

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Open Session

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, March 8, 2018

Work Order No.: NRC-3581

Pages 1-178

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

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1
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

+ + + + +

651st MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

OPEN SESSION

+ + + + +

THURSDAY

MARCH 8, 2018

+ + + + +

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., Michael
Corradini, Chairman, presiding.

COMMITTEE MEMBERS:

MICHAEL L. CORRADINI, Chairman

PETER RICCARDELLA, Vice Chairman

MATTHEW SUNSERI, Member-at-Large

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

1 MARGARET SZE-TAI Y. CHU, Member
2 VESNA B. DIMITRIJEVIC, Member
3 WALTER L. KIRCHNER, Member
4 JOSE MARCH-LEUBA, Member
5 DANA A. POWERS, Member
6 HAROLD B. RAY , Member
7 JOY L. REMPE, Member
8 GORDON R. SKILLMAN, Member
9 JOHN W. STETKAR, Member

10

11 DESIGNATED FEDERAL OFFICIAL:

12 CHRIS BROWN
13 DEREK WIDMAYER

14

15 ALSO PRESENT:

16 SHAUN ANDERSON, NRR
17 JOSEPH ASHCRAFT, NRO
18 MARCIA CARPENTIER, OGC
19 KEVIN COYNE, NRO
20 AMY CUBBAGE, NRO
21 FAROUK ELTAWILA
22 STANLEY GARDOCKI, NRC RES
23 BRIAN GREEN, NRO
24 ARTHUR KEVIN HELLER, NRR
25 SHANA HELTON, NRR

1 JAZHOON JEONG, KHNP
2 STAN JONES, Framatome
3 REBECCA KARAS, NRC
4 NADIM KHAN, NRR
5 TAE-JIN KIM, KHNP
6 ROBERT KRSEK, DCM
7 OLIVIER LAREYNIE, NRO
8 JOHN LEHNING, NRR
9 CHANG-YANG LI, NRO
10 ATA ISTAR, NRO
11 IMTIAZ MADNI, NRO
12 JAN MAZZA, NRO
13 NICHOLAS MCMURRAY, NRO
14 ANDY OH, KHNP
15 KEVIN QUICK, Framatome
16 SHEILA RAY, NRR
17 JONATHAN ROWLEY, NRR
18 JOHN SEGALA, NRO
19 ROB SISK, Westinghouse
20 DAVE WAGNER, KHNP
21 WILLIAM WARD, NRO
22 CHRIS VAN WERT, NRO
23 ANDREW YESHNIK, NRO
24
25

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

CONTENTS

Introduction 5

Discussion of Reg Guide 1.232 7

Public Comments

 By Jim Kinsey,

 Idaho National Lab 81

Discussion on Bullet Points to go Into the Letter

 Dennis Bley 85

PLUS7 Field Design topical 105

Adjourn 140

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

(8:30 a.m.)

CHAIRMAN CORRADINI: The meeting will come to order. This is the first day of the 651st meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following. Reg Guide 1.232, Guidance for Developing Principle Design Criteria for Non-light Water Reactors. The topical report ANP 1033P, Rev.0. Aurora-B, an evaluation model for boiling water reactors, application to control rod drop accidents. Preparation of ACRS reports and topical report APR 1400-FM-TR-13001-P Rev.1. PLUS7 fuel design for the AP1400.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, or FACA. As such, this meeting is being conducted in accordance with the provisions of FACA. That means that the Committee can only speak through its published letter reports.

We hold meetings to gather information to support our deliberations. Interested parties who wish to provide comments can contact our offices requesting time after the Federal Register Notice describing a meeting is published. That said, we only

NEAL R. GROSS

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

1 -- we set aside ten minutes for extemporaneous
2 comments from members of the public attending or
3 listening to our meetings. Written comments are also
4 welcome.

5 Mr. Derek Widmayer is the designated
6 federal official for the initial portion of the
7 meeting.

8 The ACRS section of the U.S. NRC's public
9 website provides our charter, bylaws, letter reports
10 and full transcripts of all our full and subcommittee
11 meetings including all slides presented at the
12 meetings.

13 We've received no written comments or
14 requests to make oral statements from members of the
15 public regarding today's sessions. There will be a
16 phone Bridge line open. To preclude interruption of
17 the meeting, the phone will be placed in a listen-in
18 mode during the presentations and committee
19 discussions.

20 Also, a transcript of portions of the
21 meeting is being kept. And it is requested that
22 speakers use only the microphones -- use on of the
23 microphones, identify themselves and speak with
24 sufficient clarity and volume so they can be readily
25 heard. Also, please silence your various devices so

NEAL R. GROSS

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

1 that we don't have extraneous noises popping up.

2 With that, I'll turn it over to Dr. Bley,
3 who will lead us through the first discussion of Reg.
4 Guide 1.232.

5 MEMBER BLEY: Thank you, Mr. Chairman.
6 Yes, we're looking forward to this, when we've been at
7 this for a few years with the staff. And now it's
8 nice to have the point -- I guess it's the final draft
9 report in our hands at this time. And we look forward
10 to your presentations. I'll turn it over to John,
11 John Segala.

12 MR. SEGALA: Thank you, Dr. Bley. So we
13 had the subcommittee meeting on February 7th. And I
14 think we had a lot of insightful discussions on Reg
15 Guide 1.232. The staff, after the meeting, got
16 together and worked on addressing the subcommittee's
17 comments. We ended up updating the regulatory guide,
18 and then we provided a copy to staff.

19 So today we plan to go through each one of
20 the comments as we understood them and how we
21 addressed them. And we look forward to hearing from
22 the full committee today. And we are hopeful of
23 getting a clean letter so we can go ahead and issue
24 the regulatory guide as a final guide. With that,
25 I'll turn it over to Jan Mazza.

NEAL R. GROSS

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

1 MS. MAZZA: Thank you, John. So, as John
2 said, I'm going to be presenting the staff's responses
3 to the comments that we received from the ACRS
4 subcommittee meeting. I have members of the team that
5 helped --

6 MEMBER BLEY: Jan, I have to interrupt
7 you.

8 MS. MAZZA: Yes.

9 MEMBER BLEY: You had comments from
10 individual members there. You didn't have any
11 comments from --

12 MS. MAZZA: Oh, okay. I'm sorry.

13 MEMBER BLEY: -- the ACRS.

14 MS. MAZZA: Thank you. Thanks. But
15 anyway, I do have some members of the team, that
16 helped develop the reg guide, here today to help
17 support any discussion or questions. But I'm going to
18 go ahead and present all the slides.

19 So since this is a public meeting, I'm
20 going to go through a little bit of background first
21 and then get into the discussion.

22 So this slide was presented at the
23 subcommittee meeting last month, and it illustrates
24 the work that NRC's doing to prepare for non-light
25 water reactor applications. It also shows that the

NEAL R. GROSS

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

1 non-light water reactor design criteria fit in this
2 framework under Strategy 3, along with the Licensing
3 Modernization Project.

4 This slide shows all the interactions for
5 the non-light water reactor design criteria reg guide
6 to date. So you can we've been before the
7 subcommittee three times, and then this is our second
8 time before the full committee.

9 Here is the recent progress on the
10 non-light water reactor design criteria reg guide. We
11 issued the draft guide in February of 2017 for a 60-
12 day public comment period. We had a public meeting in
13 August of 2017 and then additional public interaction
14 on November 1st, 2017. And then we issued the draft
15 final reg guide ahead of the subcommittee meeting last
16 month.

17 We've also publicized the version that we,
18 the redline version, that we sent out ahead of this
19 meeting to the public as well. That has the comments
20 in the margins and it has a different watermark on it
21 than the one that was published for the February 7th
22 meeting.

23 So during the Future Plans Design
24 subcommittee meeting, we had some comments from
25 individual members. And they're mainly in the area of

NEAL R. GROSS

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

1 Modular High Temperature Gas Reactor Criteria 10,
2 which is a reactor design; design and technology
3 specific criteria of the SFR and MHTGR design
4 criteria, specifically; ARDC 16, which is containment;
5 ARDC 17, which is electric power; and then ARDC 26,
6 which is reactivity control systems.

7 So the next several slides, they're in
8 table format. First column shows which design
9 criteria in the comment it was applicable to. The
10 second column is a summary of the ACRS individual
11 comments. Third column is the discussion and proposed
12 resolution. And then the fourth column provides a
13 reference in the draft reg guide.

14 And you'll note that there's footnotes in
15 Column 3 that correspond to the notes in Column 4.
16 And so these highlight the redline version of the reg
17 guide that I provided to ACRS ahead of this meeting.

18 So, starting with Modular High Temperature
19 Gas Reactor Design Criteria 10, comment that we got
20 was SARRDL should be replaced with SAFDL. SARDDL
21 would be difficult for designers to implement. And
22 SAFDL can be adapted in an MHTGR design using
23 tristructural isotropic fuel.

24 So our response to that is we don't plan
25 to modify MHTGR DC 10 to replace SARRDL with SAFDL.

NEAL R. GROSS

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

1 And we note that the reg guide is flexible and that a
2 designer could apply SAFDL to TRISO fuel if desired.
3 And so the following excerpt from the reg guide
4 demonstrates this flexibility.

5 And it reads, "Applicants may use the reg
6 guide to develop all or part of the principle Design
7 Criteria and are free to choose among the ARDC, SFRDC
8 or MHTGRDC to develop each principle design criteria
9 after considering the underlying safety basis for the
10 criterion, evaluating the rationale for this
11 adaptation described in this reg guide."

12 And this is on Page 12 of the reg guide
13 under intended use of this regulatory guide, Paragraph
14 2.

15 CHAIRMAN CORRADINI: I guess I want to
16 understand what the stuff in bold italics means. So
17 are you saying they are free to choose or they must
18 stick with SAFDL until they justify something
19 different? That's what I'm trying to understand.

20 MEMBER BLEY: SARRDL?

21 MS. MAZZA: SARRDL?

22 CHAIRMAN CORRADINI: Well, our comment I
23 understand. I'm trying to understand your
24 clarification.

25 MEMBER BLEY: The current MHTGR DC10 only

NEAL R. GROSS

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

1 talks about SARRDLs.

2 CHAIRMAN CORRADINI: Correct.

3 MS. MAZZA: So we're saying that an
4 applicant could come in and use --

5 CHAIRMAN CORRADINI: Either.

6 MS. MAZZA: -- whatever. They could
7 develop a new principle design criteria when, in any
8 case, this is a guidance document. So this is an
9 example of how you could adapt the general design
10 criteria from modular high temperature gas reactors.

11 CHAIRMAN CORRADINI: Okay, so --

12 MEMBER REMPE: And I'd like --

13 CHAIRMAN CORRADINI: I'm sorry. Maybe
14 Joy's going the same place I am. I'm just trying to
15 understand, if I'm reading this, what do I take away
16 if I'm coming within, with a gas -- because all of
17 these are divided by coolant. I view this as a
18 coolant dissection.

19 So if I come in with a gas-cooled reactor
20 design, what do I take away? I have an either/or or
21 I have a must?

22 MS. MAZZA: So if you're saying a gas-
23 cooled reactor, not a modular high temperature gas-
24 cooled reactor, so there's different technologies,
25 right. There's the gas-cooled reactor --

NEAL R. GROSS

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

1 CHAIRMAN CORRADINI: Well, that -- you're
2 getting to my next question which is -- just trying to
3 understand.

4 MS. MAZZA: So this is a specific
5 definition for the modular high temperature gas
6 reactor designs --

7 CHAIRMAN CORRADINI: Right.

8 MS. MAZZA: -- which I get into on the
9 next slide, that they have a pretty specific, narrow
10 definition of what they are. And that's --

11 CHAIRMAN CORRADINI: So if I come in with
12 an MHTGR then my --

13 MS. MAZZA: You can start with the --

14 CHAIRMAN CORRADINI: The guidance shows
15 that I can do either?

16 MS. MAZZA: Correct.

17 CHAIRMAN CORRADINI: Okay. I want to make
18 sure that I've got it right because the way in which,
19 at the time of the subcommittee, at least the way I
20 read it, yes, SARRDL is acceptable, but the way I
21 understand this bold italics is it's -- is that
22 somebody coming in with an MHTGR could do either.

23 MS. MAZZA: Correct.

24 CHAIRMAN CORRADINI: Okay.

25 MS. MAZZA: They could start with the

NEAL R. GROSS

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

1 ARDCs and say, I'm not even going to pay attention to
2 the MHTGRDCs. I'm going to start here and come up
3 with my principle design criteria.

4 CHAIRMAN CORRADINI: Fine.

5 MR. SEGALA: So the overarching
6 requirement is that they come in and provide their
7 principle design criteria for their specific design.
8 And so we developed these to provide early designers
9 some idea of where the -- what the staff might find
10 acceptable for that technology.

11 But we also -- I guess there -- we have
12 designs out there that have molten salt with solid
13 fuel, molten salt with liquid fuel. There's all sorts
14 of different combinations of designs out there. So we
15 tried to pick some categories and give people an idea
16 of where the staff -- what the staff would find as
17 acceptable.

18 And then they have to come in and look at
19 that and say, well, you know, that particular one is
20 not really applicable to my design. So I got to pick
21 maybe one of the other ones or I need to come up with
22 my own principle design criteria in that area.

23 And then they need to provide
24 justification in their application of why that's the
25 appropriate principle design criteria for their

NEAL R. GROSS

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

1 design.

2 MEMBER REMPE: And the MHTGR, even though
3 it has a lot of design information, does apply to both
4 the prismatic and the pebble bed fuel. Right?

5 MR. SEGALA: Yes.

6 MEMBER REMPE: And if I'm a pebble bed
7 person, I would rather, I think, have a SARRDL
8 requirement than a SAFDL requirement because that
9 would force me to try and figure out the time and
10 temperature that that pebble -- the TRISO fuel in the
11 pebble -- had accumulated.

12 And so it's not easy. So that's why I
13 tried to counter the point that was being raised by
14 Walt, that he's got in his mind it's a prismatic
15 design, and it's not necessarily that.

16 VICE CHAIR RICCARDELLA: Isn't it fair to
17 say that SAFDL is one way to meet SARRDL, but you
18 could still violate SAFDL and meet SARRDL if you have
19 other ways to prevent reactivity release, right?

20 MS. MAZZA: Correct. I have Jeff Schmidt
21 back there nodding his head yes. So maybe I'll let
22 him speak, so.

23 MR. SCHMIDT: This is Jeff Schmidt from
24 Reactor Systems. And the answer is yes, that, you
25 know, the SAFDL is really to have an upset condition

NEAL R. GROSS

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

1 cause no additional fuel failures -- which the SAFDL
2 is more restrictive than, potentially, the SARRDL.
3 So, yes.

4 MEMBER REMPE: Unless there's some lift-
5 off involved. And if I may just -- it depends.

6 CHAIRMAN CORRADINI: So let me go back to
7 my other question, which is, what are the
8 characteristics that make something MHTGR?

9 MS. MAZZA: So I have that on the next
10 slide.

11 CHAIRMAN CORRADINI: Okay.

12 MS. MAZZA: So here we have, in two areas
13 in the reg guide where MHTGR is actually defined. And
14 that's really why the -- that's -- the MHTGR design
15 criteria illustrated method that the designer could
16 use for this specific design type.

17 And the definition of modular high
18 temperature gas reactor is the category of HTGRs that
19 use the inherent high-temperature characteristics of
20 tristructural isotropic coated fuel particles,
21 graphite moderator and helium coolant as well as HACCP
22 heat removal from a low-powered density core with a
23 relatively large diameter ratio with an uninsulated
24 steel reactor vessel.

25 The second sentence here was part of the

NEAL R. GROSS

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

1 DOE report. I didn't originally have this as part of
2 the definition in the reg guide. But we've since
3 included it. And that is the MHTGR is designed in
4 such a way to ensure that, during design basis events,
5 including loss of force cooling or loss of helium
6 pressure conditions, radionuclides are retained at
7 their source, in the fuel and regulatory requirements
8 for off-site dose are met at the exclusionary
9 boundary.

10 So that definition's located in two places
11 in the reg guide -- once on Page 11, under the Key
12 Assumptions and Clarifications and then, again, in
13 Appendix C, in the introduction of modular high
14 temperature gas-cooled reactor design criteria.

15 MEMBER MARCH-LEUBA: So, again, is that
16 the statement from the staff? And does that become --
17 like when the Pope speaks of something that that is an
18 unimpeachable truth?

19 MS. MAZZA: What --

20 MEMBER MARCH-LEUBA: The fact that the
21 MHTGR are designed so that no radioactivity will come
22 out?

23 MS. MAZZA: That's how it's designed, yes.
24 That's the definition.

25 MEMBER MARCH-LEUBA: By definition, not by

NEAL R. GROSS

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

1 analysis or by demonstration?

2 MS. MAZZA: No, again -- go ahead, Joe.

3 MR. SCHMIDT: So when I was considering
4 the SARDL concept for the modular high temperature gas
5 reactor, the concept -- and we talked about this, I
6 think, in our last, the subcommittee meeting, was that
7 there are, for these designs, they're designed in such
8 a way that they have large margins to the failure
9 points, like the catastrophic failure points similar
10 to like the NDR.

11 So there was some discussion in the
12 subcommittee that, yes, you've assumed a certain kind
13 of class of designs for the modular high temperature
14 gas reactors. And our response was, yes, that's true.

15 MEMBER MARCH-LEUBA: So what you're saying
16 is that the TRISO particulars have a lot of margin to
17 the SAFDLs?

18 MR. SCHMIDT: To their effectively -- yes.
19 Yes.

20 CHAIRMAN CORRADINI: So, but, Jeff, then
21 --

22 MEMBER MARCH-LEUBA: By definition, right?

23 CHAIRMAN CORRADINI: But if I might --

24 MR. SCHMIDT: By the design of the plant.

25 CHAIRMAN CORRADINI: So because of that

NEAL R. GROSS

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

1 large margin -- I'm still struggling. I know where
2 you're going with this, but I'm still not sure the
3 words express it. If there's a large margin, then
4 you're allowing a subsequent barrier to be different,
5 not eliminated, but different.

6 MR. SCHMIDT: It has, yes, I mean, you'd
7 have to look at the multiple barrier strategy to see
8 how you're going to weight each barrier.

9 MEMBER KIRCHNER: So, I mean, really, this
10 is an exception so they can deal with blowing down a
11 primary system. It's a high pressure helium system.
12 The building to contain that helium can be very
13 expensive, very large.

14 So, therefore, they want to keep the
15 coolant inventory and lift off and et cetera to an
16 acceptable level so that when the system blows down in
17 a design basis accident, it doesn't exceed the off-
18 site limits.

19 CHAIRMAN CORRADINI: Okay, which is --
20 thanks. That's what I was guessing. But now let's
21 just think this through. Currently, in current light-
22 water reactors, the source term methodology is
23 disconnected from the design basis event.

24 I've got a light-water reactor that
25 undergoes a LOCA, but I pick a source term that

NEAL R. GROSS

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

1 wouldn't be generated by a LOCA for a diversity plan.
2 So this is being not considered here?

3 MR. SCHMIDT: I'm not sure I'm the guy to
4 answer that question. I think you have to -- you have
5 to --

6 CHAIRMAN CORRADINI: Well, maybe I'm wrong.
7 I'm looking at Dana to speak up so I don't
8 misunderstand. But that's my understanding of the
9 current practice.

