August 2007

NEDO/NEDE 33386 ESBWR Plant Flood Zone Definition Drawings and Other PRA Supporting Information, R0 September 2007

NEDO/NEDE 33392(P) The MAC Experiments: Fine Tuning of the BiMAC Design, R0 March 2008

NEDO 33411 Risk Significance of Structures, Systems, and Components for the Design Phase of the ESBWR, R0 March 2008

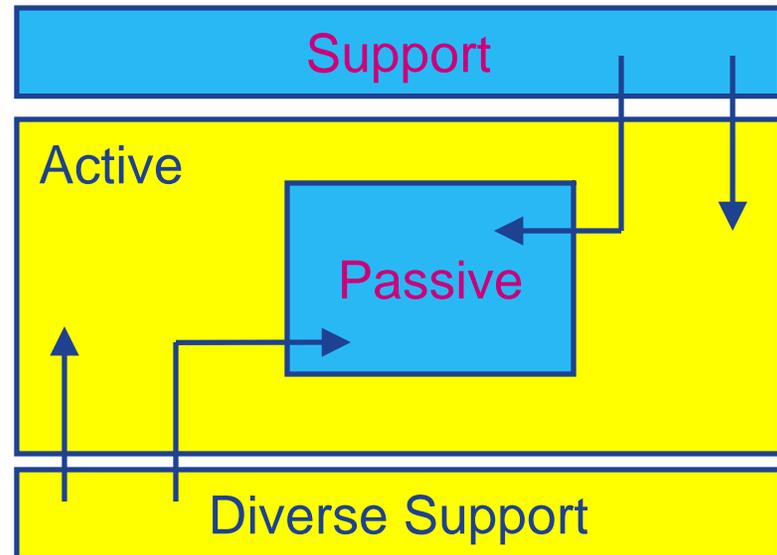


HITACHI

Key Features of ESBWR Design Risk Management

- Passive safety systems
- Active asset protection systems
- Support system diversity
- Minimize reliance on human actions
- Use applicable historical data

Target configuration for core damage prevention functions



Features of ESBWR PRA

Detailed Fault Tree / Event Tree Models

Level 1, 2, and 3

Internal & External Events

All Modes

Seismic Margins

Generic Data

Historical Initiating Event Frequencies

Parametric Uncertainty

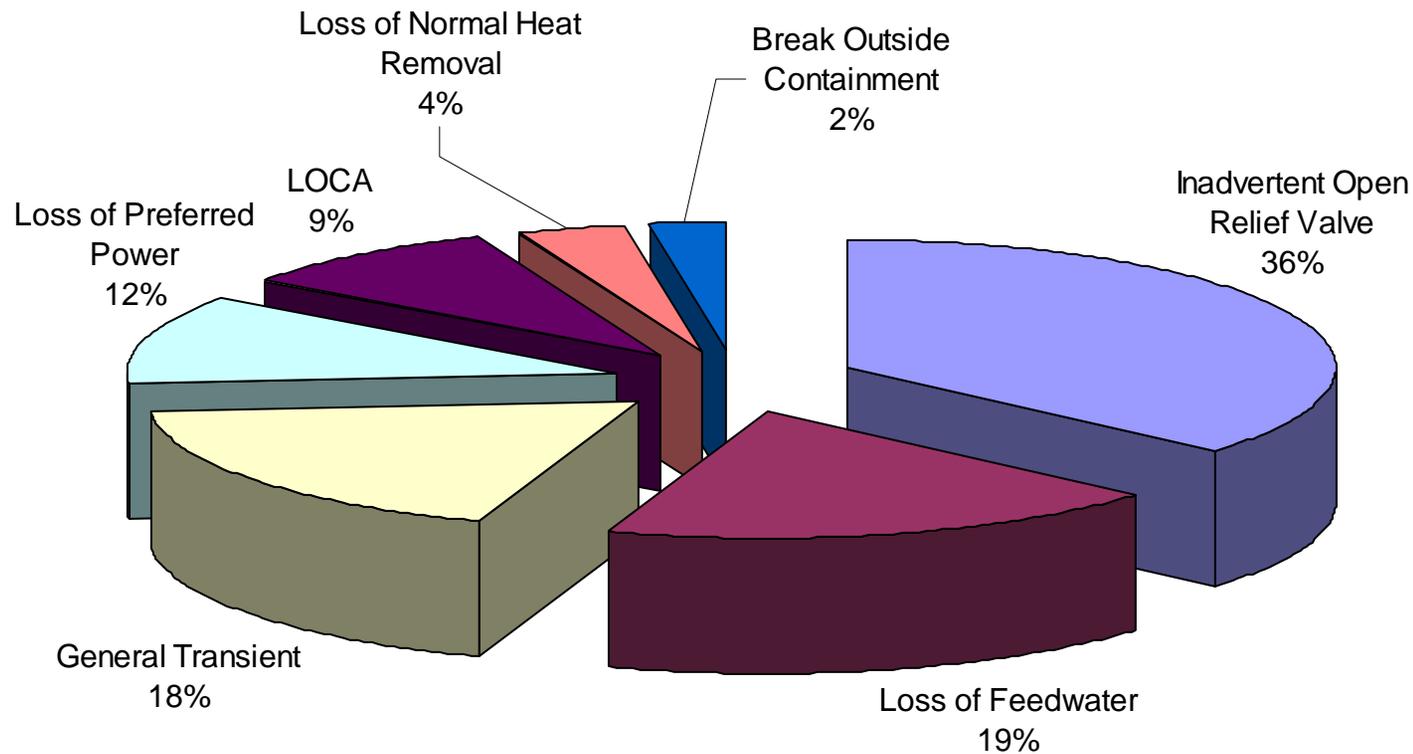
Systematic Search for Key Modeling Uncertainties

Internal review for compliance with ASME-RA-Sb-2005



HITACHI

ESBWR Core Damage Risk Profile



$$CDF_{pe} = 1.2 \times 10^{-8} / \text{yr}$$

At power internal events



HITACHI

Overall Results

	Internal Events	Fire	Flood	High Winds
At-Power CDF	1.2×10^{-8}	8.1×10^{-9}	1.6×10^{-9}	1.3×10^{-9}
Shutdown CDF	9.4×10^{-9}	2.7×10^{-8}	5.2×10^{-9}	1.2×10^{-9}
At-Power LRF	1.0×10^{-9}	5×10^{-10}	2×10^{-10}	3×10^{-11}
Shutdown LRF	9.4×10^{-9}	2.7×10^{-8}	5.2×10^{-9}	1.2×10^{-9}

Point Estimate Values
Units are per calendar year



Scope of Severe Accident Analyses

Discussion of severe accident prevention

- Examples: ATWS, SBO, Fire Protection & ISLOCA

Discussion of severe accident mitigation

- Examples: Hydrogen control, debris coolability, high-pressure melt eject, containment performance, containment vent, equipment survivability

Severe accident mitigation design alternatives

Contained in DCD Ch 19, NEDO-33201 Ch 21, and NEDO-33306



HITACHI

PRA Was a Major Influence on Design

Examples

- Design of digital / mechanical interface to eliminate spurious actuations from fire
- Selection of diverse components
- Addition of redundancy to RWCU isolation features
- Addition of BiMAC to preclude containment failure
- Main control room design
- Addition of severe accident water injection pump
- More enhancements identified to resolve during procedure development



NRC Staff Review Helped Enhance PRA

Examples

- Extend Level 3 to external events
- Enhanced documentation of assumptions
- Upgrade from FIVE to Fire PRA
- Systematic evaluation of the PRA with respect to endorsed standards



Limited Open Items Remain

PRA quality assessment

- GEH responded and it is under staff review
- Audit of ESBWR PRA scheduled for December

Seismic margins analysis

- Selection of response spectrum
- GEH response is in development

High winds analysis

- Assumptions for building capabilities in extreme wind events
- GEH response is in development

Shutdown event details

- GEH responded to 2 issues / in development for 2 issues

Severe accident resolution

- Questions from BiMAC test report
- GEH responses are in development



NRC RTNSS Criteria

- A SSC functions relied upon to meet beyond design basis deterministic NRC performance requirements such as 10CFR50.62 for anticipated transient without scram (ATWS) mitigation and 10CFR50.63 for station blackout
- B SSC functions relied upon to resolve long-term safety (beyond 72 hours) and to address seismic events
- C SSC functions relied upon under power-operating and shutdown conditions to meet the Commission's safety goal guidelines of a core damage frequency of less than 1.0E-4 each reactor year and large release frequency of less than 1.0E-6 each reactor year
- D SSC functions needed to meet the containment performance goal (SECY-93-087, Issue I.J), including containment bypass (SECY-93-087, Issue II.G), during severe accidents
- E SSC functions relied upon to prevent significant adverse systems interactions



RTNSS Design Treatment

Redundant active components

Fire and flood protected

Hurricane category 5 missile protection

Designed for accident environment

Quality suppliers (not Appendix B)

Seismic category II for post-72 hr functions

Technical Specifications for SSCs Needed to Meet CDF and LRF Goals

Availability Controls Manual for Frontline Systems



HITACHI

RTNSS Open Items

Availability Controls

- ACs did not state the associated instrumentation functions and the number of required divisions in the AC LCOs for some functions
- AC bases do not explicitly state the minimum level of system degradation that corresponds to a function being unavailable, or the number of divisions used to determine the test interval for each required division (or component) for AC surveillance requirements
- No AC Surveillance Requirements provided for FAPCS pumps
- AC LCOs for FAPCS and EDGs inconsistent with PRA assumptions

RTNSS Open Items

Design standards for post-72 hour functions

- Resolved

Augmented design standards for flood protection

- Existing RAIs resolved

RTNSS status of some active systems

- Responses in development

Conclusions

ESBWR PRA and Severe Accident chapters meet the requirements for certification

Limited open items to be resolved

NRC review confirms that the required objectives will be satisfied in the DCD



Historical Perspectives and Insights on Reactor Accident Consequences Analyses

Hossein Nourbakhsh

Senior Technical Advisor

Advisory Committee on Reactor Safeguards (ACRS)