10 MEMBER POWERS: The presumption is that,
11 again, it doesn't lift anything off, which is
12 nonsense. I mean, we -- these things are dusty as all
13 get out and there's an accumulation of radionuclides
14 in the peripheries of a block.

15 So when you do a blow-down, you're going
16 to get a dose out at your site boundary. There's just
17 no way to avoid it. I mean, they can plead all they
18 want to. We know, absolutely, that's true.

19 You can't avoid it because when the --
20 when things heat up, they rub together. And that
21 rubbing together creates dust.

22 MR. SCHMIDT: I'd just to like add, I
23 mean, the whole concept of why Jan brought this in
24 here was there was a concern that, when we developed
25 the list of these MHTGR design criteria, what if

NEAL R. GROSS

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

1 another design came in that was different than the set
2 of designs that were considered when we developed
3 these?

4 So the idea here was we were trying to
5 paint sort of a box of these design criteria that
6 would be applicable to a design that fits that --

7 MEMBER MARCH-LEUBA: Right. The problem
8 I have with the blue underlined sentence in the middle
9 column, I'm reading that as the NRC staff certifies
10 that all MHTGR designs do this. That's the way I read
11 that sentence.

12 MR. SCHMIDT: Well, I think what we're
13 trying -- yes.

14 MEMBER MARCH-LEUBA: It should really say
15 -- obviously, it's a mass redesign in such a way. I
16 mean, this is a design criteria. The way I read this,
17 is you certify that they're good, no matter what they
18 come up with the design.

19 MR. SCHMIDT: I think what we're saying is
20 if your design meets this, then you could choose to
21 use these design criteria.

22 CHAIRMAN CORRADINI: Okay. So can I go
23 back to what Dana said? Because that's the crux of
24 it. So, therefore, if somebody chooses this criteria,
25 they're going to have to show, based on either

NEAL R. GROSS

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

1 experiment or combination experiment and analysis that
2 the residual radioactivity during operation will not
3 be released during a DBE -- somehow.

4 MEMER POWERS: And the fundamental
5 difficulty --

6 MR. SCHMIDT: Yes. This is Jeff Schmidt
7 from Reactor Systems. Yes, they're going to have to
8 have some type of transport model to show where the
9 fission products go.

10 MEMBER REMPE: So it isn't really they
11 won't be released. It's that the release will still
12 allow them to meet the dose limits. That's different.
13 I mean, they can release something. They just have to
14 meet the dose limits, right.

15 MEMBER POWERS: And the problem, the
16 conceptual problem that comes up in these analyses is
17 people think that it's just flow that causes this
18 resuspension. No, it is both. It's synergistic
19 effect between flow and vibration and shock to the
20 substrate.

21 And we have absolutely no experimental
22 data to show how much resuspension we get in those
23 situations. We have some experiments in the
24 laboratory, at small scales, that say, yes, there's
25 synergism between them.

NEAL R. GROSS

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

1 There is no mechanism in place by either
2 the licensee or the regulator to evaluate the effect,
3 the synergistic effect between flow and vibration and
4 shock to the substrate.

5 MEMBER REMPE: Does that comment include
6 the comity test? I don't know, but they did some
7 comity tests and --

8 MEMBER POWERS: Nothing -- there is
9 nothing out there.

10 MEMBER REMPE: -- but they're fairly
11 larger scale.

12 MEMBER POWERS: There is nothing out there
13 that --

14 MEMBER REMPE: Okay.

15 MEMBER POWERS: The only thing that I know
16 of that's even vaguely applicable is Corn's work in
17 making 54. And any woman using a rug beater on a
18 windy day to get dust out of the carpet. I've never
19 seen a man do it.

20 (Laughter)

21 I have never seen a man do it.

22 MEMBER REMPE: I'll bet you could learn if
23 you tried, when you retire.

24 MEMBER POWERS: You can't teach old dogs
25 new tricks.

NEAL R. GROSS

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

1 MEMBER KIRCHNER: Well, a buried
2 assumption in this, too, is extremely high quality
3 fuel. And the only way you're going to know that is
4 when you make it. And notwithstanding all the Oak
5 Ridge tests, fine. That's not production fuel. It's
6 small batch fuel. It's not the same as going to a
7 large batch operation.

8 And there, you know, you will get defects.
9 So there's a buried assumption in here of a fuel
10 quality that's yet to be determined. And I am
11 appreciative of the pebble bed concept. I know how it
12 works. Yes, it's just much difficult when you move
13 fuel, in any way, to know what you've got.

14 MEMBER REMPE: What about when you say
15 large batch? Are you including the PNW fuel produced,
16 the PNW-produced fuel?

17 MEMBER KIRCHNER: It's still not at the
18 amounts that you'll need to load one of these
19 reactors. And that's all critical in this concept.
20 That is -- and it's difficult.

21 The Germans made very good fuel. A lot of
22 the quality assurance and control processes that they
23 used at NewChem have been adapted by PNW. But it's
24 still the challenge, and the applicant is going to
25 have to come before the Commission and demonstrate

NEAL R. GROSS

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

1 that the fuel is of that high quality.

2 And then you're going to operate and see
3 what you get. Someone said you get some interesting
4 things as the blocks or the pebbles move through the
5 system in terms of dust or other --

6 MEMBER POWERS: And we get protestations
7 all the time of what's going to happen in these
8 reactors that just aren't borne up as soon as we take
9 one apart.

10 The fundamental problem is that the TRISO
11 fuel is a dynamic fuel that cannot be cured by driving
12 it to an equilibrium state because driving it to
13 equilibrium destroys it.

14 And so small changes in operational
15 condition or feed stock make big changes in the
16 stability of the fuel. Germans made good fuel as long
17 as the particular individual involved in plotting
18 didn't go on vacation. As soon as he went on
19 vacation, things fell apart.

20 That's just how sensitive any kind of
21 dynamic restructuring fuel is. And, as Walt says, you
22 don't really know until you put it in the reactor.

23 MS. MAZZA: Okay to move on to the next
24 slide?

25 CHAIRMAN CORRADINI: That being another

NEAL R. GROSS

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

1 controversial one, we'll move on to the next one.

2 MS. MAZZA: Okay. So the next two slides
3 deal with a comment from the subcommittee, being that
4 these design criteria are highly -- that SFR design
5 criteria and MHTGR design criteria are highly design-
6 specific and they may cause confusion for designers
7 with similar technology but not the same design
8 features.

9 So we agree that the reg guide needs
10 clarification regarding the design-specific features
11 of the SFR and MHTGR design criteria. And we added a
12 footnote in three places.

13 And the footnote reads, "The technology-
14 specific design criteria were developed using
15 available design information, previous NRC application
16 reviews of the design types and more recent industry
17 DOE National Laboratory initiatives in these
18 technology areas.

19 See Reference 17, which is the DOE
20 Report. And it is the responsibility of the designer
21 or the applicant to provide and justify the design
22 criteria for a specific design."

23 And so those footnotes are located in
24 three places in current draft of the reg guide. One's
25 on Page 9, which is Footnote Number 3. And then in

NEAL R. GROSS

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

1 the beginning of Section B -- or Appendix B, which is
2 the SFR design criteria and then again in Appendix C,
3 which is the MHTGR design criteria.

4 And then on the next slide, if we follow
5 along with it, we know that the maturity of the SFR
6 and MHTGR designs is discussed in the reg guide on
7 Page 11, Bullet 9. There's a section titled "Key
8 Assumptions and Clarifications Regarding the Non-light
9 Water Reactor Design Criteria."

10 And this reads, "The SFRDC and MHGTRDC
11 were developed because the designs were mature and the
12 design features diverse for these technologies.
13 Additional sets of technology-specific design
14 criteria, for example, MSRs or LFRs, may be developed
15 in the future as more information about the designs
16 become available."

17 So this reinforces the concept that the
18 SFR and MHTGR were developed from mature designs.
19 Also notes the design criteria for other technologies
20 may be developed in the future.

21 MEMBER REMPE: So, Jan, this is a little
22 off topic, but I've gone to several of these meetings
23 over the last couple of years and I know that you are
24 requiring or encouraging some of the 80-plus
25 developers to have a regulatory implementation plan,

NEAL R. GROSS

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

1 which I think's a great idea.

2 But I'm still thinking that there are
3 limited resources. And if one's to try and make
4 progress, that the fact that you can have much more
5 informed design criteria that can help someone if they
6 have a mature design.

7 And even with the mature designs, there
8 were some areas where you guys would respond to
9 comments saying, well, we need more design information
10 before we can answer your question.

11 And I'm thinking that -- I know, like way
12 back in your earlier slide, there's like a Strategy 3.
13 And at first you guys used to say, oh, we're going to
14 do highly prioritized design. You know, I used to ask
15 you about, well, how do you prioritize?

16 And that word went away. The meeting had
17 non-functional containments by that time. And I'm
18 thinking that, not only having a regulatory
19 implementation plan but some sort of a mature design
20 should enable a developer to have more attention from
21 the regulator.

22 And you can have, quantify a mature design
23 by a certain technology-readiness. Those things are
24 well stated in the literature. And that might help
25 you make more progress. And, I mean, do you have any

NEAL R. GROSS

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

1 thoughts about that?

2 I mean, with some guidance from the
3 regulator to the 80-plus applicants with their
4 different designs that are difficult to try and
5 accommodate -- and it doesn't mean you'll ignore them,
6 but you're going to give more priority if they have
7 more information to make it worth your attention.

8 And would some guidance like that be a
9 good idea?

10 MS. MAZZA: Well, we do publicize a RIS
11 that do publish every year and encourage people to
12 respond to, which gives us an indication of how mature
13 or how far along somebody is in their design process.
14 And it also helps us with budgeting.

15 So that -- so providing a RIS response
16 actually triggers us to say, okay, these people are
17 mature enough, they have enough going on that we're
18 going to budget them in the next couple years for a
19 review. So that's sort of how we get our priorities.

20 MEMBER REMPE: So they respond with
21 something that says, okay, I have now a technology-
22 readiness level of 7 and I'm planning to submit my
23 regulatory implementation plan and this design for you
24 to review. And then you give them --

25 MS. MAZZA: And then there's a set of

NEAL R. GROSS

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

1 questions they have to answer.

2 MEMBER REMPE: -- more attention, which,
3 really, is I wouldn't even say attention, but, I mean,
4 they do get more --

5 MS. MAZZA: Budget for them.

6 MEMBER REMPE: Yes.

7 MS. MAZZA: When we get to that point with
8 them.

9 MEMBER REMPE: Okay.

10 MS. CUBBAGE: This is Amy Cubbage. I'd
11 just like to say a few words. First of all, there's
12 a lot of noise out there in the press about the
13 numbers, and there's a lot of different companies out
14 there designing. There's really only a handful that
15 have talked to us. There's only one we're actively
16 engaged with.

17 So at this point, it's not that type of
18 concern or being distracted by that many applicants.
19 And as Jan said, the regulatory issue summary, RIS,
20 that we put out, when we get responses to that,
21 they're indicating when they plan to submit
22 applications, who they're partnering with, as much
23 detail as they can about their plans.

24 And then when we have drop-in meetings, we
25 do have extensive discussions with these developers.

NEAL R. GROSS

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

1 They're telling us, okay, now we're in the conceptual
2 design phase and we expect to end by X date. And
3 principle design criteria are one of the things we
4 talk about in all these drop-in meetings. That would
5 be a good thing for people to talk to us early about
6 how they intend to use or adapt the ARDC reg guide to
7 meet the specifics of their design.

8 MEMBER REMPE: So if I could paraphrase
9 your response, because even though there's a lot of
10 noise out there about all the different designers and
11 they may be on the Hill talking to congressmen and to
12 DOE, the one's -- there's only a handful that have
13 actually come to the regulatory?

14 MS. CUBBAGE: Exactly.

15 MEMBER REMPE: That's interesting. Maybe
16 that'll be something that DOE needs to prioritize.
17 But anyway, thank you.

18 MS. CUBBAGE: Yes.

19 MEMBER RAY: Well, let me make a comment
20 here. This may be a little aligned with what Joy
21 said, but maybe not. I just would ask the question,
22 the change to put the emphasis on the quality of the
23 fuel, the discussion that Walt and Dana had, it seems
24 like a profound part of what's happening here.

25 Is that clear? In other words, is the

NEAL R. GROSS

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

1 assumption that the ultimate licensing of the plant,
2 based on a design assumption that has to be
3 demonstrated, is that clear enough, you think, so that
4 the people that we're talking about out there are
5 aware that that's a huge, huge hurdle that's crucial
6 to what's going on here? Or is it just something that
7 we all know and they'll find out about it later?

8 MS. MAZZA: We do have a lot of
9 interaction with stakeholders. We have a stakeholder
10 meeting every six weeks. And we talk about a lot of
11 these issues and what --

12 MEMBER RAY: Well, I'm more interested in
13 how explicit it is in the material that we're dealing
14 with here now, the reg guide, basically. I know it
15 seems like, well, maybe it's obvious to all of us.
16 And yet, Joy was talking about people on the Hill.

17 These are the kind of things that, later
18 on, come in for a lot of criticism of the regulatory
19 process because it's something that's a big challenge,
20 ultimately, to demonstrate that you can rely on that
21 assumption in licensing and operating a plant and what
22 it takes to demonstrate that. And yet, it's never
23 made clear up front that that's going to be the case.
24 It's assumed that the design is what is what the
25 developers assume.

NEAL R. GROSS

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

1 But it's not clear what's required to
2 demonstrate that assumption as valid. And I just make
3 that comment because I don't know that that comes
4 through from just discussions as opposed to being
5 explicit.

6 MS. MAZZA: So in the front matter of the
7 reg guide we do talk about the role of the principle
8 design criteria and what the importance of them and
9 that it's, the designer also has to meet other
10 requirements. So I think we're pretty clear about
11 that.

12 Now this is a reg guide. It's guidance.
13 I don't know if it's the place to discuss all of the
14 regulatory requirements for something, for a design.

15 MEMBER RAY: Well, I hadn't thought about
16 it before, but when you say specified acceptable fuel
17 design limits, for example, design limits can, but
18 don't necessarily do include quality requirements that
19 are demonstrated to exist.

20 And I'll shut up now, but it seems to me
21 like a real important issue that if people, this
22 audience of people that are looking at the process
23 that we're talking about going forward with here now,
24 this embedded assumption needs to somehow be clear
25 enough.

NEAL R. GROSS

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

1 And I'm just not sure I'm confident in the
2 dialogues that take place making that clear as opposed
3 to making it clear that design limits include
4 demonstrating quality. It seems obvious to all of us
5 who have been involved with this as long as we have
6 that that would be the case. But it's not going to be
7 easy.

8 CHAIRMAN CORRADINI: Can I ask Harold's
9 question a different way? Early in the light-water
10 reactor development business, the fuel quality would
11 have to be part of it too. So in some sense, a
12 defense in-depth barrier just in case was part of the
13 thinking, at least I thought, unless I misunderstand.
14 So, I mean --

15 MEMBER RAY: No, but my -- just to
16 interrupt you, I think this is much more significant
17 than light-water reactors, the one barrier that the
18 fuel --

19 CHAIRMAN CORRADINI: Sure, but, if I
20 might, it's -- it is significant because, at least the
21 way some people are thinking of satisfying it, they
22 remove a barrier. But if they didn't remove a
23 barrier, it's historically similar. Would it not be?

24 MEMBER RAY: Well, I don't think so. And
25 I don't think so just in the sense that -- well, let

NEAL R. GROSS

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

1 me not go any further. I --

2 CHAIRMAN CORRADINI: That's fine.

3 MEMBER RAY: It seems to me like we're
4 pulling the barriers down to a point that has to be
5 shown that they're met at the fuel.

6 CHAIRMAN CORRADINI: I mean, so here's
7 where I'm coming from -- personal opinion. I don't
8 have a problem with lack of a leak-tight containment
9 as long as I had some sort of barrier, confinement,
10 something where I can monitor release so that I know,
11 given a design basis event, I can accept -- and I'll
12 just say it this way -- a somewhat unrealistic release
13 and still show I have a margin.

14 And I think that's where Harold's coming
15 from, which is there's a potential lack of a barrier
16 or a different barrier that everything is relied upon
17 in the fuels. That's --

18 MEMBER RAY: Yes, or you can bring the
19 boundary in much closer because that's one of -- the
20 sighting is a major issue here or benefit of the --

21 MEMBER KIRCHNER: Which was done, for the
22 record, for Fort Saint Vrain which use TRISO fuel.
23 And they were able to use five miles instead of ten
24 miles for the --

25 MEMBER RAY: Yes. Or -- so all I'm saying

NEAL R. GROSS

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

1 -- and, Mike, I think you are reinforcing what I said,
2 but the point is that I just want it to be clear to
3 people, up front, that this is not something you just
4 assume and proceed but has got to somehow be shown to
5 be met.

6 Just as you pressurize a containment in a
7 light-water periodically and demonstrate that it will
8 -- its leakage is limited to a certain amount, there
9 has to be some way of saying, on the fourth fuel cycle
10 at a plant that, yes, we still have a barrier
11 integrity that we assumed in the design, even though
12 the guy went on vacation, as Walt said.

13 MR. SCHMIDT: And I would just add, I
14 mean, Jan mentioned -- I mean, we're talking about
15 what's in the reg guide versus more generically, but
16 we are interacting with industry . There's currently
17 EPRI is working on providing us some sort of fuel
18 quality topical report that they want to submit in
19 terms of TRISO fuel and stuff.

20 So we're interacting with industry. I
21 think it's understood that the quality of the fuel --
22 manufacturing and all that stuff is very important for
23 TRISO fuel. And it is something that we've been
24 discussing, so --

25 MEMBER RAY: I just would like to find a

NEAL R. GROSS

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

1 way to mention it explicitly, that's all.

2 MS. MAZZA: It is mentioned in the
3 rationale for Number 16 for functional containment,
4 and it's part of the NGNP reference, so.

5 MEMBER KIRCHNER: Not to -- just to
6 emphasize what Harold's saying, if you look at the
7 very slight change in wording, from your ARDC to the
8 MHTGR, it says -- it leads off with the reactor core.
9 That's the ARDC.

10 In the MHTGR Criterion 10, it says the
11 reactor system. And that almost doesn't explicitly
12 say fuel. Or it doesn't imply that -- or maybe it
13 does imply that.

14 MEMBER BLEY: As I interpreted that, and
15 I think we talked about the reason they pushed that
16 way was because their view of the practical way to
17 keep track of this was to track the radioactivity in
18 the system and bring it out --

19 MEMBER BLEY: Oh, you will. But you do
20 that in other LWRs too. That's how you tell you have
21 leakers. And if you have leakers here or if you get
22 a bad batch of TRISO fuel, it will show up pretty
23 quickly. Unfortunately, that's when you'll know you
24 have bad fuel. You go right -- yes.

25 MEMBER POWERS: And the challenge is --

NEAL R. GROSS

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

1 MEMBER RAY: And it could be plated out
2 more.

3 MEMBER POWERS: The challenge is it's much
4 harder to extract a leaker in an MHTGR than it is in
5 a PWR.

6 MEMBER BLEY: Yes.

7 MR. SCHMIDT: This is Jeff Schmidt from
8 Reactor Systems. I purposely changed the word in the
9 modular high temperature gas reactor II system to
10 denote that, you know, there fission products that
11 remain in the system and can remain in the system for
12 a long period of time and then be released during a
13 design basis event.

14 So I didn't want to focus just on the fuel
15 because that is only a potential component of it. But
16 I purposely changed that word for system for that
17 reason.