Presented at

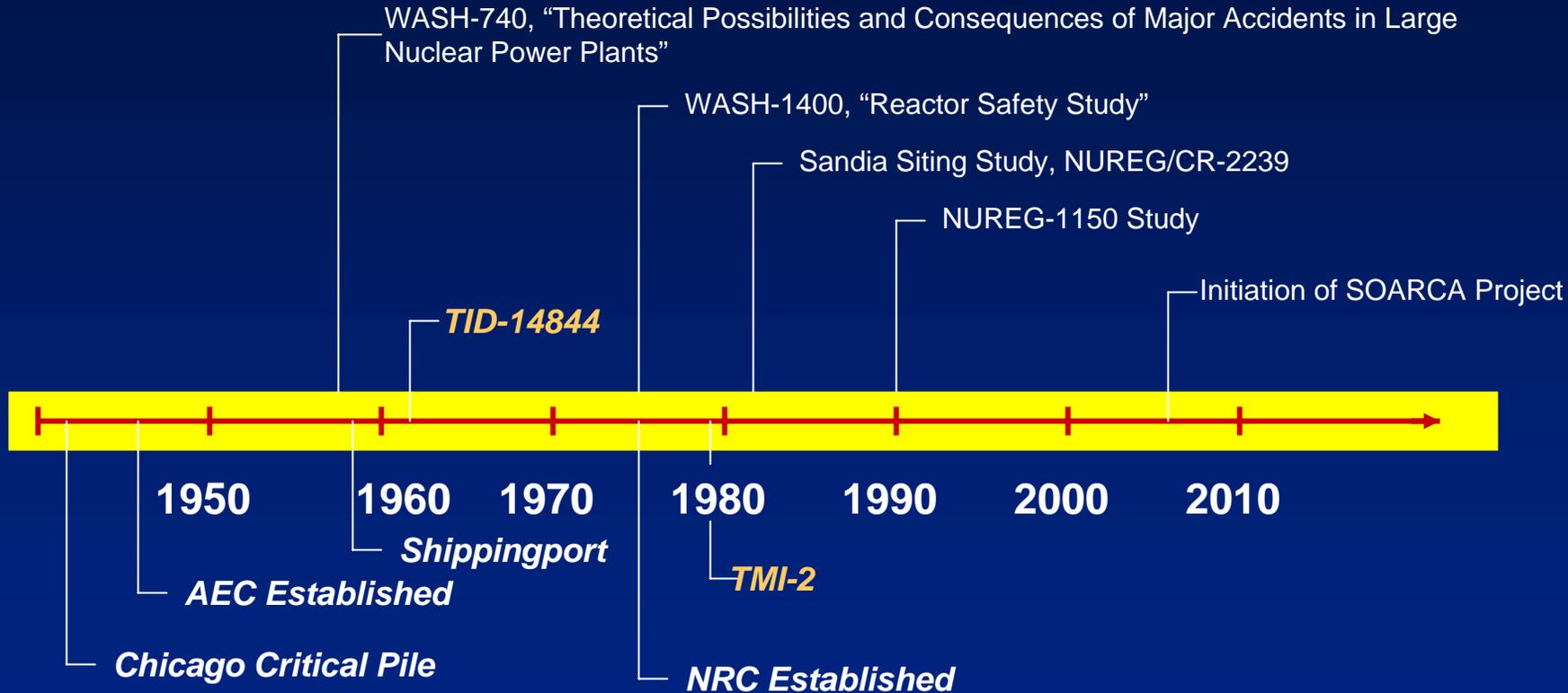
556th Meeting of ACRS

October 2, 2008

Objectives

- To provide historical perspectives and insights on previous state-of-the-art analyses of the consequences of severe reactor accidents
- To discuss the feasibility of using a simplified, yet systematic and defensible, approach to benchmark many aspects of SOARCA

Timeline of Major Studies of Reactor Accident Consequences



WASH-740

- The first estimates of consequences of severe accidents were published in the 1957 U.S. Atomic Energy Commission report (WASH-740), “Theoretical Possibilities and Consequences of Major Accidents in Large Nuclear Power Plants”
- An attempt to provide upper bounds of the potential public hazards resulting from certain severe hypothetical accidents
- Conservative values were used for many factors influencing the magnitude of the estimated accident consequences
- At the time, the technology and the state-of-knowledge of severe accidents had not progressed to the point where it was possible to use quantitative techniques to estimate the probabilities of such accidents. However, there was a general agreement that the probability of occurrence of severe accidents in nuclear power reactors was exceedingly low.

Reactor Safety Study (WASH-1400)

- The first systematic attempt to provide realistic estimates of public risk from potential accidents in commercial nuclear power plants
- Included analytical methods for determining both the probabilities and consequences of various accident scenarios
- Two specific reactor designs were analyzed in WASH-1400, Surry and Peach Bottom
- Calculations were performed for a number of accident sequences and the results for these calculations were used to define a series of release categories (nine for PWR and five for BWR) into which all of the identified accident sequences could be placed.

Post TMI-2 Review of Source Term Technical Basis

- Following the publication of WASH-1400 and the accident at TMI-2, work initiated to review the predictive methods for calculating fission product release and transport
- Review resulted in several conclusions that represented significant departure from WASH-1400 assumptions including the suggestion that cesium iodide (CsI) will be the expected predominant iodine chemical form under most postulated LWR accident conditions
- These studies formed the basis for development of a generic set of radiological releases, characterized as Siting Source Terms (denoted SST1-5), used in Sandia Siting Study (NUREG/CR-2239)

Brief Descriptions of the Characteristics of the Accident Groups

(NUREG-0771, p. 8)

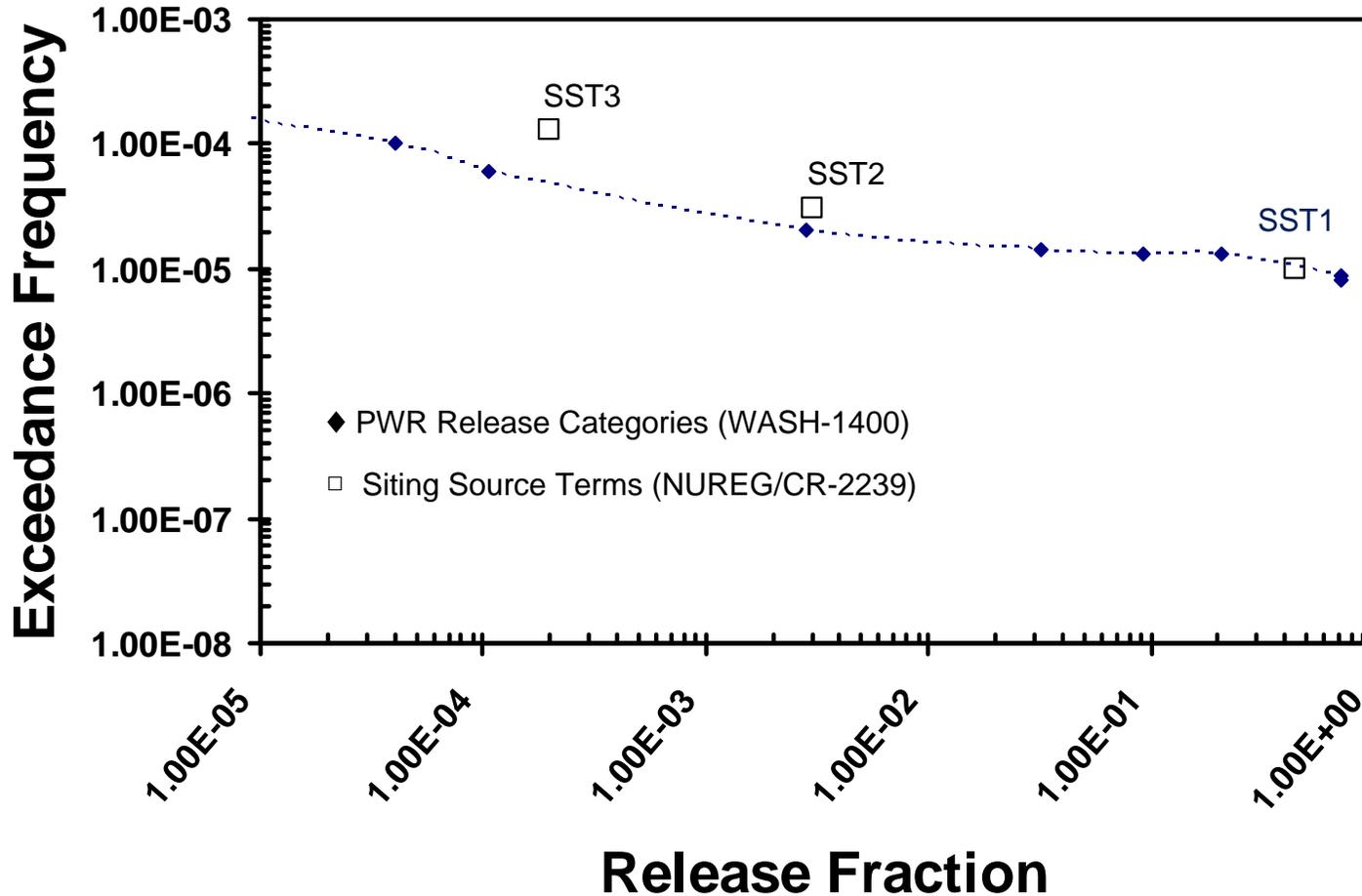
- Group 5 - Limited core damage. No failures of engineered safety features beyond those postulated by the various design basis accidents are assumed. The most severe accident in this group includes substantial core melt, but containment functions as designed (siting DBA equivalent).
- Group 4 - Limited to modest core damage. Containment systems operate but in somewhat degraded mode (TMI-2 equivalent)
- Group 3 - Severe core damage. Containment fails by basemat melt-through. All other release mitigation systems have functioned as designed (analogous to Reactor Safety Study Pressurized Water Reactor, PWR, Categories 6 and 7)
- Group 2 - Severe core damage. Containment fails to isolate. Fission product release mitigating systems (e.g., sprays, suppression pool, fan coolers) operate to reduce release (analogous to Reactor Safety Study PWR Categories 4 and 5)
- Group 1 - Severe core damage. Essentially involves loss of all installed safety features. Severe direct breach of containment (analogous to Reactor Safety Study PWR Categories 1 and 3)