18 MEMBER KIRCHNER: So, well, personally,
19 and this is just myself, and I held forth too long at
20 the subcommittee on this, when you actually design
21 this and achieve those attributes that you described
22 in previous slides, you will do the analysis. It'll
23 be the fuel, and you will specifically go through all
24 the analyses that are necessary to show that time and
25 temperature, that you don't go into a breakdown

NEAL R. GROSS

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

1 threshold, cross that threshold where you get
2 significant release. So it just strikes me that, yes,
3 it's a system that you're looking at for the
4 circulating inventory. But it all starts with the
5 fuel.

6 And it just is, as Harold was indicating,
7 it's not so obvious. It's accepted. We all say it's
8 TRISO fuel. It's going to be great and, therefore, we
9 just say, well, we'll worry about how it performs in
10 the system.

11 MEMBER BLEY: I guess, of course, it
12 starts there. But the thing we haven't seen in LWRs
13 is the potential for a large release from plated out
14 material that can rival the release from the fuel.
15 And that's why it seems to make sense to me to focus
16 on the system. Because that's a different
17 characteristic than we're used to.

18 MEMBER KIRCHNER: Yes, because they have
19 vented confinement to accommodate a design basis
20 event. So, yes, a major break for the helium system.
21 And then you'll get the ensuing lift-off. No, I agree
22 with you, again, but it's the attribute of the system,
23 I guess, or the reactor.

24 MEMBER BROWN: When we talked about this
25 in the subcommittee meeting, I guess I made an

NEAL R. GROSS

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

1 observation. I don't know whether I made it. I think
2 I did, anyway, that if you look at the SFR design
3 criteria that are proposed, there is a paragraph
4 talking about the containment leakage shall be
5 restrained.

6 MS. MAZZA: We haven't gotten on to this
7 containment slide yet. I haven't --

8 MEMBER BROWN: But you were talking about
9 ARDC 16.

10 MS. MAZZA: No, I haven't started talking
11 about that. I'm just --

12 MEMBER BROWN: Oh, is that -- we're still
13 on the last slide?

14 MS. MAZZA: I ready to. We're still on
15 the last slide.

16 MEMBER BROWN: Okay, I will put some time.
17 I will wait. I apologize for that. Flip it back so
18 I can continue to read. Or it gives you -- it's a
19 preview of coming attractions.

20 MS. MAZZA: So I just wanted to mention
21 for Harold, in the rationale to MHTGRDC 16, we talk
22 about the NGNP project and we actually in there say,
23 "approval of the proposed approach to functional
24 containment for the MHTGR concept, with its emphasis
25 on passive safety features and radionuclide retention

NEAL R. GROSS

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

1 within the fuel over a broad spectrum of off-normal
2 conditions would necessitate that the required fuel
3 particle performance capabilities be demonstrated with
4 a high degree of certainty."

5 And that's right out of the NGNP
6 documentation for the NGNP project.

7 MEMBER RAY: Yes, that's responsive. I
8 just hope that it's understood.

9 MS. MAZZA: Okay.

10 MEMBER RAY: Because it's going to be
11 difficult and expensive.

12 MS. MAZZA: Okay, so move on to ARDC 16?
13 Okay so here the comment was, clarify how the
14 essentially leak-tight requirement would apply to non-
15 light water reactors. Include a reference to Appendix
16 J. Include the reference to off-site dose limits in
17 50.34, similar to SFRDC 16.

18 So in response to this, we added a
19 sentence to the rationale of ARDC 16 to clarify the
20 performance of the leak-tight barrier. The sentence
21 reads, "The assumed degree of leak-tightness for a
22 containment is used within the safety analysis and
23 plant performance requirements to confirm onsite and
24 off-site doses are below limits as specified in 10 CFR
25 50.34.

NEAL R. GROSS

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

1 We didn't include a reference to Appendix
2 J because it's specific to light-water reactors. And
3 we also noted that this criterion could be -- may be
4 modified to incorporate the Commission's decision on
5 the functional containment performance criteria for
6 non-light water reactor design's SECU paper.

7 MEMBER BLEY: Jan?

8 MS. MAZZA: Yes.

9 MEMBER BLEY: In our letter from a year
10 ago, on the draft of these criteria, one of our
11 recommendations was that staff should consider making
12 a number of design criteria more explicit, as
13 described in that letter itself.

14 And you addressed almost all of those, but
15 there was one on ADR -- I'm sorry, ARDC 16 that asked
16 DSFAR to define essentially leak-tight a little
17 better, which I think you've done. But also we
18 suggested examination for the possibility of reactor
19 pressure boundary failure to induce containment
20 failure should be included explicitly. Did you think
21 about that?

22 MS. MAZZA: Yes, we did. And I do have
23 Imtiaz Madni and I think he's here. We had some
24 discussions on this and I think I'll let him, since
25 he's the expert --

NEAL R. GROSS

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

1 MEMBER RAY: Okay, I'd just like to hear
2 how that turned out and what drove you --

3 MS. MAZZA: Okay.

4 MEMBER RAY: -- not to do that.

5 MR. MADNI: Well, this is Imtiaz Madni.
6 I think the ACRS subcommittee meeting of 2017, I think
7 it was Dana Powers who brought up this point that if
8 you have a failure of the helium and the pressure
9 boundary, it could lead to containment failure. And
10 so we took two or three different interpretations of
11 that.

12 One of them is that it applies to the
13 MHTGR, in which case it would be the helium pressure
14 boundary. And so we talked about that in the February
15 meeting this year, that the reactor building vents
16 that allow for release or the emission of which
17 pressurizes the reactor building. And then it closes.

18 And then thereafter the pressure build-up
19 is not that high, but then you can have more paid-out,
20 more stuff coming out from the fuel which would really
21 change. Initially, the pressure build-up is with very
22 little, already localized because this is the initial
23 part.

24 So that was the interpretation for the
25 MHTGR. And if it's for the SFR, for example, in that

NEAL R. GROSS

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

1 case, definitely, that's important. But you could
2 have maybe a natural, maybe disaster, for example,
3 earthquake or something that causes a break in the
4 primary system. And that could pressurize the
5 containment.

6 So that's one of the reasons why we have
7 -- we have mentioned in the design criteria somewhere
8 that there should be -- we should be careful not to
9 have common cause failure. For example, if you have
10 the guard vessel surrounding the containment -- sorry,
11 surrounding the reactor vessel which, for the pool
12 type includes everything, including the IHS.

13 So if the guard vessel is -- I think it
14 had containment then, it has to have a different,
15 maybe a support system from the reactor vessel because
16 if the support system is the same, then if one fails,
17 maybe the other one will also fail. So we have
18 addressed these in our rationale. And --

19 MEMBER BLEY: You know, to me, avoiding
20 common cause failure is a great goal, but it's so
21 general and broad, it doesn't put any spotlight on
22 particular issues. So the first one you talked about
23 requires that the active system to work to protect the
24 containment.

25 The second one kind of hinges on making

1 the link with common cause failure. And it just seems
2 -- well, it's just not explicit, as we had suggested
3 and that did come from Dana originally.

4 MR. MADNI: And the other thing is that --

5 MEMBER BLEY: So it doesn't seem like
6 you're quite there and the rationale isn't written
7 down, that I've seen. So it's still a little gap for
8 me. We'll talk about that some when there's some more
9 --

10 MEMBER KIRCHNER: Yes, specifically, if
11 you go through that scenario, then it requires, as we
12 discussed in the subcommittee, that whatever vent
13 design they use, whether it's roll-out dampers,
14 panels, through water or whatever, would then,
15 subsequent to that event, remain intact to control
16 subsequent release. And I -- Jan, I didn't find that
17 in the HTGR rationale.

18 MS. MAZZA: I'm sorry. I was looking at
19 something else.

20 MEMBER KIRCHNER: If you go through a
21 blow-down of the helium system, and that's vented,
22 subsequent to that, then that design implies that the
23 confinement would remain intact such that you could
24 control releases below the 10 CFR 50.34 requirements.
25 Although you don't explicitly ask that of the HTGR.

NEAL R. GROSS

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

1 You seem to ask that of the SFR.

2 MS. MAZZA: So we have the additional
3 MHTGRDCs 70 through 72. We discuss the structural
4 integrity of the reactor building.

5 (Simultaneous speaking)

6 MR. MADNI: Did you say 72?

7 MS. MAZZA: 70 through 72.

8 MEMBER KIRCHNER: See, even in your note
9 there, you explicitly say, in 71, it's noted that the
10 reactor building is not relied upon to meet the off-
11 site dose requirements. That's 50.34.

12 You're assuming a lot there because, if
13 subsequent to the blow-down, you have unimpeded air
14 access to the primary system or other --

15 MS. MAZZA: So if you read the rationale
16 there, the reactor building functions are to protect
17 and maintain passive cooling geometry and provide a
18 pathway for the release of helium from the building in
19 case of a line break in the reactor-helium pressure
20 boundary.

21 MEMBER KIRCHNER: No, I understand that.
22 But after it's done the job, you want it to seal. You
23 see where I'm going? Subsequent to the blow-down
24 event, then you don't want unimpeded access of air
25 into the building nor do you want a wide open,

NEAL R. GROSS

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

1 essentially no barrier to the outside either.

2 MS. MAZZA: Can I ask someone from the DOE
3 Labs that are on the phone to speak to that, just to
4 make sure that we're not missing something? They're
5 on the separate line -- maybe Dave Alberstein or --

6 MEMBER RAY: But their line may not be
7 open.

8 MS. MAZZA: Okay.

9 MEMBER RAY: They might be mute.

10 MEMBER REMPE: While we're waiting for
11 that, though, isn't the question is what is safe
12 enough? In the old days, when we used analysis for
13 cool-downs, yes, there's a release, but what's the
14 frequency of it and will it meet the dose
15 requirements? And they used to use paths.

16 So, yes, you're right. It comes out, but
17 you can't bring up stuff. How safe is safe enough and
18 the benefit of the container, but it's better to let
19 Dave Albertstein or someone answer it than me, but I
20 think that's the philosophy on why they filed it.

21 MEMBER KIRCHNER: Well, the --

22 MEMBER REMPE: In the air ingress
23 accident, the same thing. They allowed it, but how
24 safe is safe enough?

25 MS. MAZZA: So do we have Dave on the

NEAL R. GROSS

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

1 phone?

2 MR. ALBERTSEIN: If the line's open, I'm
3 here and you should be able to hear me.

4 MS. MAZZA: Okay, we can hear you.

5 MEMBER KIRCHNER: Loud and clear.

6 MS. MAZZA: Did you hear the question?

7 MR. ALBERTSEIN: Yes, I heard it.

8 MS. MAZZA: Okay.

9 MR. ALBERTSEIN: Post blow-down, no credit
10 needs to be taken for the reactor building as a
11 radionuclide retention barrier to meet the off-site
12 dose requirement -- so 50.34, et cetera.

13 Now with regard to air ingress, these
14 buildings are typically designed with a leak rate of
15 about a hundred percent per day. And so with regard
16 to air ingress, they do not provide any significant
17 restriction to the amount of air that can get into the
18 system.

19 MEMBER MARCH-LEUBA: So who provides the
20 restriction for the oxygen to get close to the
21 graphite? And we maybe are getting too much into the
22 design of a particular reactor instead of the design
23 criteria, but which is my --

24 MR. ALBERTSEIN: Yes, that's right, you
25 are.

1 MEMBER MARCH-LEUBA: Yes. It is not my
2 primary concern that these design criteria are so
3 design-specific as to almost being useless. And there
4 should be high level safety goals that, when you
5 design your reactor, you must satisfy. They should
6 not assume what the reactor does when you're writing
7 the design criteria.

8 I mean, I see a genetic fault in the whole
9 exercise. They are too design-specific without having
10 the design done.

11 MEMBER BROWN: Part of my comment on this
12 ARDC 16 in the subcommittee meeting was along the same
13 lines that Jose just mentioned. Seems to me there is
14 a certain set of principles that apply to all these
15 designs. One of them is in the containment area,
16 whatever we want to -- however we want to define it.

17 Another one is in the safe shutdown world.
18 In other words, how do you define that? It's not
19 plant-specific. And so what do you need these plants
20 to meet those general, you know, high level criteria?

21 In the SFR design descriptions you have in
22 Appendix B, there's a very explicit statement appended
23 over in the design criteria which says the containment
24 leakage shall be restricted to be less than that
25 deemed acceptable onsite and off-site, as specified in

NEAL R. GROSS

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

1 10 CFR 50.34.

2 That's a very high level principle. It
3 doesn't say how you do it, what you do with it. It
4 doesn't tell you about reactor buildings. It just
5 says you can't expose people locally or onsite or off-
6 site. That same statement is not in the ARDC and it's
7 not in the MHTGR.

8 MS. MAZZA: So we added the statements to
9 the rationale.

10 MEMBER BROWN: That's in the rationale.

11 MS. MAZZA: I --

12 MEMBER BROWN: I'm talking about there are
13 certain design principles that ought to be articulated
14 in the specific design criteria, not in this overall
15 discussion.

16 MS. MAZZA: The current GDC is what we're
17 pointing to for the ARDC for now.

18 MEMBER BROWN: Yes?

19 MS. MAZZA: And that's not in the current
20 GDC but we included it in the rationale here.

21 CHAIRMAN CORRADINI: Well, I think all
22 Charlie's asking, unless I misunderstand, is if it's
23 good enough for the sodium reactor, why isn't it good
24 enough generically?

25 MEMBER BROWN: Yes. Yes, for the other to

NEAL R. GROSS

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

1 address the HTGR and --

2 CHAIRMAN CORRADINI: Right, exactly.

3 MEMBER BROWN: I mean, and I'm not --
4 we're looking at --

5 MS. MAZZA: But it cases it, sitting back
6 in the rationale.

7 MEMBER BROWN: -- the general -- you all
8 have looked at all the general design criteria. How
9 should we adapt these and utilize them for non-light
10 water reactors? The principle is very well
11 articulated in that particular one. The principles
12 should be part of the design criteria.

13 MS. MAZZA: It's the same as light-water
14 reactors.

15 MEMBER BROWN: You're -- we're re-
16 evaluating what was in there and how we apply them to
17 the light-water reactors. Just because it wasn't in
18 the light-water reactors doesn't mean you can't apply
19 it to the non-light water reactors in terms of a high
20 level principle.

21 That just goes beyond my comprehension.
22 So I just -- that's the point I was trying to make at
23 the subcommittee. I'm just trying to make it again
24 here, that those high level principles -- the same
25 thing applies with safe shutdown. I'm going to walk

NEAL R. GROSS

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

1 through that particular resolution once we get to that
2 slide as well.

3 MS. MAZZA: Fair enough.

4 MEMBER BROWN: So that's where I come down
5 on it, that we ought to -- somehow, these design
6 criteria ought to be based on high level principles.
7 I -- Jose phrased it properly, and I do -- and there's
8 two areas, the containment, safe shutdown are two
9 major ones. Maybe there's other ones.

10 And my area, personally, of I&C, I believe
11 in independence. How can we define that? I've said
12 that over and over again in many, many meetings. So
13 anyway, that was -- that's my comment here.

14 MEMBER KIRCHNER: Can I concur with you?

15 MEMBER BROWN: You can have --

16 MEMBER KIRCHNER: I concur with Charlie as
17 well because the -- what I note as distinctive changes
18 in wording -- ARDC 16 talks about a leak-tight barrier
19 against uncontrolled release.

20 But the next two talked about controlled
21 release. And that begs the question, controlled
22 against what measures? And that gets you back to
23 50.34. So I would concur with Charlie that it seems
24 to me that, at the highest level, that's an
25 appropriate addition to your ARDC. And if it's a

NEAL R. GROSS

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

1 policy issue and you're waiting for the Commission --

2 MS. MAZZA: Yes.

3 MEMBER KIRCHNER: -- containment for the
4 HTGR, fine, but you already defined it into the SFR.

5 MS. MAZZA: And we're waiting for a policy
6 decision on all non-light water reactors for
7 functional containment. And that's --

8 MEMBER KIRCHNER: But consistency here
9 actually means something then because it takes you to
10 the next level. It takes you to a functional
11 description of what you expect that this containment
12 or confinement barrier to how it should perform.

13 MEMBER BROWN: The words that are in the
14 -- let me rephrase it again. If you look at 930.92,
15 you talk about the Commission policy with the new
16 light-water -- non-light water should not be required
17 to meet the essentially leak-tight -- I'm not
18 disagreeing with that. It's just the principle ought
19 to be that you shouldn't expose people onsite or off-
20 site. Step it up to the higher level. And it ought
21 to be included in the basic design criteria.

22 So that policy has already been
23 articulated. And those words into the SFR follow that
24 articulation. It's very clear and it meets the higher
25 level principle. Why don't those apply for the ARDC

NEAL R. GROSS

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

1 and MHTGR?

2 MS. MAZZA: Well, 930.92 were specific
3 designs.

4 MEMBER BROWN: You've lost the point.
5 We're re-evaluating all the way along the line how
6 should we re-articulate those things to be applicable?
7 And if we're going to fall back on basic principles,
8 we ought to fall back on basic principles, not on
9 fuzzy language when it's off somewhere else. And --
10 well, that's -- I've said enough. I will --

11 MEMBER KIRCHNER: I'm waiting to get my
12 order in here.

13 MS. MAZZA: That has to meet 50.34. I
14 think Andrew Yeshnick, from our staff is --

15 MR. YESHNICK: I was involved in a good
16 portion of the discussion on the crafting of this ARDC
17 and one of the difficulties that we had was that these
18 are supposed to be generic to any reactor. And we
19 don't know much about this generic design. It could
20 be molten salt. We don't know. Trying to figure out
21 the characteristics of that containment building
22 without knowing anything about the --

23 MEMBER BROWN: It doesn't matter. You're
24 protecting the health and safety of the public. The
25 words I'm referring to have nothing to do with whether

NEAL R. GROSS

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

1 it's built out of concrete, steel or sand blocks.

2 CHAIRMAN CORRADINI: Interrupting the
3 argument, we need your name and position on the
4 record.

5 MR. YESHNICK: Oh, yes, sorry about that.

6 CHAIRMAN CORRADINI: Sure.

7 MR. YESHNICK: It's Andrew Yeshnick,
8 commenting on NRL --

9 MEMBER BROWN: Those words are not
10 specific to any particular design. They're totally
11 high level and generic. And so we -- it's not a
12 matter of coming to grips with the difficulty of
13 dealing with different specific reactor designs.
14 That's non-specific. So I just -- I can't buy the
15 argument that's being made that we -- we're struggling
16 over specific designs, when those have nothing to do
17 with it. Excuse me.

18 MEMBER SKILLMAN: I'd like to get my order
19 in. Jan, the sentence that you have added seems to
20 focus mostly on an analytical solution as opposed to
21 a basic principle, as Charlie and Walt have pointed
22 to. But I would offer, with a slight modification to
23 your sentence, you certainly get to where I want to
24 be.

25 If you remove the word, "assumed" and the

NEAL R. GROSS

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

1 word, "is" and the word, "within" and the sentence
2 read, "The degree of leak-tightness for a containment
3 used in safety analysis and plant performance
4 requirements must confirm onsite and off-site doses
5 are below limits as specified in 10 CFR 50.34" I get
6 to where I think we need to be as a basic design
7 principle.