Sandia Siting Study (NURG/CR-2239)

- Used Siting Source Terms (SSTs) at 91 existing or proposed reactor sites to perform accident consequence analyses
- Detailed PRAs were not performed for all reactors. Based on available PRAs at the time, NRC suggested the following representative probabilities for the SSTs
 - SST1 1×10^{-5}
 - SST2 2×10^{-5}
 - SST3 1×10^{-4}

Frequency of Release for Iodine

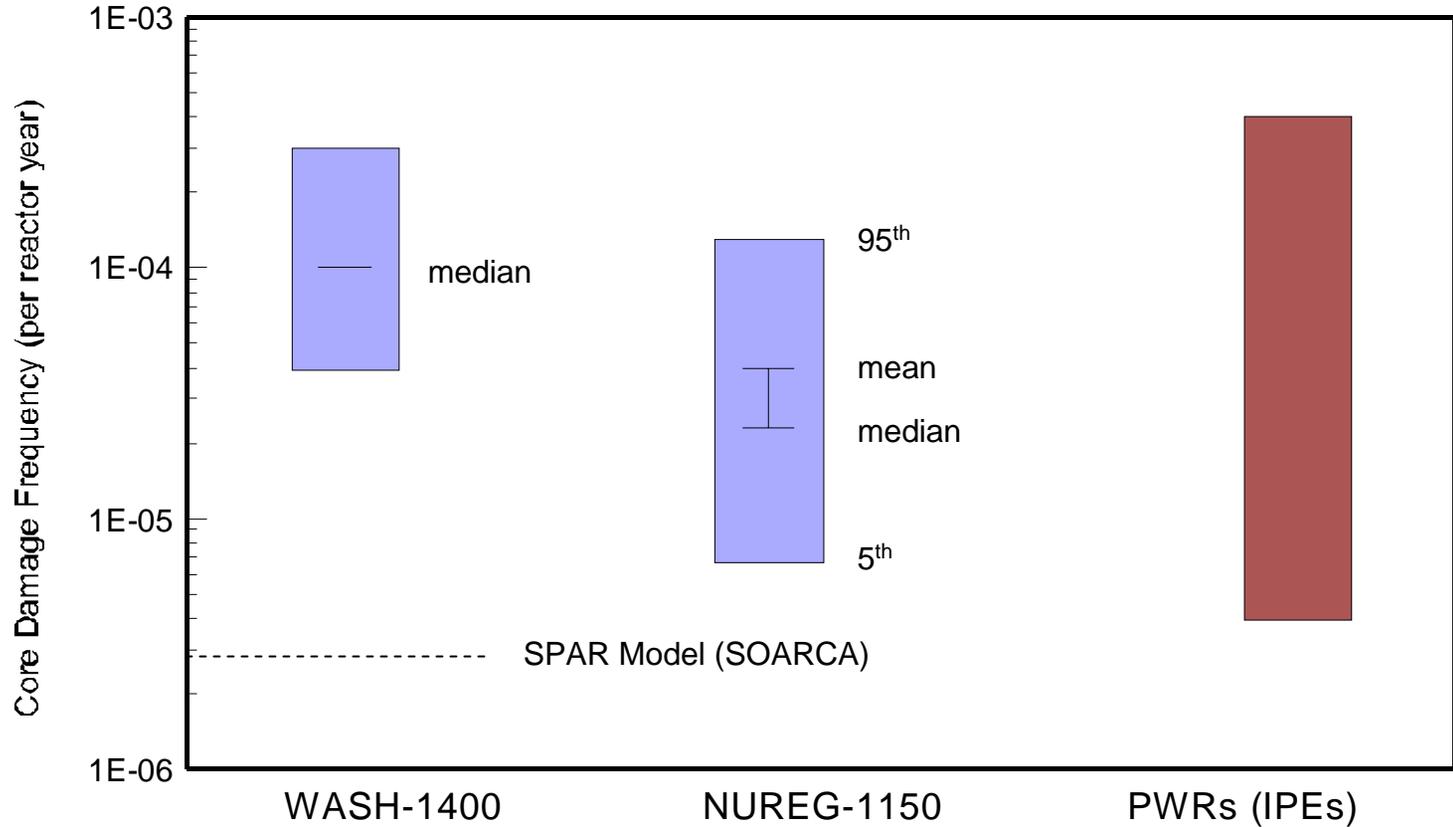
(Comparison of WASH-1400 PWR Release Categories and SSTs)



NUREG-1150 Study

- The NUREG-1150 study was a major effort to put into a risk perspective the insights into system behavior and phenomenological aspects of severe accidents
- An important characteristic of this study was the inclusion of the uncertainties in the calculations of core damage frequency and risk that exist because of incomplete understanding of reactor systems and severe accident phenomena
- The elicitation of expert judgment was used to develop probability distributions for many accident progression, containment loading, structural response, and source term issues
- Five specific commercial nuclear power plants were analyzed :
 - Surry, a 3-loop Westinghouse PWR with a subatmospheric containment
 - Zion, a 4-Loop Westinghouse PWR with large dry containment
 - Sequoyah, a 4-loop Westinghouse PWR with ice-condenser containment
 - Peach Bottom, a BWR-4 reactor with a Mark I containment
 - Grand Gulf, a BWR-6 reactor with a Mark III containment