8 And my basis for saying that is on March
9 29, 1979 there was a 35, 40, 45-pound pulse inside of
10 TMI2. That was a hydrogen -- call it what you want.
11 But it crushed equipment and it burned stuff to
12 smithereens inside the building. I went in and
13 looked.

14 And then we have graphic images of
15 Fukushima 1, 2 and 3 exploding. If there had been a
16 tight box, doesn't have to be sophisticated, but a
17 tight box, the people from the Fukushima prefecture
18 would not have been evacuated. Nobody around TMI
19 needed to be evacuated. They left based on the
20 government's order. But they were safe and they
21 returned to their homes. And their homes were clean.

22 And so the basic principle is, for
23 heaven's sakes, put it in the box. And whether that's
24 a functional containment or a solid containment, it
25 seems that, to me, is an issue of wording that a very

NEAL R. GROSS

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

1 slight adjustment to these words would create the
2 principle that some of us are trying to communicate.

3 MS. MAZZA: Okay, so just to clarify, if
4 you say put it in a tight box, then you put in a lead
5 building, MHTGR.

6 MEMBER SKILLMAN: Why couldn't you?

7 MS. MAZZA: Because if you don't have a
8 tight box, you don't --

9 MEMBER SKILLMAN: Well, then you can make
10 something that's strong around it.

11 MS. MAZZA: I mean, you're allowing that
12 initial pop. So it's not the same.

13 MEMBER BROWN: Are you still required to
14 meet the onsite and off-site doses?

15 MS. MAZZA: You are.

16 MEMBER BROWN: Well, those words say that.
17 I mean, we're losing the bolts --

18 (Simultaneous speaking)

19 MEMBER BROWN: -- anything for the MHTGR.

20 MEMBER SKILLMAN: You would have to
21 demonstrate that you meet 50.34 with whatever you have
22 chosen. And at least it's got to be strong enough and
23 the degree of leakage has to be both radionuclide
24 leakage and other leakage needs to be low enough.

25 MR. SEGALA: Regardless of 16, all

NEAL R. GROSS

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

1 designs have to meet the dose limits in 50.34.

2 MEMBER MARCH-LEUBA: I guess the approach
3 we have in his -- he was saying the same thing I was
4 saying before -- the way this language reads, it reads
5 almost as an evaluation of a design instead of a
6 requirement of what the design must satisfy.

7 MEMBER BROWN: It should in the design
8 criteria not in a general discussion of things to
9 think about. And it's non-specific.

10 MS. MAZZA: Okay. Can we move on to the
11 next slide? Another favorite, Number 17, electric
12 power systems. So the comment was the use of
13 important safety to describe non-safety related
14 functions such as post-accident monitoring, control
15 and habitability, emergency lighting, et cetera is not
16 consistent with the NRC's use of this term.

17 So in response to this comment, we
18 modified the rationale for ARDC 17 which is also the
19 same as SFR and MHTGR and ARDC 17 to read, "In this
20 context, important safety functions refer to the
21 broader, potentially non-safety related functions such
22 as post-accident monitoring, control room
23 habitability, emergency lighting, radiation
24 monitoring, communications and/or any others that may
25 be deemed appropriate for the given design." And so

NEAL R. GROSS

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

1 this is consistent with the use of the term throughout
2 this reg guide.

3 MEMBER BLEY: Jan, a couple of things.
4 This takes care of the question of what does it mean
5 here. The other thing some of use were concerned
6 about was that "important to safety" is used
7 extensively, such as in 50.59 throughout the NRC and
8 throughout the industry.

9 And there it means it's a significant
10 contributor to risk. And it's also, well, a similar
11 language, safety significant, is used in 50.69. So
12 the question was, we're now introducing the same words
13 we use elsewhere to mean something different. We said
14 it's consistent here. The other place I saw it was in
15 ARDC 26, and is that what it means in ARDC 26 in
16 rationale?

17 MS. MAZZA: So important to safety
18 encompasses a lot of -- encompasses safety-related.
19 It encompasses regulatory, you know, not -- does that
20 mean --

21 MEMBER BLEY: No, safety-related is
22 different than important to safety.

23 MS. MAZZA: That is assessment --

24 MEMBER BLEY: Not all safety-related is
25 important to safety. And that's what 50.69 was all

NEAL R. GROSS

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

1 about.

2 MS. MAZZA: So I have -- I'm not an expert
3 in this, but, you know, the Denton letter is what we
4 fell back on, that important to safety encompasses --

5 MEMBER BLEY: Since Denton's been gone a
6 long time, there's been a lot of history here at NRC.

7 MS. MAZZA: I know. But so we were --

8 MEMBER BLEY: I think you fell back on the
9 wrong thing.

10 MS. MAZZA: Well, that's what the staff
11 falls back on. I don't know if anybody wants to speak
12 to that in the audience here, but that's what --

13 MEMBER BLEY: But I --

14 MS. MAZZA: -- throughout the --

15 MEMBER BLEY: I'm going to pin you down
16 specifically. In ARDC 26, you use this language. And
17 there you mean it to be the same as this. That's
18 true?

19 MS. MAZZA: I'm not going to answer that.
20 I have two more -- I have to work around text you're
21 talking about, but --

22 MEMBER BLEY: Or there do you mean it more
23 like it's used everywhere else in the NRC? That's
24 what bothers me about using it, these words to mean
25 something completely different than they use every

NEAL R. GROSS

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

1 day.

2 MS. MAZZA: In the context of 26, it's --
3 it could be safety-related equipment. But in this
4 context or, you know, if an operator has to go do
5 something that uses lights --

6 MEMBER BLEY: You've got a regulation that
7 clearly distinguishes between safety-related and
8 important to safety. And that's 50.69.

9 MS. MAZZA: Something that -- no. Can I
10 ask Bill Reckley to step up here? Because he's the
11 one that helped with this language.

12 MEMBER BLEY: Oh, good.

13 MR. RECKLEY: Bill Reckley with NRO. Yes,
14 the company --

15 MEMBER BLEY: Hi, Bill.

16 MR. RECKLEY: There's only -- there are
17 only so many words in the language. And so what we
18 try to fall back, as Jan said, was within the
19 regulatory context, important to safety. And that
20 ties back to how that term, in a regulatory sense, was
21 developed in the Denton letter to cover things like
22 station blackout where important to safety means it
23 has a regulatory control, but it's not safety-related.

24 And so, in that context, I think we are
25 consistent in 26, non-safety-related but there may be

NEAL R. GROSS

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

1 a reactivity feature that's going to get maybe special
2 treatment or otherwise considered in the regulations,
3 but it'll be a non-safety-related system.

4 MEMBER BLEY: Excuse me. A question, a
5 comment.

6 MR. RECKLEY: Yes?

7 MEMBER BLEY: Is the meaning, as defined
8 here, the same as the usage in ARDC 26?

9 MR. RECKLEY: Yes.

10 MEMBER BLEY: That's good. You're
11 internally consistent. Inconsistent with something 30
12 years ago is nice. But since then, 50.59 (sic) is
13 really the watch word of what goes on out in the
14 industry.

15 MR. RECKLEY: 50.69.

16 MEMBER BLEY: And 59.

17 MR. RECKLEY: And -- 59's --

18 MEMBER BLEY: 59's used every day. And --

19 MR. RECKLEY: That's true.

20 MEMBER BLEY: And there these words mean
21 something very different. I would say --

22 MR. RECKLEY: 50.65 and --

23 MEMBER BLEY: I would say extremely
24 different because some of these things --

25 MR. RECKLEY: And for any given design,

NEAL R. GROSS

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

1 don't look at the example. I mean, part of the
2 problem that we were trying to address in this
3 particular case was the original GDC, if you go back
4 far enough, important to safety and safety-related
5 were synonymous when these were first developed in the
6 70s.

7 MEMBER BLEY: That was the hope way back
8 then.

9 MR. RECKLEY: So, no -- well, but we're
10 tied to that because we started with the GDC, right.
11 And so as we move forward, we actually added this.
12 This wouldn't have been in the original GDC because
13 the GDC were really aimed at safety-related equipment.
14 We added this, in particular, on electrical systems to
15 reflect that there are things you may need for non-
16 safety-related DC or AC power, such as these things
17 that we would want some regulatory controls on.

18 So we added this to the ARDC and other
19 design criteria. It's kind of artificial because they
20 wouldn't have been in the original GDC. And you're
21 right, in most cases, these wouldn't have elevated to
22 the point of being in there.

23 But given that these designs are backing
24 away from having any safety-related AC or DC systems,
25 we added this so people wouldn't forget, if you will,

NEAL R. GROSS

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

1 that there are other things that you want, like
2 indications.

3 MEMBER BLEY: We like the concept.

4 MR. RECKLEY: Right.

5 MEMBER BLEY: We like the concept a lot
6 and we supported it. My complaint is you're using
7 language that has become commonplace in the last 20
8 years to mean something different. And that's going
9 to come back to bite you at some point. That's all I
10 have.

11 MEMBER STETKAR: And just to get it on the
12 record, I love the word, "patchwork". The evolution
13 of what you're referring to is part of the evolution
14 of the patchwork of regulations that, oh, my God,
15 certain things in electric power are -- weren't
16 safety-related but they're important to safety.

17 So we have to rewrite the way we phrase
18 things. And, oh, my God, certain things on --
19 shutting down the reactor are important to safety, but
20 those weren't safety-related in the past. So we have
21 to look at those things. It's evolved in a patchwork
22 process.

23 It's time to step back from that and use
24 -- and I think that's what Dennis is saying --
25 consistent interpretation of the terminology as it is

NEAL R. GROSS

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

1 understood today in the regulations, in other parts of
2 the regulations -- 50.69, 50.65, the maintenance rule
3 has interpretations of what is covered under the
4 maintenance rule as being important to safety or risk
5 significant.

6 50.59 is the, you know, how people
7 determine whether something rises to a need for change
8 from the FSAR or a need for regulatory oversight.
9 That's different than things were 50 years ago.

10 MS. CUBBAGE: This is Amy Cubbage. We're
11 getting there. That's the, what, April subcommittee's
12 answer to --

13 MEMBER BLEY: Here's an opportunity.

14 MS. CUBBAGE: -- modernization project
15 where we're going to be going through an integrated
16 process.

17 MEMBER BLEY: But don't wait. The message
18 here is don't kick the can down the street. This is
19 something that's coming out now. And we're aware of
20 that, right?

21 MS. CUBBAGE: Yes, but we need to put this
22 one to bed and then move on to the next thing. And if
23 we need to come back and adjust this, we will. We
24 can't hold up everything, waiting to do everything, if
25 that makes any sense. We need to make some progress.

NEAL R. GROSS

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

1 This is something that's very important for the
2 industry to get out there so they can have something
3 to get started with. It's very important to the
4 Department of Energy, who initiated this project, for
5 closure in this.

6 MEMBER BLEY: All we were suggesting was
7 pick a word that doesn't mean something else.

8 MS. CUBBAGE: Okay. Well, I got the
9 impression you were talking about --

10 MEMBER BLEY: And that can't be gamed.

11 MS. CUBBAGE: -- some dramatic changes to
12 this.

13 MEMBER BLEY: No, no, no, no. No, no.

14 CHAIRMAN CORRADINI: John would never do
15 that.

16 MEMBER REMPE: Should they define whatever
17 they pick so it's obvious?

18 MS. CUBBAGE: Of course.

19 MEMBER BLEY: So --

20 MS. MAZZA: Originally we put this -- we
21 had this --

22 MEMBER BLEY: Of course. They've defined
23 it nicely here.

24 MS. MAZZA: -- left out and then you all
25 asked for it to be in the reg guide. So we did and

NEAL R. GROSS

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

1 now --

2 MEMBER BLEY: No, this isn't -- at the
3 same time we said that, we said you're using the same
4 language that means something very different. We had
5 a long discussion with Bob when he presented this
6 about that. He didn't know about that, I don't think.

7 MS. MAZZA: I think raise the importance
8 of these other things that need to be --

9 MEMBER BLEY: We agreed with that.

10 MS. MAZZA: So that's --

11 MEMBER BLEY: And we like having it --

12 MS. MAZZA: That's how we were trying to
13 address it.

14 MEMBER BLEY: We -- I like having it in
15 your rationale. I think it's great. It's just using
16 the same words that mean something different, for no
17 particular gain.

18 CHAIRMAN CORRADINI: Can I, since Amy
19 brought up something that, at this time. So the
20 thinking process is that industry wants to see
21 something that they can start chewing on now.

22 MS. CUBBAGE: Yes.

23 CHAIRMAN CORRADINI: And then, with the
24 licensing modernization program and the policy
25 statement you have to bring in front of the Commission

NEAL R. GROSS

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

1 relative to their decision on functional containment
2 criteria, this will be revisited.

3 MS. CUBBAGE: It could be revisited
4 generically in an update to the reg guide, if
5 warranted. It also can be revisited by any applicant
6 when they propose their principle design criteria.

7 CHAIRMAN CORRADINI: So maybe this is
8 putting the cart before the horse, but for the
9 chairman of our subcommittee, I'd like to talk to some
10 of the industry and information meeting to understand
11 why this is so crucially important to hurry up and do
12 now. Because, to me -- and I don't think this is
13 staff's issue, I think this is --

14 MEMBER BLEY: Before we take on the
15 letter?

16 CHAIRMAN CORRADINI: No, no, no. Because
17 I think what Amy said is that they're going to revisit
18 this. So in the letter, we should state that it needs
19 to be revisited, for example. But I think, down the
20 road, I'd like to understand, by a certain design, how
21 some of these things are going to be met. Because I'm
22 still a bit foggy about this. And I think maybe a
23 particular potential applicant that is keen about
24 coming quickly ought to at least explain to us what
25 their thinking is.

NEAL R. GROSS

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

1 MEMBER BLEY: So it is our continuing
2 following of the regulatory plan for dealing with
3 these, yes.

4 CHAIRMAN CORRADINI: But the point is that
5 this has got to be revisited --

6 MEMBER BLEY: Gradually, I'm sorry.

7 CHAIRMAN CORRADINI: -- as you stated.

8 MEMBER BLEY: Go ahead, Jan.

9 MS. MAZZA: Okay.

10 MR. SEGALA: And we've already gotten
11 feedback from developers already that, even based on
12 the drafts, that they found this very helpful for them
13 in the early stages of their technology readiness to
14 have some bar to shoot for in terms of what the NRC
15 might find acceptable.

16 MS. MAZZA: Also, there's three ANS
17 efforts on non-light water reactor design criteria are
18 designers' guides. One's for sodium fast reactors.
19 And they've adopted basically all the FSR design
20 criteria that is in this reg guide. And then there's
21 the molten salt reactor/liquid fuel group. And
22 they've used some of these, but then they've adapted
23 others for the molten salt/liquid fuel designs.

24 And then there's the fluoride high
25 temperature reactor group, and they're also doing the

NEAL R. GROSS

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

1 same thing, picking and choosing which ones apply and
2 modifying the ones for their technology. So it is, in
3 practice, being used for these groups.

4 All right, moving on to Number 26, which
5 we had a lot of discussion on, was to provide us a
6 definition of safe shutdown. So we thought about it
7 and, once again, went back to SECY 94084 which talks
8 about policy and technical issues associated with the
9 regulatory treatment of non-safety systems in passive
10 plant designs which is reference 32.

11 And it describes the characteristic of a
12 safe shutdown condition as a reactor subcriticality,
13 decay heat removal and radioactive materials
14 containment. So this is a pretty important SECY
15 paper. It's included in the history package on design
16 certification developed by Jerry Wilson. It's a
17 collection of about a hundred documents that are very
18 important. And staff uses this. So we felt that it's
19 well-defined there and that was our response. So I
20 know I'm going to get --

21 MEMBER BROWN: So you're going to get an
22 argument from me again in that, this, again, is a high
23 level principle. And that principle ought to be
24 reflected in the design criteria and not just in a
25 general discussion. I mean, safe shutdown, there's

NEAL R. GROSS

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

1 nothing reactor-specific about subcriticality, decay
2 heat removal and whatever the last words were -- and
3 radioactive materials containment.

4 And those ought to be moved over into this
5 is the general, the design criteria that you need to
6 address, not as part of a subsequent discussion from
7 a 1993 or whatever the year was, 1994 SECY paper or
8 policy paper. When addressing these, we ought to be
9 defaulting, in most cases, where we can, to high level
10 principles so that they're not generic, they're not
11 specific to a specific plant or plant design.

12 Those words are not specific to any plant
13 design and should be incorporated in every one of the
14 GDC-26s for each of the different types that you're
15 discussing. That's the comment I made back during the
16 subcommittee meeting. And I feel very strongly that
17 the high level principle is what needs to be
18 discussed, not -- I understand where you've gone and
19 you've put the words into the rationale part.

20 But design criteria principles are
21 principles. And that's what the industry should be
22 addressing, on a principle basis. And out of that,
23 those were very generic terms, terms of criticality,
24 subcriticality, decay heat removal and material,
25 radioactive materials containment. You can't get much

NEAL R. GROSS

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

1 more high level than that. Similar to the last,
2 that's my personal opinion.

3 MEMBER MARCH-LEUBA: I -- Charlie, I'm
4 going to disagree with you on this one because the
5 language says thou shall achieve a safe shutdown. And
6 then the discussion tells you what the safe shutdown
7 means. So I don't think they need to repeat all this
8 in the language because, I mean, if you read GDC-26,
9 it tells you a safe shutdown goes with that.

10 MEMBER BROWN: But it doesn't define what
11 it is.

12 MEMBER MARCH-LEUBA: It defines it on the
13 discussion which, to me, is acceptable.

14 MEMBER BROWN: Not to me.

15 MEMBER BLEY: Just one member's comment.
16 I really want to congratulate you folks for including
17 the rationale as part of the reg guide. We've had so
18 many cases, especially with rules, where things like
19 this were buried in statements of consideration which
20 is great until, 15 years later, you try to find them.
21 And that's very difficult. And I think having these
22 memorialized right with the GDC is going to be very
23 helpful in the future.

24 MEMBER BROWN: I don't disagree with that
25 thought process, by the way. Having the basis for

NEAL R. GROSS

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

1 some of these discussed in the reg guides is very
2 good. I just think the industry needs to have a
3 little bit more emphasis that the principle is the
4 principle and that may not be quite as rubbery as may
5 be perceived because it's not in the principle part
6 of it. We'll, obviously, have that discussion when we
7 write our letter. Thanks.

8 MS. MAZZA: Anything else on this then?
9 Okay, I'm going to move on to the last slide. And
10 this was specifically to address Member Brown. You
11 had some questions for Number 26, which was a response
12 to a public comment, which is Number 70.

13 So clarify staff's response to public
14 comment Number 70 -- "Does staff agree with the
15 industry comment that reactors with passive or
16 inherent shutdown capability can justify that a second
17 means of shutdown is superfluous? Also clarify why
18 design basis events were replaced with AOs and
19 postulated accidents."

20 So I asked Jeff to help, to respond to
21 this. And this is what his response was, and then
22 he's here, also, if you have any additional questions.
23 So, "Staff did not agree with the industry comment
24 that one reactivity system is adequate. So as noted
25 in Section 2 of ARDC-26, a means which is independent

NEAL R. GROSS

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

1 and diverse from the others shall be capable of
2 controlling the rate of reactivity changes. So,
3 therefore, a single means is not acceptable, even when
4 an inherent or passive means of reactivity control is
5 present."