Internal Core Damage Frequency for Surry



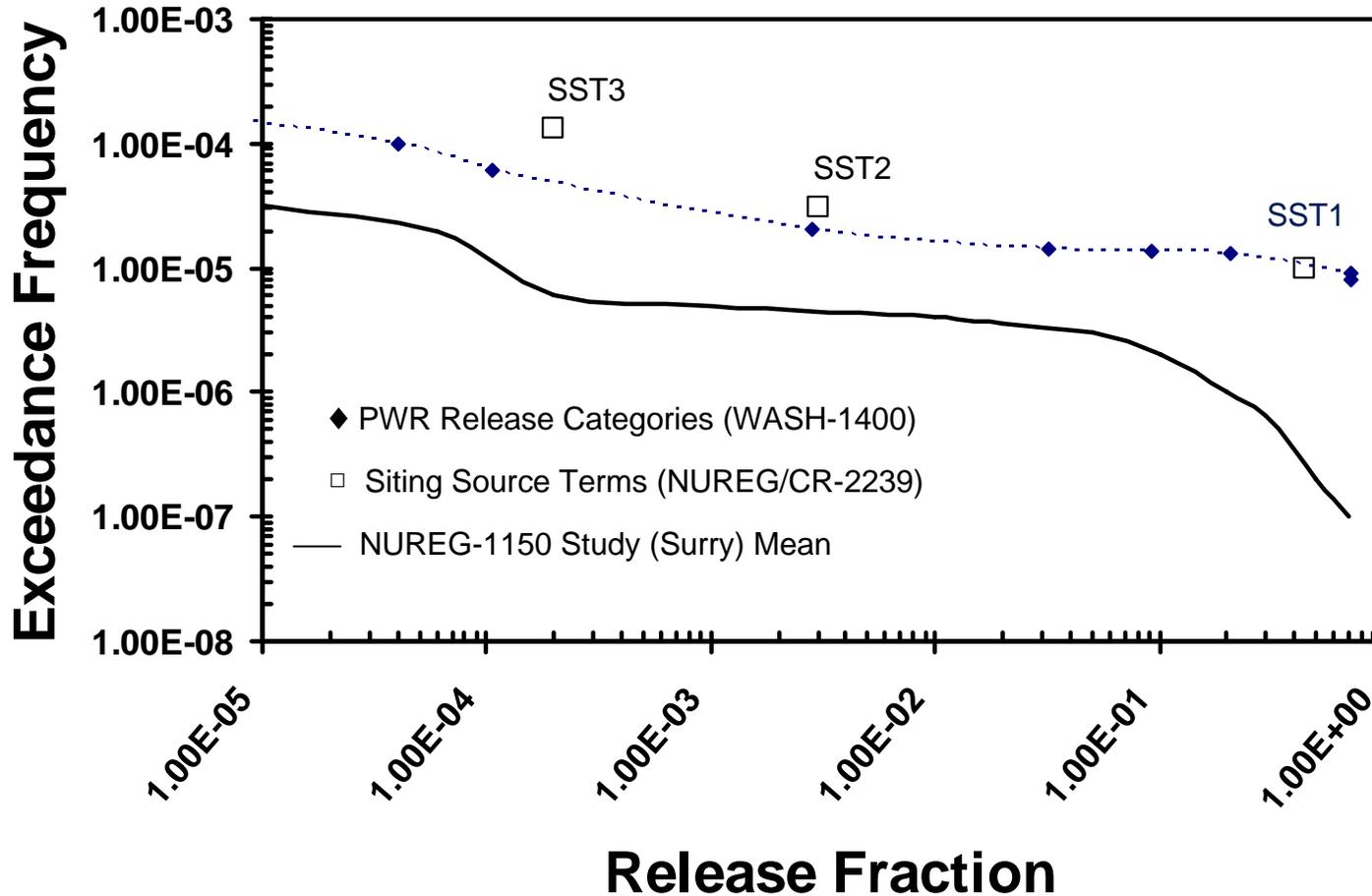
Conditional Probability of Accident Progression Bins at Surry (NUREG-1150, p. 3-12)

SUMMARY ACCIDENT PROGRESSION BIN GROUP	SUMMARY PDS GROUP (Mean Core Damage Frequency)							
	-----Internal Initiators-----					Fire	Seismic	
	LOSP	ATWS	Transients	LOCAs	Bypass	All	LLNL	
	(2.8E-05)	(1.4E-06)	(1.8E-06)	(6.1E-06)	(3.4E-06)	(4.1E-05)	(1.9E-04)	
VB, alpha, early CF	0.003	0.003		0.005		0.003	0.005	0.006
VB > 200 psi, early CF	0.005		0.001	0.001		0.004	0.013	0.008
VB, < 200 psi, early CF								0.082
VB, BMT or late CL	0.079	0.046	0.013	0.055		0.059	0.292	0.280
Bypass	0.003	0.078	0.007		1.000	0.122		0.001
VB, No CF	0.310	0.523	0.217	0.586		0.346	0.690	0.435
No VB	0.599	0.350	0.762	0.352		0.466		0.189

Key: BMT = Basemat Melt-Through
 CF = Containment Failure
 CL = Containment Leak
 VB = Vessel Breach

Frequency of Release for Iodine Group

(Comparison of WASH-1400 PWR Release Categories, SSTs, and NUREG-1150)



Reassessment of Selected Factors Affecting Siting of Nuclear Power Plants (NUREG/CR-6295)

- A series of probabilistic consequence assessment calculations were performed in support of an effort to re-assess reactor siting
- Insights from NUREG-1150 and the LaSalle independent risk assessment studies were used to develop representative source terms
 - A small set of source terms (4 to 7 for each plant) based on dominant plant damage states, accident progression groups and the associated release characteristics were developed for each reactor design to represent the full spectrum of severe accidents
- Examined consequences in a risk based format consistent with the quantitative health objectives (QHOs) of the NRC's Safety Goal Policy

Characteristics of Surry Release Categories, Internal Events

(NUREG/CR-6295, pp 3-19)

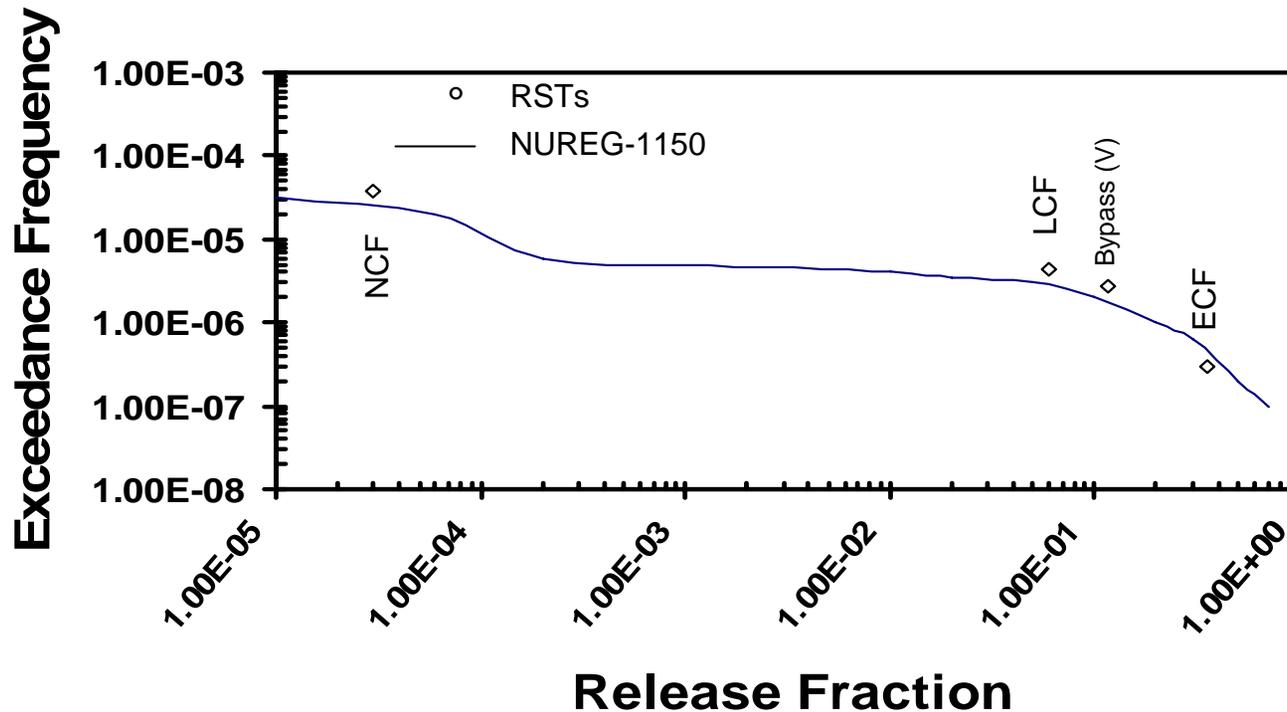
Release Category	Plant Damage State	Accident Progression Characteristics						
		Containment Failure Time	Containment Failure Mode	CCI	Amt CCI	RCS Pres.	VB Mode	Sprays
RSUR1	LOSP	CF at VB	Rupture	Prm Dry	Medium	Low	Alpha	No
RSUR2	LOSP	Late CF	Leak	Prm Dry	Large	Low	Pour	No
RSUR3	LOSP	No CF	No CF	Prm Dry	Large	Low	Pour	L+VL
RSUR4	Bypass (V)	No CF	Bypass	Prm Dry	Large	Low	Pour	No

Radionuclide Release Characteristics into Environment for Surry, Internal Events

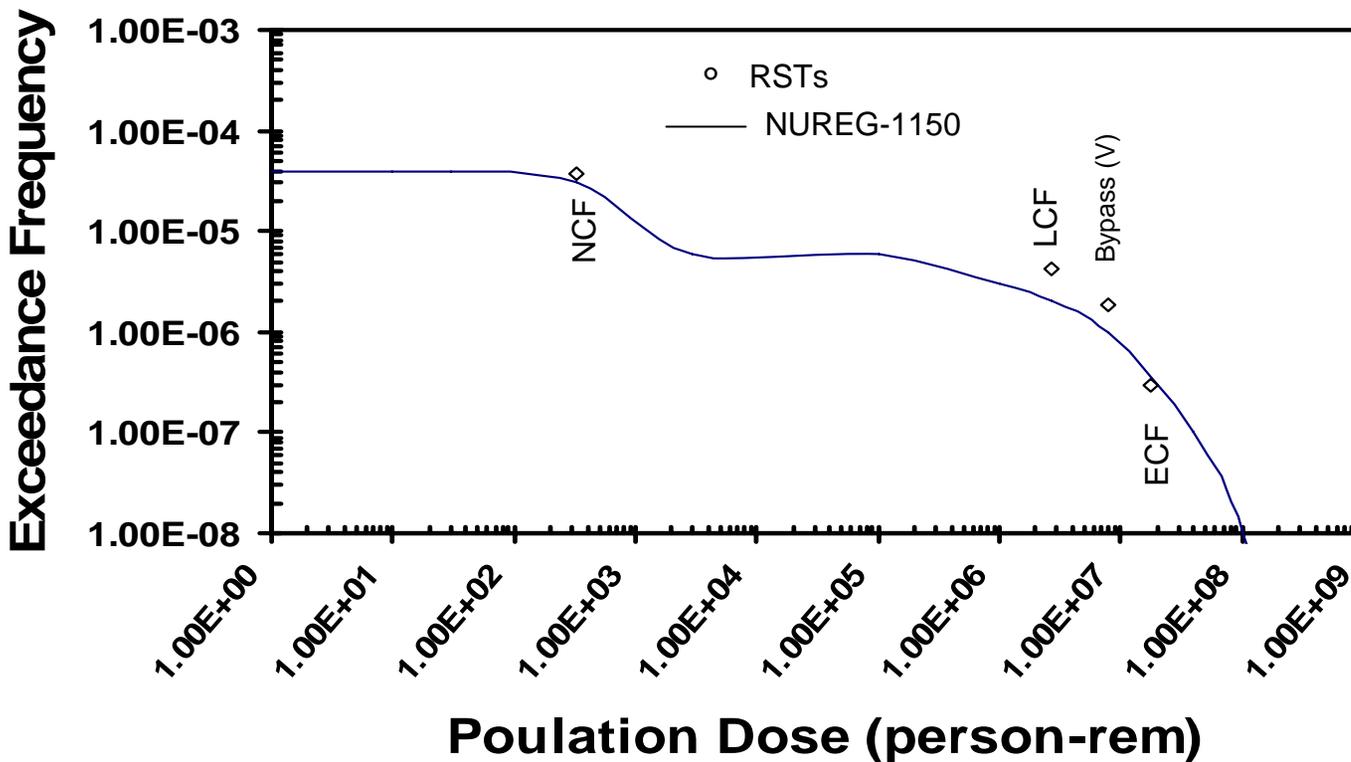
(NUREG/CR-6295, pp3-19)