6 And for the second part, clarify why
7 design basis events were replaced with AOOs and
8 postulated accidents, the term design basis events was
9 used in Draft Guide 1330, consistent with the
10 definition given in SRP Section 15. GDC-27 and,
11 hence, ARDC-26, because they were put together into
12 one, deal with normal operation, AOOs and design basis
13 accidents and not external or natural events.

14 Public comments stated that the meaning of
15 design basis events was unclear, perhaps based on the
16 inclusion of external events, and that the current
17 GDCs don't use or define the phrase, "design based
18 events". So the staff does not agree that design
19 basis is undefined or confusing in the case of ARDC-
20 26. However, the commenter was correct that the GDC's
21 used the phrase, "normal operation including AOOs and
22 postulated accidents" to describe non-external events
23 which form part of the licensing basis. So,
24 therefore, ARDC-26 was changed to AOOs and postulated
25 accidents to be consistent with the current GDC

NEAL R. GROSS

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

1 language. So I'm hoping that answers your question.

2 MEMBER BROWN: Let me -- I'll try to think
3 about that a little bit. You're probably going to
4 have to apply some calibration concerns of some of my
5 peers, as we discussed. I understand, but you -- it's
6 distorted. So I'm not going to try to stick a fork in
7 it right now.

8 MS. MAZZA: Okay.

9 VICE CHAIR RICCARDELLA: And on your first
10 paragraph, you discuss a means which is independent
11 and diverse, but nobody argues with that. I guess the
12 question is, does that have to be a safety-related
13 system to --

14 MS. MAZZA: Jeff?

15 MR. SCHMIDT: This is Jeff Schmidt from
16 Reactor Systems. The answer is no.

17 VICE CHAIR RICCARDELLA: Okay. Let me ask
18 a question relative to that. We have diverse needs
19 today in our light-water reactors. And I guess, are
20 they safety-related today?

21 MR. SCHMIDT: No.

22 VICE CHAIR RICCARDELLA: There's just a
23 little bit -- sometimes -- that was my impression,
24 that sometimes they are, but they're --

25 MEMBER STETKAR: The answer is -- yes, not

NEAL R. GROSS

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

1 always.

2 VICE CHAIR RICCARDELLA: Not always?

3 Okay.

4 MEMBER STETKAR: Mostly they are, I would

5 say.

6 VICE CHAIR RICCARDELLA: I guess I'm a

7 little --

8 MEMBER BROWN: Not always, I think is --

9 VICE CHAIR RICCARDELLA: Do you have a --
10 do you know of when it's not?

11 MEMBER BLEY: It seems not to have been
12 a requirement.

13 VICE CHAIR RICCARDELLA: Pardon?

14 MEMBER BLEY: It seems not to have been a
15 requirement.

16 MEMBER BROWN: In the existing plant
17 designs, but that -- LWRs. But in most cases, based
18 on your-all's comments, it sounds like it ended up
19 that way.

20 MEMBER SKILLMAN: I think the plants that,
21 the pre-GDC plants, plants through about 1968, '69 in
22 the old GDC, old general design criteria 26 and 27,
23 together, required a 2 and I think, at least the way
24 those of us who were involved interpreted those, was
25 they were all safety-related. So you ended up with

NEAL R. GROSS

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

1 rods and boron, safety-related non-basis.

2 MEMBER BROWN: But post --

3 MEMBER SKILLMAN: And it was -- there was

4 --

5 MEMBER BROWN: -- 60s, early 70s?

6 MEMBER SKILLMAN: -- a drift after that,
7 and I can't account for that, but I know what it was
8 like earlier, and they were both safety-related.

9 MEMBER BROWN: Yes, I just don't have a
10 good feel for that, based on my past experience
11 relative to the civilian commercial plants. I know
12 what the ones I worked on did and what we couldn't do,
13 so. All right, thank you.

14 MS. MAZZA: Okay. So that, that concludes
15 my presentation on the reg guide.

16 MEMBER BLEY: I'd like to thank the staff.

17 MEMBER MARCH-LEUBA: Oh, I have a
18 question, since we have plenty of time?

19 MEMBER BLEY: Well, we have some things we
20 want to do with some of that time, but go ahead.

21 MEMBER MARCH-LEUBA: We talked in the past
22 about the design basis events and since we are going
23 into -- I know you are going to issue this once we
24 chart what is specific and design-specific design
25 criteria. I think there should be an effort to couple

NEAL R. GROSS

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

1 this to defining the basis, the design basis events
2 that goes, for certain, with them.

3 For example, just because we're picking up
4 a particular design, is oxygen egress into areas we
5 would have graphite a design basis event or not? And
6 that is a crucial decision point for the capability of
7 the design basis. So I think -- I mean, do you any
8 plans to work on that or at least ask DOE to work on
9 that?

10 MS. MAZZA: So we have the licensing
11 modernization project which, you know, we have the
12 section on licensing basis events. And, you know,
13 again, that's pretty technology-specific/design-
14 specific work which needs to be done. And so it's up
15 to applicants to define those and for us to review, so
16 --

17 MEMBER MARCH-LEUBA: Yes, but I see these
18 two things coupled. The way we are running with this
19 design criteria, that they assume what the design
20 basis are going to drop, in a sense. You assume that
21 there won't be rapid oxidation of the graphite.

22 MS. MAZZA: Well that's something that --
23 this is guidance. These are not requirements. This
24 is not the rules. So, you know, it's ably --

25 MEMBER MARCH-LEUBA: Okay. I just posed

NEAL R. GROSS

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

1 a comment in there.

2 CHAIRMAN CORRADINI: But I think Jose's
3 question is, is it within the licensing modernization
4 program that the DBEs that might have to be thought
5 about relative to the three categories that are to be
6 discussed? That's where I think --

7 MS. CUBBAGE: Yes.

8 CHAIRMAN CORRADINI: And the answer to
9 that is yes?

10 MS. CUBBAGE: From a process perspective,
11 the licensing modernization projects will establish
12 the frequency consequence-based approach to
13 establishing what events are considered and analyzed.
14 And that plays in with how the ARDCs would be applied
15 to a particular facility.

16 MEMBER BLEY: Back to our earlier letter,
17 we had suggested it would be important to identify
18 those ahead of time because they will affect these.
19 And we see how this is going forward. Have you -- you
20 expect that once the design basis or licensing basis
21 events are selected, you'll need to come back and
22 revisit these design criteria to make sure they're
23 appropriate in the future.

24 MS. CUBBAGE: That gets done on a
25 applicant-specific basis only. It can't be done until

NEAL R. GROSS

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

1 you have a specific design and that particular
2 applicant design is an iterative process, of course,
3 informed by the risk of their facility. And then they
4 define what their licensing basis events are, the
5 classification of their safety systems.

6 And then they will propose their principle
7 design criteria informed by their specific design,
8 licensing basis events, using the reg guide as
9 guidance. And then they have to propose to us and
10 justify their principle design criteria for their
11 facility.

12 MEMBER BLEY: Should there be a warning in
13 this document to put in fast reactor people and MHGTR
14 people? No, screwed that up. That when they have
15 developed their specific design, these, I like to say
16 concept-specific design criteria in this document may
17 not be appropriate for them.

18 MS. CUBBAGE: Jan would have to speak to
19 these ad words in the reg guide, but it's understood
20 in the regulations that each applicant has to propose
21 principle design criteria. And they can use this reg
22 guide as information to help them develop their PDCs.

23 MEMBER BLEY: Yes. I think that's clear
24 in the document. I think I'm just -- people want
25 Appendix B and Appendix C to help them along the way.

NEAL R. GROSS

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

1 But I wonder if they're lulling themselves or they
2 might be lulling themselves into believing those are
3 fixed for them, even though this, the designs that led
4 to these aren't complete and their designs might lead
5 them somewhere else.

6 MS. CUBBAGE: I appreciate your concern.
7 And we'll continue to communicate that. As we meet
8 with individual applicants, we always bring up the
9 issue about they need to develop their PDCs and are
10 they following what we're doing on the reg guide and
11 understanding how they would need to justify their
12 PDCs.

13 MEMBER BLEY: Okay, thanks. Anything
14 else? I guess, before I turn it back to you, we
15 should do public comments, Mr. Chairman?

16 CHAIRMAN CORRADINI: Yes.

17 MEMBER BLEY: Is there anyone in the room
18 who would like to make a comment on the issue we're
19 talking about today?

20 MR. KINSEY: Yes, this is Jim Kinsey from
21 the Idaho National Lab. I just want to make a couple
22 of observations. We appreciate the discussion today.
23 I wanted to mention a couple of things about the
24 original scope of this joint initiative between DOE
25 and NRC because I think it plays into some of the

NEAL R. GROSS

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

1 feedback that the Committee provided today.

2 The feedback, back in the 2012 and 2013
3 time frame for industry, through a series of technical
4 review panel meetings with DOE and then the feedback
5 they were getting from NRC and their interactions with
6 future licensees was that they were all struggling
7 with how to start working through the LWR-based
8 Appendix A GDCs and felt that they could really use
9 some help in making them more advanced reactor --
10 advanced non-LWR generic or specific rather than each
11 individual licensee having to tackle all 54 criteria
12 individually.

13 And what we agreed is that we'd work to
14 identify and describe the underlying safety basis for
15 each of those criteria and then work to adapt those to
16 that something everybody could use as their starting
17 point. As Dr. Bley mentioned, I think we worked
18 pretty hard to have that well-described in the front
19 matter of the DOE proposal and, I think, in our battle
20 over the staff, we carried that over well into the
21 rationales that helped describe the background for
22 what's here.

23 But I'd also mentioned that, all along the
24 way, it's always been a balance of trying to maintain
25 the original goal of staying at the same general

NEAL R. GROSS

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

1 construct and level of detail of Appendix A so that we
2 can stay inside that structure and not getting into
3 too many broadly applicable topics like basic safety
4 principles or high level principles on the more broad
5 or higher level side of the fence and also not diving
6 down into some of the specific design details that
7 might presuppose an accident sequence or a specific
8 configuration.

9 So there's always been a balance along the
10 way. And in the discussion today I kind of heard both
11 sided of that. So I just wanted to mention that we
12 have that in mind. We try to, both agencies try to
13 steer down the center of that road and maintain a
14 similar and reasonable level of detail as Appendix A,
15 but kind of explain the background for why what's
16 there is there. So I just wanted to provide that
17 feedback. But we appreciate the insights from the
18 Committee.

19 MEMBER BLEY: Thank you. Is there anyone
20 else on the line who would like to make a comment?

21 MS. CUBBAGE: Is the public line open?
22 Because I -- Jim was on a DOE line, right?

23 MEMBER BLEY: It's supposed to be open.
24 I can't guarantee it.

25 CHAIRMAN CORRADINI: Why don't you ask

NEAL R. GROSS

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

1 again? Is the public line open, Derek?

2 MEMBER BROWN: Both lines are open.

3 CHAIRMAN CORRADINI: Okay.

4 MEMBER BLEY: Thank you.

5 CHAIRMAN CORRADINI: Ask again.

6 MEMBER BLEY: Anyone else on the phone
7 line would like to make a comment, please identify
8 yourself. I hear none. Back to you, Mr. Chairman,
9 with one kind of caveat.

10 CHAIRMAN CORRADINI: I figured you had a
11 caveat.

12 MEMBER BLEY: We have -- I think we have
13 time to do some of our bullet point discussion. I
14 don't know whether we want to do it right away or take
15 our break and then come back and do it as we get ready
16 for the next meeting.

17 CHAIRMAN CORRADINI: We have a -- our next
18 topic will start at 10:45. So why don't we take a --
19 why don't we break until 10:20 now and then come back
20 and have our discussion in preparation for the letter
21 writing? Okay, we'll take a break until 10:20.

22 (Whereupon, the above-entitled matter
23 went off the record at 10:07 a.m. and resumed at 10:20
24 a.m.)

25 CHAIRMAN CORRADINI: So let me remind

NEAL R. GROSS

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

1 everybody. So as we had decided back in December that
2 the Subcommittee Chair has the flexibility to try a
3 new paradigm. So Dr. Bley is in the new paradigm
4 mode, so he has developed a set of bullet points that
5 will logically go into the letter. He wants to
6 discuss it with us.

7 MEMBER BLEY: Okay. Just a quick
8 introduction to our discussion. We already talked
9 about most of this, except I think we really got
10 started on this back when we were playing with the
11 NGNP. The white papers didn't -- we didn't have one
12 on this, but the discussions involved how would you
13 come up with sets of new design criteria.

14 Our letter last year had two
15 recommendations that I'm going to come back to a
16 little later.

17 So I'm going to introduce this and then
18 it's open for discussion. The current version of the
19 Reg Guide we've been looking at it seems to me
20 addresses many of the individual members' concerns,
21 especially with those criteria listed here. And they
22 considered all the received public comments; it didn't
23 deal with them all, and it memorializes the staff
24 rationale, which I think is the -- that's the first
25 time I've seen that done this well, so I think that's

NEAL R. GROSS

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

1 a great thing to help us.

2 The discussion points that I know of; and
3 you can add more to this, we had discussion a little
4 bit today and a lot at the Subcommittee meeting on the
5 design-specific design criteria, which are really kind
6 of general designs. They're concept designs. And it
7 cannot speak to all the specific concept variants, but
8 this time around they at least tell us where the
9 designs came from that led to Appendices B and C.

10 From my point of view the pros that I
11 heard were that with at least some design information
12 you can reduce the uncertainty in the design criteria
13 and identify technical policy issues for Commission
14 consideration. That's some of what's driving the need
15 for -- kind of the desire to have Appendices B and C,
16 satisfying the strong needs of the developers, too.
17 The cons are you could misapply these things.

18 Do we want to make a point of this in the
19 current letter? Do you want to talk anymore about
20 this? Where do people fall out on this thing?
21 Personally I wouldn't talk much more about it, but,
22 John, yes, go ahead.

23 MEMBER STETKAR: Well, I -- when I read
24 through it initially I came and asked -- given the
25 discussions we had today, come away with the notion of

NEAL R. GROSS

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

1 it's not clear to me what those two design -- I'll
2 call them design-specific appendices add and can they
3 be misused? It's clear that, to me anyway, whoever
4 wrote those things had a very specific design in mind
5 and knew how that design worked and knew what was
6 going to be important. And it may cause problems.
7 People didn't have to think so hard about the general
8 design criteria in a way.

9 So I -- it -- that's not a very
10 coherent --

11 MEMBER BLEY: Well, what --

12 MEMBER STETKAR: -- but I think we
13 should --

14 (Simultaneous speaking.)

15 MEMBER BLEY: -- thinking of the letter --

16 MEMBER STETKAR: Yes.

17 MEMBER BLEY: -- I suggested to them do
18 they need more warning, and he said, well, we'll make
19 sure everybody pays attention to this. But we could
20 have a warning that these -- don't assume these are
21 going to fit your specific design. Use them with care
22 and caution, because we're writing not just to the
23 staff. That's one way out of it.

24 MEMBER STETKAR: That's one way out of it,
25 yes. I personally would be a little stronger than

NEAL R. GROSS

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

1 that, but that's -- I'm only one of --

2 MEMBER BLEY: In --

3 MEMBER STETKAR: -- and I haven't thought
4 all that much about it, because again it was --

5 MEMBER BLEY: In what direction?

6 MEMBER STETKAR: -- just my initial
7 reaction was why the heck do we need Appendices B and
8 C at all?

9 MEMBER BLEY: And Walt pushed that pretty
10 hard --

11 MEMBER STETKAR: And --

12 MEMBER BLEY: -- the last time?

13 MEMBER STETKAR: Well --

14 MEMBER BLEY: Although --

15 MEMBER STETKAR: -- I think we need them
16 because somebody spent a hell of a lot of time and
17 money --

18 MEMBER BLEY: The Government --

19 MEMBER STETKAR: -- to do that.

20 MEMBER BLEY: -- DoE and NRC spent a lot
21 of time working with the industry --

22 MEMBER STETKAR: But --

23 MEMBER BLEY: -- to come up with these and
24 the industry wanted them to.

25 MEMBER STETKAR: -- given that somebody

NEAL R. GROSS

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

1 spent that, you could throw those away as -- archive
2 them and make sure that the general design criteria in
3 Appendix A are written well enough such that they
4 don't contraindicate anything that you had thought
5 about before. And I'm not sure that --

6 CHAIRMAN CORRADINI: And that's what
7 you're --

8 MEMBER STETKAR: -- people hear the second
9 part of that --

10 (Simultaneous speaking.)

11 CHAIRMAN CORRADINI: -- proposing?

12 MEMBER STETKAR: I'm not necessarily
13 proposing it for our letter. I mean, that's a fairly
14 extreme --

15 CHAIRMAN CORRADINI: Well, I --

16 MEMBER STETKAR: -- position --

17 (Simultaneous speaking.)

18 CHAIRMAN CORRADINI: Okay. I'm glad you
19 said that. I thought that was an extreme way of doing
20 it. I thought Dennis' suggestion of essentially
21 putting a caveat as to these are examples and only
22 examples --

23 MEMBER STETKAR: You could probably phrase
24 it that we had discussions and we just we've got to
25 clarify the --

NEAL R. GROSS

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

1 MEMBER BLEY: Okay. That gives me some
2 help. I'm going to go to the next one because we
3 aren't going to get done. We'll come back after lunch
4 and do some of this.

5 At the Subcommittee meeting we talked
6 about the multiple definitions of containment in the
7 three appendices and that that could cause problems
8 and isn't satisfying. It's going to stay I think that
9 the staff -- my understanding is the staff plans to
10 integrate all three if the functional containment
11 policy issue is approved by the Commission. And I'd
12 probably include some words like that, or not. I
13 don't know if we need it.

14 MEMBER STETKAR: But again, to me that's
15 another example of what I just said, that --

16 CHAIRMAN CORRADINI: We're talking the
17 last paragraph.

18 MEMBER BLEY: I'm sorry, I'm talking
19 multiple --

20 CHAIRMAN CORRADINI: Oh, I'm sorry.

21 MEMBER BLEY: Walt had pushed this pretty
22 hard at subcommittee.

23 MEMBER KIRCHNER: Yes, I still feel
24 strongly about it. I don't want to repeat myself --

25 MEMBER BLEY: No, please don't.

NEAL R. GROSS

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

1 MEMBER KIRCHNER: Well, I think we should
2 address it in the letter because if you take the ARDC
3 16, it adopts the GDC as we know it. The other two
4 suggest controlled leakage, control the release, to
5 use their words. And that requires a mechanistic
6 source term.

7 MEMBER BLEY: Yes.

8 MEMBER KIRCHNER: And that's a distinct
9 difference. And I don't know that that leaps out at
10 everyone. I guess the people -- certainly the people
11 in DoE and the laboratories have been working with
12 these two concepts. They understand that, but it's
13 not -- it's -- there's -- the inconsistency there is
14 significant, I think.

15 MEMBER BLEY: And there's going to be a
16 paper on --

17 MEMBER KIRCHNER: Functional
18 containment --

19 (Simultaneous speaking.)

20 MEMBER BLEY: Well, also there's going to
21 be a paper on mechanistic source term and that we have
22 a session -- I don't know where that is on the agenda.
23 Do we still have a meeting scheduled on mechanistic
24 source term, or was it just for NuScale?

25 CHAIRMAN CORRADINI: NuScale has been

NEAL R. GROSS

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

1 postponed to fit in with the generic one, was the
2 answer.