Release Category	Frequency	Elevation (m)	Energy (W)	Time of Core Uncovery	Time of Release (hrs)	Release Duration	Fractional Releases								
							Ng	I	Cs	Te	Sr	Ba	Ru	La	Ce
RSUR1	2.9E-7	10	2.8E+7	5.0 hrs	6.0	200 sec	1.0E+0	2.5E-1	1.8E-1	8.0E-2	2.0E-2	2.0E-2	5.0E-3	1.0E-3	5.0E-3
		10	1.6E+6		6.06	2 hrs	0.0E+0	1.0E-1	1.3E-1	1.0E-1	4.0E-2	4.0E-2	1.0E-3	5.0E-3	5.0E-3
RSUR2	2.4E-6	10	5.2E+5	5.0 hrs	12.0	3 hrs	1.0E+0	6.0E-2	3.0E-2	9.0E-2	3.0E-3	3.0E-3	1.0E-3	4.0E-4	4.0E-4
RSUR3	3.3E-5	0	0.0E+0	5.0 hrs	6.0	10 hrs	2.5E-3	1.5E-5	1.2E-8	7.5E-9	2.5E-9	2.5E-10	2.0E-10	3.0E-10	4.0E-10
		0	0.0E+0		16.0	10 hrs	2.5E-3	1.5E-5	1.2E-8	7.5E-9	2.5E-9	2.5E-10	2.0E-10	3.0E-10	4.0E-10
RSUR4	1.6E-6	0	1.9E+6	20 min	1.0	30 min	1.0E+0	7.5E-2	6.0E-2	2.0E-2	5.0E-3	5.0E-3	1.0E-3	3.0E-4	1.0E-3
		0	1.7E+5		1.5	2 hrs	0.0E+0	4.0E-2	6.0E-2	6.0E-2	2.0E-2	2.0E-2	6.0E-4	3.0E-3	3.0E-3

Frequency of Release for Iodine Based on Representative Source Terms (RSTs) for Surry Internal Events



Frequency of Population Dose to Entire Region at Surry



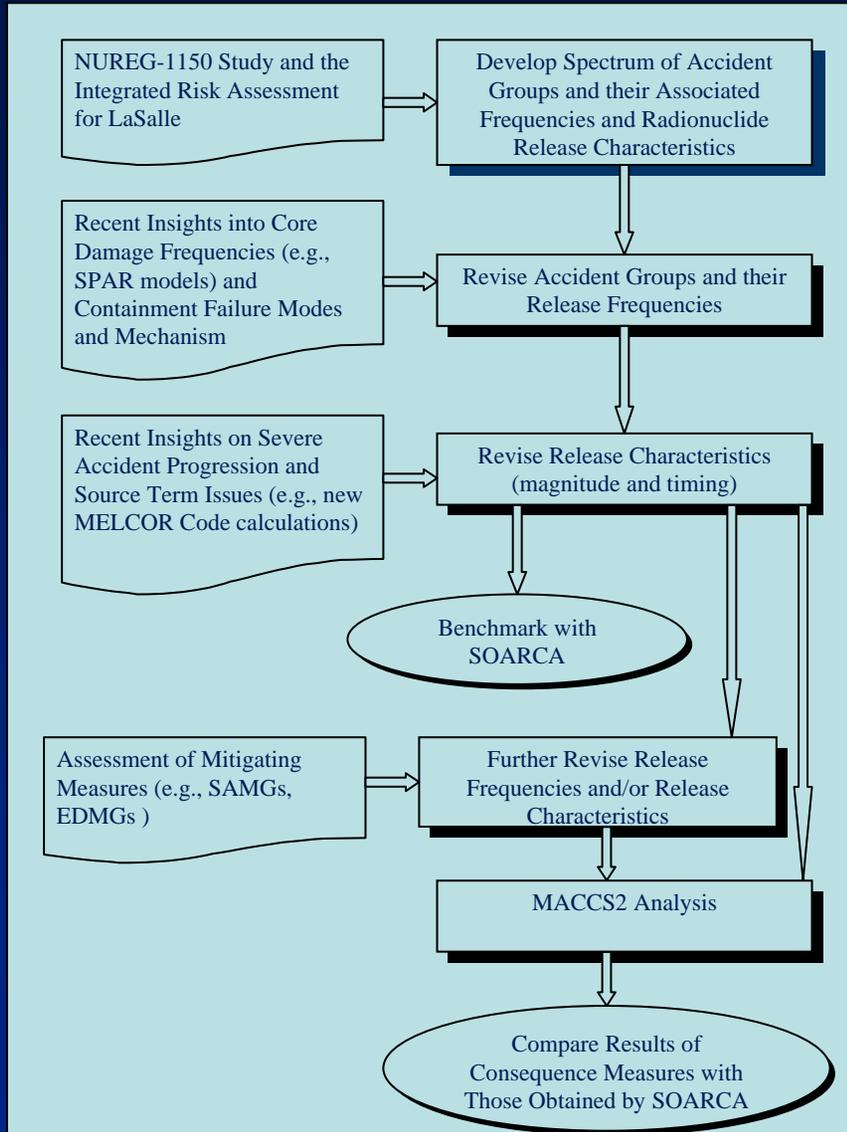
Recent Advances in Understanding of Severe Accident Phenomenology and Containment Failure Mechanisms

- Since the completion of NUREG-1150 Study, more analytical and experimental studies have been performed to address many severe accident issues including:
 - Direct Containment Heating (DCH) Issue
 - “Mark I Liner Attack” Issue
 - In-vessel steam explosion (alpha mode failure)

A SIMPLIFIED APPROACH TO SOARCA BENCHMARKING

- Although performing Level-3 PRAs for the pilot plants is the best way to benchmark the SOARCA methodology, results and insights from the NUREG-1150 Study and Integrated Risk Assessment for LaSalle, together with more recent advances in understanding of the severe accident issues and containment failure mechanisms, could be used for developing a simplified, yet systematic and defensible, approach to benchmark many aspects of SOARCA.