3 MEMBER BLEY: So right now we don't have
4 a generic --

5 CHAIRMAN CORRADINI: Nothing is scheduled
6 until fall. So if I might just work back, as long as
7 -- the way I interpreted the staff on this is it's an
8 either/or. It's not -- and as long as it's either/or
9 and the vendors appreciate how difficult the "or" is,
10 I don't have a problem with allowing it -- personally
11 have a problem allowing it in, but it's a difficult
12 standard because I think we're back to the phenomena,
13 and Dana identified the phenomena. You've got to be
14 able to show that all this dusty stuff stays where you
15 think it's going to stay.

16 MEMBER RAY: Yes, and that's of course the
17 main, but not the only --

18 CHAIRMAN CORRADINI: No, no. I
19 understand.

20 MEMBER RAY: -- variable. So again, I
21 just want to underscore that probably expresses my
22 concern as well, which is the source term, whether
23 it's depending on operational considerations or
24 manufacturing quality, whatever it is. I just feel
25 like we need to be clear. I mean, people are going

NEAL R. GROSS

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

1 out and financing things and they're going to just be
2 super upset if the hurdle to get over on that score of
3 source term becomes impossible way down the road.

4 MEMBER BLEY: Do we want to hold this for
5 the letter on functional containment or do we want to
6 do something in this letter?

7 MEMBER RAY: Well, I'm just responding to
8 what you --

9 (Simultaneous speaking.)

10 PARTICIPANT: At a minimum you should flag
11 it in some way.

12 CHAIRMAN CORRADINI: I think flagging it.

13 PARTICIPANT: Yes.

14 CHAIRMAN CORRADINI: Harold, can you
15 finish?

16 MEMBER RAY: What?

17 CHAIRMAN CORRADINI: Did you -- what do
18 you think?

19 MEMBER RAY: Well, I thought that was a
20 good expression of it. I just want to say it links up
21 with what I was trying to say, which is I don't think
22 we're making it clear enough that that's a key element
23 here.

24 MEMBER BLEY: Important key and hard to
25 do.

NEAL R. GROSS

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

1 MEMBER RAY: And difficult, yes. And I
2 worry not about -- well, never mind. I've taken
3 enough time. I got another group over here that wants
4 to meet with me.

5 MEMBER BLEY: Okay. But if you have
6 something to say, I'd rather hear it now than after I
7 bring the letter in.

8 MEMBER RAY: I've said it, which is it's
9 the source term and how you ensure that it's correct
10 in licensing a plant.

11 MEMBER BLEY: Well, anybody else?

12 MEMBER REMPE: Just to be clear, what you
13 might do is to emphasize the point that Jan quoted
14 about the fuel, that -- how it's tied to this
15 containment and then how they have to qualify the fuel
16 on the MHTGR one is how you might address this in your
17 write up.

18 MEMBER BLEY: But it sounds like, at least
19 the sense of some members, is we ought to go beyond
20 that, make a point of it.

21 MEMBER STETKAR: Yes, I wouldn't get
22 specific. Don't get in the same trap of a specific
23 design.

24 MEMBER REMPE: This is the MHTGR criteria
25 and why it's different is because of the fuel and --

NEAL R. GROSS

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

1 as opposed to the other ones. And so if you emphasize
2 that point it would help.

3 MEMBER BLEY: Ah, damn it. Excuse me.

4 (Laughter.)

5 MEMBER BLEY: Got away from me. I'm
6 sorry. Finish. I'm sorry.

7 MEMBER REMPE: It's trying to deal with
8 computers. It's good thing you're not up there
9 presenting like they are.

10 MR. SEGALA: This is John Segala from the
11 staff.

12 MEMBER BLEY: Yes, John?

13 MR. SEGALA: I just wanted to clarify that
14 outside of NuScale there is no source term thing we're
15 bringing in front of you for advanced reactors.

16 MEMBER BLEY: Okay. No paper; no nothing.
17 That's interesting.

18 MEMBER KIRCHNER: I think we're going to
19 trip over it, Dennis. I think we're going to trip
20 over this when we go to early site permit for Clinch
21 River.

22 MEMBER BLEY: Oh, yes, and we certainly
23 have it at NuScale, but I'm just -- well, I don't --
24 we can't continue the meeting, so I won't talk to the
25 staff about this any further.

NEAL R. GROSS

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

1 Okay. The next one was in our letter
2 Recommendation 4 of our last letter leaned on the
3 importance of selecting the design-bases and design-
4 basis events. This note actually came from Mike, but
5 I agree with it. The ARDC are being settled in
6 advance of other initiatives that in principle ought
7 to be finished first, like what's going on in the
8 licensing monitorization project, the two policy
9 issues on EP and functional containment. We might
10 have no problem concluding that this is the way to go,
11 but it needs to be reviewed and updated as other
12 issues are being resolved

13 Now what we heard from the staff today was
14 this is going to be done done and it's up to the
15 individual applicants to adapt this once design-basis
16 events or licensing-basis events are settled out.

17 Any discussion on this or what we ought to
18 say about it in the letter?

19 MEMBER MARCH-LEUBA: Well, I like this and
20 maybe we should emphasize in our letter that we
21 realize the staff is not going to do it. But when the
22 applicants come in with their particular -- the PDCs,
23 better cover these items.

24 MEMBER BLEY: So it's another one of those
25 caveats that --

1 MEMBER MARCH-LEUBA: Yes, yes.

2 MEMBER BLEY: -- this might not be so easy
3 as you think.

4 CHAIRMAN CORRADINI: Well, I love this
5 sentence, since Dennis --

6 PARTICIPANT: Since you wrote it.

7 (Laughter.)

8 CHAIRMAN CORRADINI: -- since I wrote it,
9 but I just want to make sure that we don't sell the
10 staff short. I thought i heard Amy say that this is
11 a good start, but they're going to come back and look
12 at it after they do the licensing monitorization
13 project and they get some opinions out of Commission
14 about function containment. Did I mis-hear?

15 MR. SEGALA: Yes, this is John Segala from
16 the staff. So for functional containment, depending
17 on what the Commission comes back, we will look at
18 whether we need to update the Reg Guide.

19 On licensing monitorization that's -- that
20 is a process that a designer will use to develop the
21 LBES for their design. We're not going to be
22 developing LBES through licensing monitorization for
23 each technology as a generic activity.

24 CHAIRMAN CORRADINI: So it's a process?

25 MR. SEGALA: It's a process for developing

NEAL R. GROSS

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

1 the LBES for a specific design. And then they'll have
2 to take the Reg Guide ARDCs as necessary and see
3 whether they -- those are adequate PDCs for their
4 design based on what they learned through LMP through
5 the DBEs.

6 MEMBER BLEY: And when you reviewed the
7 DoE white papers. You reviewed the white paper on how
8 you pick licensing basis events and had comments on
9 that. We wrote on that. You're not going to give any
10 general guidance of that sort. Are you going to
11 endorse the modernization project if it works to the
12 way you're hoping?

13 MR. SEGALA: So our understanding is
14 industry is going to take all those white papers and
15 consolidate them into some sort of consolidated --

16 MEMBER BLEY: Process document.

17 MR. SEGALA: -- NEI document.

18 MEMBER BLEY: Okay.

19 MR. SEGALA: And then they're going to
20 request NRC endorsement in a Reg Guide of that
21 document. And we'll be back in front of you multiple
22 times on that Reg Guide.

23 MEMBER BLEY: Okay. So all of the issues
24 we'll cover through -- yes. Sure.

25 MEMBER REMPE: And what we've heard is

NEAL R. GROSS

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

1 they're thinking of selecting licensing-basis events
2 based on frequency and consequences. And if that's
3 the case, then the designers have the benefit of
4 saying, well, I'll put another system in to lower the
5 frequency. And so having -- if they go that route,
6 you don't want them to pick licensing-basis events.
7 So I'm not sure that we need to comment about you need
8 to revisit this after you pick the licensing-basis
9 events. It won't be possible.

10 MEMBER BLEY: The idea of this comment
11 when it first came up was we were kind of hoping
12 they'd go back, but now it's -- at least it's
13 beginning to be clear to me that the only place we'll
14 see licensing-basis events are on specific
15 applications, and those will be reviewed at that time.

16 MEMBER REMPE: Right.

17 MEMBER BLEY: So we wouldn't say something
18 exactly like this except we'd say somebody out there,
19 you applicants, are going to have to do this.

20 MEMBER REMPE: And comment that the
21 process --

22 MEMBER MARCH-LEUBA: So I think we should
23 still say then at the end we will not revisit the
24 ARDCs. We'll revisit the PDCs.

25 MEMBER BLEY: Yes.

NEAL R. GROSS

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

1 CHAIRMAN CORRADINI: Dana had a comment.

2 MEMBER POWERS: Well, it's always been a
3 mystery to me why design-basis events or licensing-
4 basis events have any role in the regulatory process
5 at all. I think they had a role, but now that we have
6 modern risk assessment tools it's just a mystery to me
7 why we focus on these things. And I think they lead
8 to a microscopic regulatory system that looks at
9 trivial things.

10 So that it seems to me that which one
11 needs in the regulatory process is say here's the risk
12 I'm willing to tolerate. And it is my belief that you
13 cannot reach this risk reliably simply by prevention,
14 that you have to have mitigation.

15 And the licensing-basis event or the
16 design-basis events are something that belong to the
17 designer. They help him design things and have no
18 role in the regulatory process.

19 MEMBER BLEY: Well, the one that I see
20 links back to a paper you helped co-author on the
21 structuralist versus rationalist stuff.

22 MEMBER POWERS: Yes.

23 MEMBER BLEY: And the rationalist has the
24 PRA to organize these things and the structuralist is
25 saying that's all well and good, but to give me a

NEAL R. GROSS

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

1 better confidence that you've considered uncertainty
2 for the most troubling of this bunch of things I want
3 something that's treated like we treated design-basis
4 events with some conservatism.

5 MEMBER POWERS: And that's exactly right
6 and that was --

7 MEMBER BLEY: And that's the role --
8 that's a regulatory role I see of it.

9 MEMBER POWERS: Yes, and that's a good
10 point and certainly one I agree with, but understand
11 that that was written in the context of the existing
12 reactors. If I'm moving to advanced reactors can I
13 not abandon that concept?

14 CHAIRMAN CORRADINI: So can I ask Dana a
15 question since I'm -- maybe other people aren't as
16 astounded, but -- so what you're basically saying,
17 unless I'm off base, is get rid of Chapter 15
18 considerations.

19 MEMBER POWERS: Essentially yes --

20 CHAIRMAN CORRADINI: Okay.

21 MEMBER POWERS: -- because most of --

22 CHAIRMAN CORRADINI: That's what I thought
23 you were saying.

24 MEMBER POWERS: -- them are being used --
25 I mean, you sit here and you go through jillions and

NEAL R. GROSS

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

1 jillions of little tiny things that it's inconceivable
2 that they will ever amount to anything as far as
3 public risk simply because they've been codified in
4 the regulatory process in an era when we didn't have
5 this marvelous tool to look at the plant as a whole.

6 And now you're talking about an advanced
7 technology where you're starting from scratch. I'm
8 saying why do we recognize that and get rid of this
9 stuff, because it's leading to -- and it has led to a
10 lot of microscopic examination that I don't think
11 really affects public health and safety.

12 MEMBER STETKAR: You still need things
13 that smell like technical specifications or
14 limitations that give you the assurance that --

15 MEMBER POWERS: You do, but I think you
16 get them a different way.

17 MEMBER STETKAR: That's right, that give
18 you assurance that you have the reliability and
19 availability of those things that you've already
20 taken --

21 MEMBER POWERS: Don't argue with that the
22 least little bit.

23 MEMBER STETKAR: -- credit for, but you
24 don't need to codify them in a specificity that
25 they're examined in.

NEAL R. GROSS

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

1 MEMBER POWERS: That's right.

2 CHAIRMAN CORRADINI: So I'm going to do a
3 time check because in three minutes we're supposed to
4 officially start the next topic.

5 MEMBER BLEY: I'm not going to go beyond
6 this one.

7 CHAIRMAN CORRADINI: Okay.

8 MEMBER BLEY: I was just going to add one
9 thing. I'm not sure what --

10 CHAIRMAN CORRADINI: We need some set-up
11 time for the --

12 MEMBER BLEY: Yes, I'm not sure what to do
13 with this last discussion, but I'll give it some
14 thought. We'll come back after lunch and finish up
15 these bullets and --

16 (Simultaneous speaking.)

17 CHAIRMAN CORRADINI: But I do want to make
18 sure I did interpret you right, because I think that
19 would be a marvelous thing to suggest. I'm not
20 exactly sure where we would put it, but a thought
21 process about thinking this way would be --

22 MEMBER POWERS: This has been an issue
23 that the ACRS has kicked around for a very long time,
24 since the paper on structuralists versus rationalists.
25 And we all struggled on where to bring this up and it

NEAL R. GROSS

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

1 was generally conceded that it was in the advanced
2 reactors. The existing reactors are the existing
3 reactors. And by existing reactors, anyone that's a
4 large water reactor. We said -- I think it's so
5 codified that you're not going to around it. But in
6 the advanced reactors where you're talking about very
7 different technologies is the place to bring it up.

8 CHAIRMAN CORRADINI: Okay.

9 MEMBER POWERS: And my own feeling is
10 there are so many of these little issues, some that
11 John pointed out. How do you assure you have
12 sufficient reliability and confidence in each one of
13 these things that are going to create this low risk.
14 I mean, the challenge in a risk assessment for a plant
15 that's never been built and operated is you don't have
16 any data, so you can't set the probabilities and
17 whatnot. And so you're working with a fairly less-
18 honed tool and so you need margin to set these things.

19 But you go through it with the structure
20 of the risk assessment rather than the structure of
21 these design-basis events. They need some fairly
22 careful articulation. And it's always been one that
23 we've said, well, we'll get back to it, but the ACRS
24 has become lazy and sacrifices its Saturday morning
25 time where it could be discussing this issue and

NEAL R. GROSS

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

1 trying to hone language that would be acceptable, that
2 people would understand, because I think it takes a
3 lot of time to write each sentence there so that it's
4 unambiguous to people because this is a break from the
5 past.

6 CHAIRMAN CORRADINI: At this point we have
7 to stop, so I'll --

8 MEMBER BLEY: Thank you very much. We'll
9 take this up then later.

10 CHAIRMAN CORRADINI: So you've been
11 helped, I assume?

12 MEMBER BLEY: I've been stuck in -- I have
13 some things to think about.

14 CHAIRMAN CORRADINI: So can we get a --
15 right, let's have a switchover.

16 (Whereupon, the above-entitled matter went
17 off the record at 10:45 a.m. and resumed at 2:59 p.m.)

18 CHAIRMAN CORRADINI: We're back in
19 session. We'll turn it over to Dr. Ballinger to talk
20 -- lead us through the PLUS7 Field Design topical.

21 MEMBER BALLINGER: Good afternoon, Mr.
22 Chairman. This afternoon, we are going to have the
23 presentation from KHNP and the Staff regarding the
24 PLUS7 Fuel Design. We had a subcommittee meeting on
25 the 28th of -- the 24th of January and we have

NEAL R. GROSS

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

1 probably several earlier sort of semi-discussions
2 related to Chapter 4 and other things.

3 So, this afternoon, we are going to hear
4 from first KHNP and then the staff. And Bill would
5 you like to say -- oh, wait a minute. Whoever you
6 are, if you would like to say something.

7 MR. WARD: I'm here.

8 MEMBER BALLINGER: Oh, but you pointed to
9 somebody else.

10 MR. WARD: No, I was grabbing the mike.

11 Thank you.

12 MEMBER BALLINGER: I don't know. He did.
13 Didn't you see it?

14 MR. WARD: This is the first of three full
15 committee meetings and represent sort of the closure
16 aspect of our interactions with ACRS. We have a
17 couple more subcommittee meetings but this is what
18 we're here for is the full committee meetings. And we
19 look forward to answering your questions and hopefully
20 a clean letter at the end. Thank you.

21 MR. SISK: This is Rob Sisk, a
22 Westinghouse Consultant to KHNP. Before we start, I
23 do want to say thank you for this opportunity to talk
24 about a topical report, not just the DCD but a topical
25 report.

NEAL R. GROSS

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

1 I just wanted --

2 MEMBER POWERS: This is your idea of a
3 vacation?

4 MR. SISK: Absolutely.

5 I just wanted to mention that the
6 presentations were developed to be nonproprietary.
7 And we will present nonproprietary presentation,
8 obviously. If, for some reason, there are questions
9 that may take us into proprietary, we will all be
10 staying aware of that and we would like to defer to
11 those to the end of the session.

12 So I just wanted everyone -- we're trying
13 to keep this, at least as we go into it, as a
14 nonproprietary session.

15 So with that being said, I will now turn
16 it over to Mr. Kwon to lead us through the
17 presentation.

18 MR. KWON: Okay. Good afternoon. My name
19 is Ohhyun Kwon from KEPCO Nuclear Fuel. The topic is
20 PLUS7 Fuel Design Topical Report or APR1400.

21 The contents consist of a summary of PLUS7
22 fuel design features, experience, and topical report,
23 progress review, and RAI status.

24 In progress review, the performed work
25 will be summarized here. In RAI status, the responses

NEAL R. GROSS

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

1 for the RAI will be mentioned.

2 As a summary of PLUS7 fuel design
3 development, PLUS7 fuel design was jointly developed
4 with Westinghouse for Korean nuclear plant, including
5 APR1400 from 1999 to 2002.

6 PLUS7 fuel was developed to improve the
7 fuel performance compared to Guardian.

8 KEPCO/KHNP submitted the PLUS7 Topical
9 Report to the NRC for approval in 2013.

10 The overall structure of a PLUS7 fuel
11 assembly is similar to the Guardian and other PWR fuel
12 assemblies. PLUS7 and Guardian has 236 fuel rods and
13 4B guide thimbles, 1B instrument tube, hold-down
14 spring, top and bottom nozzles.

15 Compared to Guardian, top nozzle and
16 debris filtering of top nozzle have been improved in
17 PLUS7 fuel.

18 PLUS7 fuel consist of improved INCONEL top
19 and bottom grid and mid grid with mixing vane, and
20 INCONEL protective grid.

21 PLUS7 incorporated the proven Guardian
22 structure and the proven Westinghouse type fuel
23 features. This table shows the main advanced features
24 of the PLUS7 fuel assembly, from Guardian fuel
25 assembly, and RFA fuel assembly.

NEAL R. GROSS

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

1 ZIRLO is used in the PLUS7 fuel cladding,
2 and fuel rod diameter was optimized, and axial
3 blankets are used to increase neutron efficiency.

4 The spring and dimple of mid grid is
5 conformal-shaped to increase fretting wear resistance.
6 The strap of mid grid is straight-shaped, to increase
7 strength. And mid grid had a mixing vane to increase
8 thermal margin.

9 Each component of the top nozzle is
10 assembled in one structure; thus, it makes it easy to
11 handle the top nozzle.

12 The bottom nozzle has a small hole and
13 slot to increase material filtering efficiency.

14 From 2002, more than 5,200 fuel assemblies
15 have been loaded in Korean PWRs, including APR1400.
16 For the APR 14 plant, PLUS7 fuel was loaded into Shin-
17 Kori Unit 3 at first and more fuels will be loaded
18 into another APR14 in the near future.

19 As a summary of the PLUS7 fuel design,
20 PLUS7 fuel design was developed in 2002 and the fuel
21 has been supplied for Korean nuclear plants until now.
22 The design complies with the Code of Federal
23 Regulation and NRC regulatory documents.