Elements of the Proposed Approach to Benchmark SOARCA



Impact of current knowledge and understanding of early containment failure on NUREG-1150 results for the conditional probability of accident progression bins at Surry

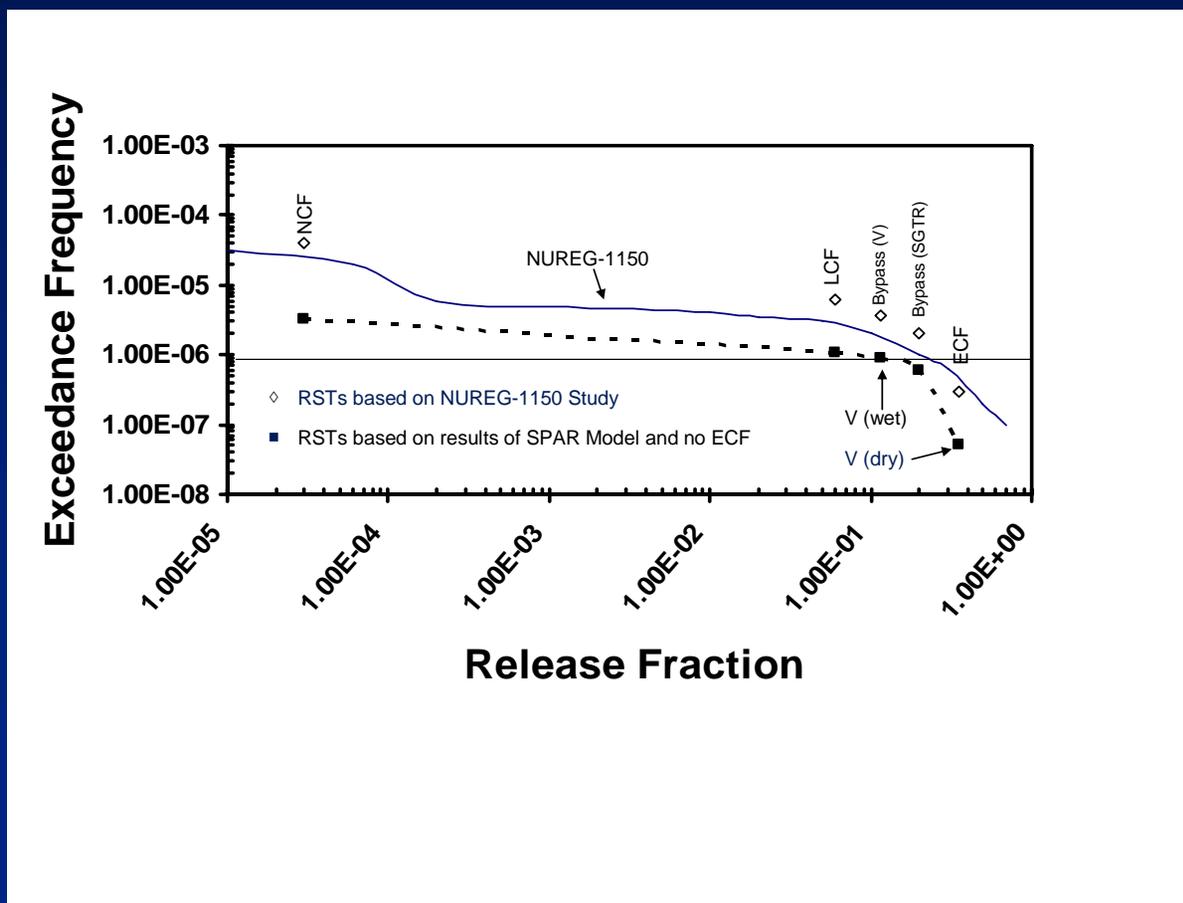
Summary Accident progression Bin Group	Summary PDS Group (Mean Core Damage Frequency)							
	Internal initiators (4.1E-05)						Fire (1.1E-05)	Seismic LLNL (1.9E-04)
	LOSP (2.8E-05)	ATWS (1.4E-06)	Transients (1.8E-06)	LOCAs (6.1E-06)	ISLOCA (1.6E-06)	SGTR (1.8E-06)		
Early CF	-- (0.008) ^(a)	-- (0.003)	-- (0.001)	-- (0.006)			-- (0.018)	0.082 (0.096)
Late CF	0.084 (0.079)	0.046 (0.046)	0.014 (0.013)	0.056 (0.055)			0.305 (0.292)	0.288 (0.280)
Bypass	(0.003)	(0.078)	(0.007)		(1.0)	(1.0)		(0.001)
No CF	0.913 (0.909)	0.876 (0.873)	0.979 (0.979)	0.944 (0.939)			0.695 (0.690)	0.630 (0.624)

(a) Numbers in parentheses are the results of the NUREG-1150 Study.

Frequencies and Magnitudes of Iodine Releases for Representative Source Terms for Surry (Internal Initiators)

Release Category	Summary PDS Group	Containment Failure Time	Containment Failure Mode	Frequency		Fractional Release for Iodine Group
				Based on NUREG-1150 Study	Revised Based on Results of SPAR Model and no Early Failure of Cont.	
RSUR1	LOSP	CF at VB (ECF)	Rupture	2.9E-07	----	0.35
RSUR2	LOSP	Late CF (LCF)	Leak	2.4E-06	1.5E-07	0.06
RSUR3	LOSP	No CF (NCF)	No CF	3.3E-05	1.95E-06	3.E-05
RSUR4	Bypass (V)	NCF	Bypass	1.6E-06 Wet (~85%) Dry (~15%)	3.5E-07 Wet (~3.0E-07) Dry (~5.0E-08)	0.115 0.115 (Wet) 0.37 (Dry)
RSUR5	Bypass (SGTRs)	NCF	Bypass	1.8E-06	5.5E-07	0.2

Comparison of frequency distribution (CCDF) of iodine release predicted by NUREG-1150 Study for Surry with that obtained from the results of SPAR model and the recent insights on early containment failure mechanisms (Internal Events)



Summary and Conclusion

- An overview of major contributions to consequence assessment was presented to provide historical perspectives and insights on previous state-of-the-art analyses of the consequences of severe reactor accidents
- It is feasible to use the results and insights from the NUREG-1150 Study and Integrated Risk Assessment for LaSalle, together with more recent advances in understanding of the severe accident issues and containment failure mechanisms, and develop a simplified, yet systematic and defensible, approach to benchmark many aspects of SOARCA