24 Fuel assembly and rod met all the design
25 criteria. The design was verified through the out-of-

NEAL R. GROSS

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

1 pile tests, in-reactor verification tests, and
2 operating experience.

3 MEMBER REMPE: Excuse me. I don't have
4 the report in front of me but I believe in your
5 topical report, on page 66, you actually don't cite
6 the number 60 gigawatt days per metric ton uranium.
7 It's a bit lower. And I just was curious. I mean
8 it's not much but is it because it was submitted a
9 long time ago and you've got more experience now?

10 MR. KWON: What page did you say?

11 MEMBER REMPE: Page 66 of the topical
12 report is what I have in my notes but anyplace that
13 you have the maximum. Does it really say 60? Because
14 I thought when I was reading through it, it was a bit
15 lower.

16 CHAIRMAN CORRADINI: Is that something he
17 discussed?

18 MR. SISK: Yes, the burnup level.

19 MEMBER BALLINGER: In their previous
20 presentations, it's been 60.

21 MEMBER REMPE: Yes, but in the actual
22 report -- can I say the number aloud without being --
23 revealing information? It's a bit lower is all I
24 guess I can say and I just was curious. But you do
25 have data for up to 60 gigawatt days per metric tons

NEAL R. GROSS

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

1 uranium.

2 CHAIRMAN CORRADINI: Can they get back to
3 you on that?

4 MEMBER REMPE: Yes, just I mean if we're
5 going to be precise, and in our letter, and things
6 like that, I just was curious. And it's not like it
7 was 59; it was a bit lower but it's not that much
8 lower. And I just was wondering.

9 I mean if you round off, you could say
10 this, that I was curious.

11 MR. JEONG: Actually, this is Jaehoon
12 Jeong from KNF. The 60 days is the maximum averaging
13 rod -- maximum fuel rod average. But so it is the
14 fuel assembly average. That is a little bit less than
15 fuel rod.

16 MEMBER REMPE: Okay, so it's just the
17 terminology and I didn't remember the precise words.
18 Okay, thank you.

19 MEMBER SKILLMAN: I would like to ask a
20 question about the fuel design, about the fuel
21 assembly design, not the pin, not the grids, but the
22 assembly.

23 I understand you loaded 241 fuel
24 assemblies PLUS7 into Shin-Kori 3 -- 241 assemblies.
25 And that's the first APR1400 experience that you're

NEAL R. GROSS

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

1 having.

2 MR. JEONG: Yes.

3 MEMBER SKILLMAN: Okay. With 241 fuel
4 assemblies, you've got a very large core basket or
5 core support assembly and a very large top works that
6 contains your 81 full-length rods and your 12 partial-
7 length rods. Right? That's accurate based on your
8 characteristics from Table 1.31 of your DCD?

9 Here's my question: With these very large
10 diameter components, if the core support assembly is
11 at its maximum allowed displacement based on machining
12 tolerances and the support for your control rods is at
13 its maximum tolerance in the opposite direction, what
14 confidence do you have that your 81 control full-
15 length rods and your 12 partial-length rods will meet
16 your upper end fitting within the allowable tolerance
17 band for interface?

18 I reviewed the Topical Report-13001. I
19 reviewed the other topical Report APR1400-14010. And
20 I will ask the staff the same question. I reviewed
21 the Standard Review Plan, Section 4.2, 3.94 -- 3.93,
22 and 3.94. I did not see any requirement for
23 evaluating tolerance stack up for the drive line.
24 That drive line is approximately 30 feet long.

25 Why am I asking you this question? I'm

1 asking you this question because I was involved in the
2 change from a large reactor to a much larger reactor
3 and when we were challenged to defend the tolerance
4 stack up, we discovered that in the most adverse
5 tolerance condition, there was over one-quarter of an
6 inch, 8 millimeters, 7 millimeters displacement
7 between the drive line of the rod as it entered the
8 fuel in the fuel assembly. And we actually had to
9 adjust to make certain if the trip times and the rod
10 insertions were not mechanically compromised.

11 And that plant was in Europe and we had to
12 satisfy the Reactor Sicherheits Commission.

13 So as I look at your experience, this fuel
14 is different than what you have at Palo Verde. So
15 this will be, if you will, a new application. And
16 maybe this has been resolved at Shin-Kori 3, which is
17 why I asked about Shin-Kori 3.

18 But my question is: Have you done a drive
19 line stack up of your controlled element into the
20 upper end fitting of the fuel assembly with the worst-
21 case tolerances?

22 MR. JEONG: Actually, we don't have the
23 experience on that reactor placements and fuel
24 assemblies. So we will check about that.

25 MR. SISK: This is Rob Sisk, for the

NEAL R. GROSS

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

1 Director. This is a discussion on the PLUS7 fuel.

2 MEMBER SKILLMAN: Yes.

3 MR. SISK: And what you're really
4 referring to is the rod assemblies and the --

5 MEMBER SKILLMAN: No, it's PLUS7 fuel.
6 The PLUS7 fuel is controlled by those rods.

7 MR. SISK: Well, the vessel. Well, agreed
8 but we don't have their people here for the vessel and
9 the lineup for the control rod insertion to answer
10 that question.

11 MEMBER SKILLMAN: It will be sufficient to
12 say we'll get back to you on that.

13 MR. SISK: We'll have to take a look and
14 see what we can find out.

15 MEMBER SKILLMAN: Okay, thank you.

16 MR. KWON: As a summary of topical report,
17 PLUS7 fuel design, PLUS7 fuel design was developed --
18 oh, yes, I already explained this.

19 Progress review; PLUS7 Fuel Topical
20 Report. In 2013, Topical Review, Revision 0 was
21 submitted. In 2014, the responses for the first RAIs
22 were submitted. In 2015, for the TCD issue, applying
23 penalty was recommended. In 2016, the responses for
24 the second RAIs were submitted, except TCD issue; more
25 than ten conference calls were conducted; face-to-face

NEAL R. GROSS

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

1 meeting for TCD penalty methodology was performed with
2 the NRC staff.

3 In 2017, the TCD penalty methodology was
4 developed. Revised Topical Report, Revision 1,
5 including TCD penalty methodology was submitted. The
6 revised responses for RAI 5-7954 were submitted.

7 ACRS Subcommittee for PLUS7 TR was held in
8 January 2018.

9 The requested RAI which were given from
10 2014 to 2016 were totaling 24 questions for the
11 topical report. These questions were about PLUS7 fuel
12 design. All the responses were submitted and no open
13 item remain.

14 The thermal conductivity degradation issue
15 has been also completed. All the RAIs, including
16 impact of TCD have been resolved. Topical Report was
17 revised and submitted in 2017. Changes in DCD in
18 response to RAIs are incorporated in the next revision
19 of DCD, Revision 2.

20 Thank you.

21 MR. SISK: And this is Rob Sisk. That
22 completes the presentation on the PLUS7 fuel, unless
23 there are questions from the committee.

24 MEMBER BALLINGER: The 15-second rule
25 applies. Thank you very much.

NEAL R. GROSS

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

1 We have the staff.

2 MR. HUGHES: Chairman, Subcommittee
3 Chairman Ballinger, my name is Brian Hughes. I'm
4 filling in for George Wunder, who is currently -- he's
5 on vacation, having a wonderful time.

6 This is Christopher Van Wert and he's our
7 staff reviewer and he'll be making the presentation,
8 as soon as I figure out how to move the slides. There
9 we are.

10 Okay, Chris Van Wert. Mr. Geelhood is not
11 available. And we'll go ahead and start.

12 MR. VAN WERT: Thank you. Again, my name
13 is Chris Van Wert. I am with the Reactor Systems
14 Branch. I'll be presenting the staff's review of the
15 PLUS7 Topical Report.

16 And as just mentioned, in addition to
17 myself, I had contract support from Pacific Northwest
18 National Laboratories in the form of Ken Geelhood.

19 So the fuel system safety review provides
20 reasonable assurance that the fuel system is not
21 damaged as a result of normal operation or AOOs; the
22 fuel system damage is never so severe as to prevent
23 control rod insertion when it is required; the number
24 of fuel rod failures is not underestimated for any
25 postulated accidents; and that the coolability is

NEAL R. GROSS

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

1 always maintained.

2 In order to provide these assurances,
3 SAFDLs are established that should not be exceeded
4 during any condition of normal operation or AOOs.

5 The SRP Section 4.2 provides the criteria
6 for fuel system damage, fuel rod failure, and fuel
7 coolability.

8 This is just a summary really of the
9 information provided in the SRP, Section 4.2. This
10 highlights some of the different criteria that we
11 looked at for fuel system damage, fuel rod failure,
12 and fuel coolability.

13 In terms of the fuel assembly structure
14 and the components that are not the fuel rod, the
15 staff did review all of the design basis -- bases, the
16 criteria, and the evaluations that were presented
17 during the review. One RAI was submitted for a
18 clarification and sample calculations and other
19 information was provided by KHNP during an audit
20 through the electronic reading room.

21 The staff's results were that the staff
22 found that the analyses were based on previously
23 approved methods and consistent with the guidance
24 provided in SRP Section 4.2

25 In terms of the fuel rod analysis, itself,

NEAL R. GROSS

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

1 the staff did find that the NRC-approved codes and
2 methods were used; however, we also identified that
3 non-conservatism was involved with the burnup
4 dependence of thermal conductivity degradation. And
5 this is related to staff concerns which have been
6 captured in Information Notice-2009-23.

7 So as a result of that, KHNP evaluated the
8 impacts of TCD on the fuel rod design analyses. And
9 as you see here, I have a list of the different
10 criteria that were looked at. Those marked with a
11 checkmark were determined to be potentially impacted
12 by TCD and received further analyses. If they were
13 marked with an X there, it was not impacted by TCD.
14 And if you see a Chapter 15, we punted to the Chapter
15 15 analysis because that was involved with the
16 postulated accidents found there.

17 So the resolution that was presented by
18 KHNP and reviewed by the staff was that the
19 methodology was revised to include a burnup-dependent
20 temperature penalty, which is applied to the FATES-3B
21 results and the penalty is based on comparisons of
22 FATES-3B predictions against available measured Halden
23 data.

24 The staff review included confirmatory
25 runs and the data -- and a review of the data set used

NEAL R. GROSS

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

1 to develop the temperature penalty itself.

2 The staff concludes that the methodology
3 ensures that fuel temperatures are appropriately
4 modeled and that the revised analyses demonstrate that
5 the impacted SAFDLs are not exceeded.

6 In conclusion, the staff concludes that
7 the topical report demonstrates that the PLUS7 fuel
8 assembly design meets all regulatory requirements and
9 that specifically: the fuel system is not damaged as
10 a result of normal operation and AOOs; the fuel system
11 damage is never so severe as to prevent control rod
12 insertion when it is required; the number of fuel rod
13 failures is underestimated for postulated accidents;
14 and that coolability is always maintained.

15 The review of fuel performance for
16 postulated accidents covered by Chapter 15 will be
17 presented during the Chapter 15 presentation, which is
18 in April.

19 MEMBER SKILLMAN: Chris, how do you
20 justify that second diamond under the first bullet:
21 fuel system damage never so severe as to prevent
22 control rod insertion when it's required?

23 I understand that this is a chat about
24 only the fuel and, if you will, fuel-induced thermal-
25 type degradation. I got that but there is so much

NEAL R. GROSS

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

1 more involved here. When you say that fuel damage is
2 never so severe, what about when there are
3 displacements of the fuel in the core as it is
4 contained in the core and some displacement that is
5 eight, or ten, or twelve feet above the core that
6 challenges the control element insertion? Did you
7 look at that? And if so, where?

8 I checked your standard Review Plan 4.2,
9 3.94 and 3.95. There are no words, at least that I
10 can interpret that would force you to do that. So I'm
11 just curious.

12 One can say well that's over in the
13 mechanical side. I would say not so fast there,
14 partner, because it's really a combined effect here.
15 The CEAs have to do what they need to do, and the fuel
16 needs to do what it needs to do, and the two have to
17 work seamlessly.

18 MR. VAN WERT: Right, right. So as far as
19 the damage mechanisms for the fuel assembly that is
20 provided, I think, in more detail in 4.2 in regards to
21 normal operation AOOs. And that will show that there
22 is no damage which would, therefore, lead to no
23 insertion.

24 MEMBER SKILLMAN: Does that include
25 mechanical damage?

1 MR. VAN WERT: Well, the stress and strain
2 limits would be part of that. So that would show that
3 there's no physical damage to the assembly.

4 But I think partially what you're getting
5 at is probably more the postulated accident damage
6 which is allowed to occur within limited scope. And
7 I will defer some of that to the Chapter 15 analyses
8 as they are presented.

9 I can touch a little bit on 4.2 also
10 covers not part of the PLUS7 topical but 4.2, in
11 general, does cover also the fuel seismic response,
12 which is also really closely tied with the Chapter 3.

13 MEMBER SKILLMAN: Now, I'm trying to stay
14 away from seismic but where I will go is is there an
15 ITAAC that requires alignment within a certain
16 tolerance so as to ensure the heatup of the CEA and --

17 MR. VAN WERT: This is non-damaged? Are
18 you referring to non-damaged?

19 MEMBER SKILLMAN: Yes, non-damaged, sure.

20 MR. VAN WERT: So for -- and I heard the
21 question before. And what we were discussing and
22 wanted to make sure was highlighted was on a cycle-by-
23 cycle basis, they do have rod drop tests and times
24 that must be performed. So that would be where you
25 would capture if there was any alignment or you know

NEAL R. GROSS

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

1 if the minimum tolerance on the whole plus the maximum
2 tolerance on the pin were to occur, if it -- I forgot
3 what the drop time limits are but if it were to exceed
4 that, that's where you would see the issue. And that
5 is performed on a cycle-by-cycle basis. So it's not
6 even just a single ITAAC which is completed and then
7 you're up and running and you don't have to worry
8 about it again. The operating plant must look at it
9 every cycle.

10 MEMBER SKILLMAN: I believe it is 90
11 percent in four seconds.

12 MR. VAN WERT: Okay.

13 MEMBER SKILLMAN: I understand your answer
14 but I would challenge whether or not the Standard
15 Review Plan really addresses this. And I would also
16 offer that flight time testing is not an adequate
17 response because it could be that you sneak by 90
18 percent on certain insertion at 3.91 seconds; you
19 pass. The next time you have that event, whatever it
20 is that trips the plant, you don't meet that insertion
21 time and you do have more reactivity than you
22 anticipated that you would have.

23 And I've lived in a plant where we had so
24 much crud we could not make our flight time tests.
25 And that is really dependent upon what the allowable

NEAL R. GROSS

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

1 gap is and what your cleanliness requirements are.

2 So I'm not trying to give you raspberries
3 here, but I believe that this idea of a drive line
4 tolerance study and confirmation that under the worst-
5 case stack up you cannot stick those rods ought to be
6 in the Standard Review Plan. And this new plant for
7 the United States that's here ought to have that same
8 protection.

9 MR. VAN WERT: Okay, just for
10 clarification, I think I take the message, but just to
11 make sure I understand it correctly, were you saying
12 that at the -- in the cycle they run a test and they
13 pass but, for argument's sake we'll say they just
14 barely passed, but then at some point during that
15 cycle crud buildup or some other mechanism develops
16 which impedes it and so that it would, therefore, fail
17 at that point?

18 MEMBER SKILLMAN: Yes.

19 MR. VAN WERT: Okay. I will take that
20 back. I agree with you, I don't think that's in 4.2
21 as far as the review guidance goes.

22 MEMBER SKILLMAN: Or 3.94 or 3.95.

23 MR. VAN WERT: Right. So, I'll take that
24 back and --

25 MR. HUGHES: Well what you're saying is,

1 when they do the drop test, they go and measure when
2 it goes into the dashpot area?

3 MEMBER SKILLMAN: It's a setup test as
4 part of your tech specs and that's been thought
5 through. So you know what the flight time
6 requirements are and you know where your sensors are.

7 MR. HUGHES: Right.

8 MEMBER SKILLMAN: So that's part of your
9 surveillance program.

10 MR. HUGHES: Right. And then you can see
11 that on the curve when it hits the dashpot.

12 MEMBER SKILLMAN: Correct.

13 MR. HUGHES: Okay.

14 MS. KARAS: This is Becky Karas.

15 Just to I guess be clear where the
16 question is going, so it is in tech specs, you know as
17 Chris mentioned, for them to check this every cycle.
18 So I think, if I understand it correctly, what you're
19 postulating is mid-cycle or something, there's dropped
20 times, potentially would not meet --

21 MEMBER SKILLMAN: I mean I'm not trying to
22 create any requirement, Becky.

23 MS. KARAS: Okay.

24 MEMBER SKILLMAN: So forgive me if that's
25 what it sounds like. That's not what I'm suggesting.

NEAL R. GROSS

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

1 I'm suggesting that this is a new build.
2 This is new fuel. This will be a new reactor in this
3 country if it's built here.

4 And we're talking about PLUS7, 241 fuel
5 assemblies with CEAs that are quite candidly fairly
6 large. My question is: Has there been a stack up, a
7 tolerance stack up to confirm that in each and every
8 case that the displacement between what is the plenum
9 that are proportioned and what is the upper end
10 fitting location is always within spec?

11 And I don't know what that specification
12 is. I'm suspecting it's eight or nine millimeters.
13 It's a half an inch or so. But the machine is so big
14 that the fit-up tolerances can allow there to be a
15 very large difference. And that will be much
16 different for a large machine than a much smaller
17 reactor.

18 MS. KARAS: Okay but you're talking about
19 something that potentially that in the initial, I
20 guess, installation, the initial startup, those
21 initial drop times that are done, something that where
22 those tolerances would stack up --

23 MEMBER SKILLMAN: Adversely.

24 MS. KARAS: -- potentially later.

25 MEMBER SKILLMAN: Adversely.

1 MS. KARAS: Right because, obviously, in
2 terms of function, the function is you know the drop
3 times, right? If it meets the drop times you know,
4 presumably, those tolerances wouldn't have been
5 stacked up such that you know it was adversely
6 affecting that function.

7 But you're saying beyond the initial
8 installation and beyond the fact that it's checked
9 every cycle, that something else could happen.

10 MEMBER SKILLMAN: Well, I would suggest to
11 you that if the tolerances are adverse and on the
12 verge of not acceptable, it would be possible to scram
13 and not be able to pull the rods back out or you'll
14 pull half a rod out.

15 MS. KARAS: Okay, so you're talking about
16 a situation where it wouldn't necessarily impact the
17 drop times.

18 MEMBER SKILLMAN: Or it could go three-
19 quarters of the way insert and stop --

20 MS. KARAS: Right.

21 MEMBER SKILLMAN: -- because it's stuck.

22 MS. KARAS: And I think we have operating
23 experience on that.

24 MEMBER SKILLMAN: Exactly.

25 MS. KARAS: That's why we do things like

NEAL R. GROSS

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

1 drop time.

2 MEMBER SKILLMAN: Yes, I know we do.

3 MS. KARAS: Right.

4 MEMBER SKILLMAN: And so I'm postulating,
5 if I look at 4.2 -- Standard Review Plan 4.2 and 3.94,
6 and 3.95 and I look for tolerance stack up rod
7 interface, there is nothing. Then I read the material
8 for the APR1400 fuel assembly and I was looking for
9 stack up tolerance interfaced with plenum and there's
10 nothing. And that's why I'm asking the question.

11 MS. KARAS: Okay. Yes, I mean I guess
12 you're -- I mean you hit on that there's a couple of
13 different chapters that omit this.

14 So in terms of manufacturing tolerances on
15 things other than the CEA itself, those are handled
16 you know with ASME Code within the Chapter 3 review.
17 So I don't know if they've gone yet to
18 subcommittee/full committee.

19 But I think you know Chris' area and the
20 fuel they do look at impacts of insertability from a
21 variety of situations, including seismic and things
22 like that.

23 MR. VAN WERT: You know so I have the fuel
24 qualification program at the fuel vendor site
25 regarding the actual -- making sure that it's designed

NEAL R. GROSS

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

1 within its tolerances but I think your question is
2 kind of beyond that.

3 MEMBER SKILLMAN: So, I've made my point.

4 MR. VAN WERT: Yes.

5 MEMBER SKILLMAN: Thank you.

6 MR. VAN WERT: Any other? Please.

7 MEMBER REMPE: I have a couple of
8 questions. One I think we will have to have in a
9 proprietary section and, if you don't mind, I'd like
10 to go through it since we have time.

11 The other one, though, I think can be
12 talked about in an open session.

13 I missed the subcommittee meeting but I
14 know during the discussion you addressed the concern
15 that was raised about load following that the
16 committee had documented in a prior letter and said in
17 Chapter 4 we clearly say that we're not considering
18 load following for this plant in the U.S. I believe
19 I'm paraphrasing what you said.

20 MR. VAN WERT: Yes.

21 MEMBER REMPE: But this is a topical
22 report and with a topical report, that applies to
23 Joe's reactor. Now in the U.S., we don't do what they
24 do in France or Germany with respect to testing and
25 qualifying the fuel for load following but this

NEAL R. GROSS

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

1 topical report regularly references load following,
2 provided the most extenuating or bounding conditions
3 for the analysis. It's throughout the whole topical
4 report.

5 But when I read the staff's SE, they were
6 silent about the topical report. They did a bunch of
7 evaluations and independent analysis and said we bless
8 this fuel.

9 So I'm thinking in the future if things
10 change and I may own a reactor, I can say well, the
11 topical report blessed the fuel for load following.
12 It didn't say they couldn't do it or didn't say we
13 didn't evaluate it.

14 So what I'm wondering is what would you
15 do? Have you thought about -- did you consider the
16 fact that it's really almost saying we can do load
17 following -- it is saying we can do load following
18 with this fuel. And you didn't say hey, we didn't do
19 anything extra to consider load following or it didn't
20 say we didn't consider load following in our
21 evaluation. It just said the fuel is blessed.

22 MR. VAN WERT: Right.

23 MEMBER REMPE: And I'm wondering about
24 that. Am I making my concern clear?

25 MR. VAN WERT: No, I understand. This is

NEAL R. GROSS

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

1 something that is kind of a newer area that we're
2 looking at here amongst the various designs. But this
3 particular one and I think you summarized it correctly
4 in that we talk about it a little bit in Chapter 4
5 space, which is where you heard about it. The APR1400
6 plant is not asking for approval for the load follow.

7 MEMBER REMPE: Right.

8 MR. VAN WERT: And when I reviewed this,
9 that's true that I kind of was thinking of it within
10 the APR1400 plan.

11 Now if someone else were to review it,
12 they would have to show that they are -- they can't
13 just take that carte blanche because the assemblies --
14 sorry, the analyses that were provided were for these
15 conditions. They would have to show applicability.
16 At that point, we would have another bite at the
17 apple. And if they are trying to do that during the
18 LAR, that they would submit to --

19 MEMBER REMPE: But none of your
20 limitations and conditions explicitly say we didn't
21 look at load followings. And so is there something
22 that we catch people? I mean if we change the
23 requirements in the U.S., they could take this fuel
24 and put it in their reactor that is now blessed for
25 load following without having to justify it is what

NEAL R. GROSS

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

1 I'm wondering.

2 And again, maybe you did put a caveat and
3 I missed it when I read it in there somewhere but I
4 sure didn't see it.

5 MR. VAN WERT: No, when this was written
6 I don't have a limitation explicitly in this topical.

7 CHAIRMAN CORRADINI: I think there is a
8 staff person to assist you. Yes, Shanlai.

9 MR. LU: Shanlai Lu, Reactors Systems.
10 I'm the lead on the APR 1400 from Reactor Systems.

11 And, as Chris mentioned, that this part of
12 the topical report is as a package of an APR1400
13 declassification. So when we got into the Chapter 4,
14 Chapter 15, and that initially we saw that the DCD has
15 a word often load followed, we had an extensive
16 discussion with KHNP; are you sure you really want to
17 do load following? If you really want to do that,
18 there is a whole series, the whole nine yards of a
19 different analysis; we are going to ask for that one.

20 So specifically, they made a commitment
21 nothing to do for U.S. APR1400, nothing to do load
22 following --

23 MEMBER REMPE: I understand that.

24 MR. LU: -- as in their package as it is.
25 So, whatever we are proving here, as Chris is going to

NEAL R. GROSS

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

1 approve is part of weaving this paradigm.

2 MEMBER REMPE: So I can't take this
3 topical report and this fuel and put it in a different
4 plant and load follow? That's what I'm asking for.
5 The topical report is for Joe's reactor to go buy that
6 fuel and use it.

7 MR. LU: Right.

8 MEMBER REMPE: And that's what I'm
9 wondering about is that if you blessed the fuel for
10 load following without potentially doing that.

11 MR. VAN WERT: Right and it's a very good
12 question because we can think of certain plants. Palo
13 Verde was mentioned earlier as a plant that probably
14 could fit this fuel.

15 MEMBER REMPE: Yes.

16 MR. VAN WERT: But they would have to do
17 that transition through a LAR process. And so it
18 would come in --

19 MEMBER REMPE: The reactor will have to be
20 blessed to load follow, which requires making sure
21 other equipment can handle it. But what about the
22 fuel? Could they not say oh, I don't have to do
23 anything for the fuel, you guys said --

24 CHAIRMAN CORRADINI: You can't load fuel.

25 MEMBER REMPE: -- the fuel --

NEAL R. GROSS

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

1 CHAIRMAN CORRADINI: I think what he's
2 trying to tell you is they have to do an SE on a load
3 of a new fuel. Every time I have a new fuel --

4 MEMBER REMPE: But this is a blessed fuel.
5 If I look at the topical report, it's blessed for load
6 following.

7 MR. VAN WERT: The topical is but it's not
8 part of the license. As part of their license
9 amendment for an operating plant, they would come in
10 with the LAR saying we're going to switch from 16 x 16
11 NGF fuel over to PLUS7 and here's -- and they would
12 reference the approved topical as the basis for it but
13 it still has to come in review and approval at that
14 point.

15 So at that point, the staff would be
16 reviewing it. I do hear you that this condition --

17 MEMBER REMPE: I think it would have been
18 cleaner if your SE said we did not do any sort of
19 evaluation for load following. And that's where I am
20 kind of wondering.

21 I think even -- I think it could be muddy
22 ten years from now when the U.S. decides to do what
23 they do in other countries and let them load follow.
24 I think you might have an issue there.

25 MR. VAN WERT: Pair it up with the wind

NEAL R. GROSS

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

1 power or whatever else, yes.

2 MEMBER REMPE: Yes.

3 MR. VAN WERT: That is a good point. I do
4 think we have a bite at the apple. It's not a done
5 deal, just because the topical is approved. They
6 can't just load it directly into it. It does come in,
7 however --

8 MEMBER REMPE: Is it too late to add a
9 little caveat in your draft SE?

10 MR. VAN WERT: I will have to look at
11 projects for that. I know it's come in --
12 unfortunately, George -- I'll have to find out if the
13 dash A is completely out or if this -- and we'll have
14 to discuss it with them.

15 MR. HUGHES: It would also have to require
16 that the license has a condition that they could not
17 do that. And I don't know if that's a practical
18 thing. That's what they're saying is if they have to
19 reduce load, bring load up --

20 MEMBER SKILLMAN: Isn't this taken care of
21 through -- if I'm Joe's reactor -- if I own Joe's
22 reactor and I've been using ABC fuel and I choose to
23 go to PLUS7, mustn't I submit a COLR, a Core Operating
24 Limits Report?

25 MR. HUGHES: Yes.

1 MEMBER SKILLMAN: And in that report, I
2 would submit for a license renewal -- excuse me, for
3 a license amendment not only for changes I made in my
4 plant for load following but also here is the fuel
5 that I intend to use.

6 MEMBER REMPE: Well --

7 MEMBER SKILLMAN: And at that juncture, at
8 that juncture I think that the fence is up for the
9 staff to say you're going to have to justify this fuel
10 for that application.

11 MEMBER REMPE: If you do it in the next
12 year or two, I'm sure the staff will pick up. But if
13 the country decided that we want to load follow
14 because of wind, or solar, or something like that and
15 they decide what's needed and other fuels are
16 approved, et cetera, then somebody may say ah, I don't
17 have to worry about this particular fuel because this
18 fuel clearly stated throughout their topical report
19 that they considered load following and all that and
20 the staff didn't say we didn't do any special
21 evaluations.

22 And that's why ten years from now, if
23 there's just total silence about it in the staff SE,
24 I don't think that's a good thing.

25 MEMBER SKILLMAN: I understand your point,

NEAL R. GROSS

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

1 Joy.

2 MR. LU: Let me just add one more word
3 here. It seems that as part of DCD SER we would
4 explicitly say that this is not for load follow.

5 MEMBER REMPE: That's true.

6 MR. LU: So down the road and then if this
7 reactor is built in this country, it's not going to do
8 load follow.

9 MEMBER REMPE: That's true. So APR1400 --

10 MR. LU: So, therefore, there's not a
11 chance for anybody to ensure that the licensing
12 process without a license amendment to do that, unless
13 we change the you know --

14 MEMBER REMPE: With the APR1400, you've
15 covered your bases, apparently. Based on the
16 transcript, you've done this.

17 But again, I'm talking about the Joe's
18 reactor who wants to say pick a fuel and I could pick
19 a fuel that might have to go through a lengthy
20 licensing process or I could say oh, I've already got
21 -- pick this fuel and have a shortcut. And that's
22 where I'm at.

23 And I think it would have been cleaner if
24 you said -- because we don't -- I'm not sure what you
25 even know what you might look at for the fuel for load

NEAL R. GROSS

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

1 following. And so I think that maybe you've left a
2 gap there.

3 And then I had one other question that it
4 wasn't clear to me that --

5 CHAIRMAN CORRADINI: Do we need to go to
6 closed for that?

7 MEMBER REMPE: Well, tell me. There was
8 some part of the transcript and maybe I didn't
9 understand but you have a plot in there that's Figure
10 3 with rod internal pressure versus burnup. Did you
11 guys discuss it in the subcommittee meeting or would
12 you mind going to closed session and discuss it with
13 me?

14 MR. VAN WERT: So that was the
15 subcommittee's slides so I don't have those here.

16 MEMBER REMPE: But it's actually -- I
17 don't even know if it was in the slides. I don't
18 think it was, actually.

19 MR. VAN WERT: Oh.

20 MEMBER REMPE: But it's the Figure 3 of
21 your SE. And if you don't mind, maybe let's just
22 close it for my education and tell me --

23 CHAIRMAN CORRADINI: So wait. Just hold
24 on a second. So if you want to have a discussion
25 about that issue and it is a proprietary issue, let's

NEAL R. GROSS

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

1 finish up the open session, go to public comments, and
2 then we can come back and answer the question.

3 So first, is that something that has got
4 to be answered in closed session?

5 MR. VAN WERT: Let me pull that out.

6 MEMBER REMPE: My question is why does it
7 go up and down so much? I would have expected it
8 would have gone without that. And if you can answer
9 that in an open session, that'd be great. The red
10 curve.

11 MR. VAN WERT: Okay, yes, I do recall that
12 one.

13 MEMBER REMPE: And if you want to go in
14 closed, that's fine. I don't care. I just was
15 curious on it.

16 MR. VAN WERT: And this question actually
17 was brought up -- yes, I do remember the question
18 coming up and that one I did defer to Ken, who was
19 here for the subcommittee meeting. He was more -- I'm
20 going to try to summarize without going into -- I will
21 keep one eye over there for any hands waiving.

22 MEMBER REMPE: Yes, if you can do it in
23 open that would be great. I don't need a detailed
24 one. Just, it looks kind of strange.

25 MR. VAN WERT: So the explanation that

NEAL R. GROSS

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

1 I've been told, and this is without opening up the
2 source code, but it appears that it had to do with the
3 time sets --

4 MEMBER REMPE: Okay.

5 MR. VAN WERT: -- and how it was
6 calculating and then renormalizing -- not
7 renormalizing but --

8 MR. SISK: Wait. Wait a second. Rob
9 Sisk.

10 Just to be on the clean side, safe side,
11 we're diving into proprietary information on this.

12 MR. VAN WERT: Okay.

13 MR. SISK: So close this, if you can.

14 MEMBER BALLINGER: I'm going to preempt
15 things here.

16 MR. VAN WERT: Okay.

17 MEMBER BALLINGER: And then we're going to
18 ask for public comments first.

19 CHAIRMAN CORRADINI: First, if I might
20 just suggest, does the committee have any more
21 questions of them in open session?

22 MEMBER BALLINGER: Okay.

23 CHAIRMAN CORRADINI: If not, then you can
24 go to public comments.

25 MEMBER BALLINGER: Fifteen seconds. So

NEAL R. GROSS

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

1 we're getting the phone line open.

2 Are there any members or any people in the
3 room that would like to make a public comment?
4 Hearing none, I haven't heard any crackling and
5 popping, so I don't know that the phone line is
6 actually open. But assuming -- there it is.

7 Is there anybody on the phone line that
8 would like to make a comment? Hearing none, good.

9 So we will --

10 CHAIRMAN CORRADINI: Let's make sure the
11 line is closed.

12 MEMBER BALLINGER: Yes, he's doing it.

13 CHAIRMAN CORRADINI: Okay.

14 MEMBER BALLINGER: So at this point, we'll
15 go into -- wait until we get a confirmation. Done.

16 CHAIRMAN CORRADINI: Okay, so we'll go
17 into closed session.

18 (Whereupon, the above-entitled matter went
19 off the record at 3:44 p.m.)

20

21

22

23

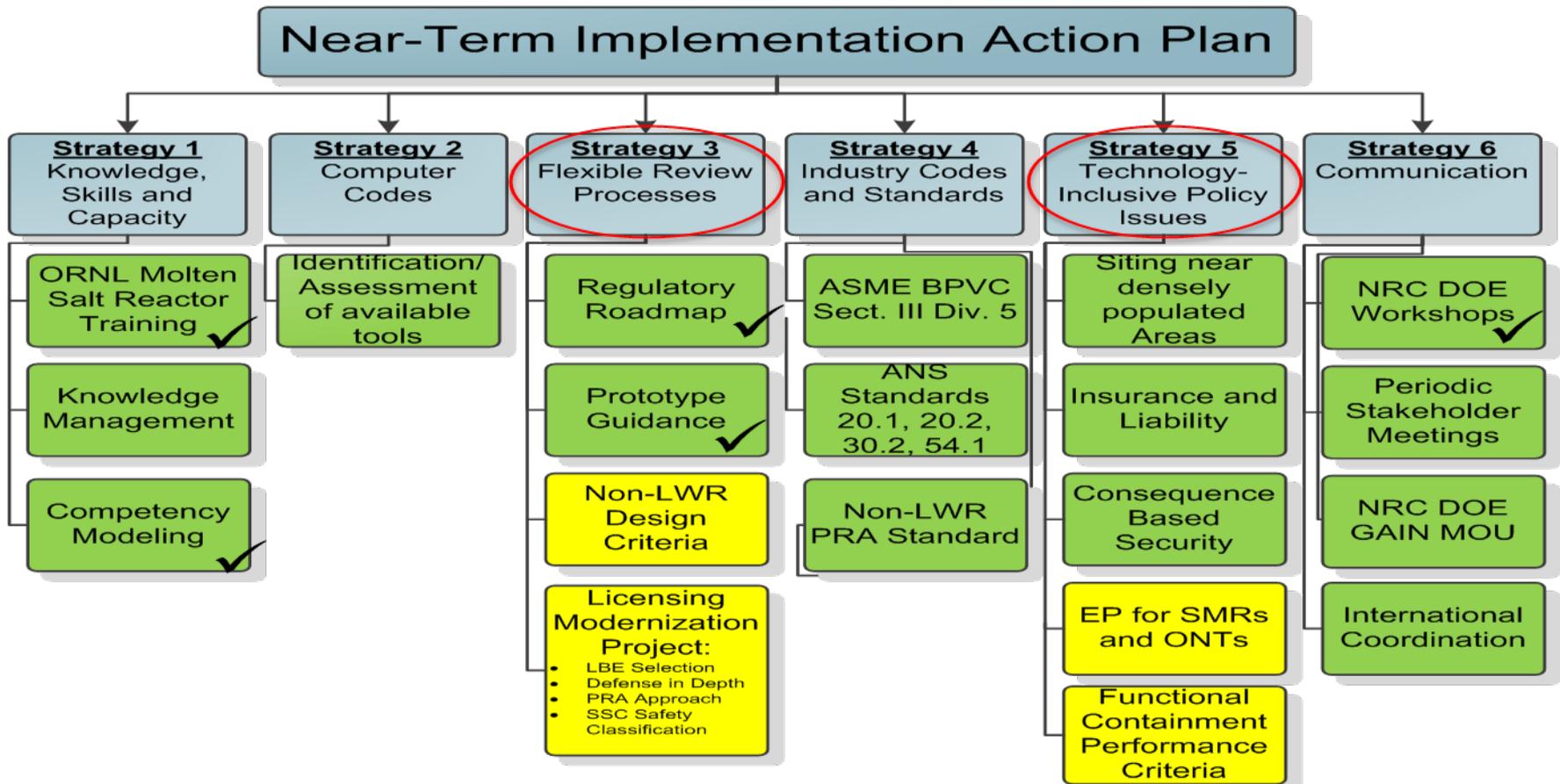
24

25

Non-Light Water Reactor Design Criteria ACRS Full Committee Meeting

Jan Mazza, Project Manager
Advanced Reactor and Policy Branch
March 8, 2018

Vision and Strategy for Advanced Reactors



ACRS Interactions for the Non-LWR Design Criteria RG

- 7/6/2016 - Future Plant Designs Subcommittee Meeting
- 2/22/2017 - Future Plant Designs Subcommittee Meeting
- 3/9/2017- Full Committee Meeting
- 3/22/2017 - ACRS Letter
- 5/10/2017 – Staff Response
- 2/7/2018 - Future Plant Designs Subcommittee Meeting
- 3/8/ 2018 - Full Committee Meeting

Recent Progress on the Non-LWR

Design Criteria RG

- **2-3-2017** DG -1330 Issued for 60 day public comment period
- **8-24-2017** Public meeting for staff interaction on public comments
- **11-1-2017** Additional Public Interaction on ARDC 17 and 26
- **1-15-2018** Draft Final RG 1.232 and Draft Public Comment Resolution Table issued for 2018 ACRS meetings
- **3-2018** Projected final RG issuance

Future Plant Designs Subcommittee

Meeting – February 7, 2018

- Subcommittee Comments were mainly in the areas of:
 - MHTGR-DC 10 Reactor Design
 - Design /Technology Specific Criteria
 - ARDC 16 Containment
 - ARDC, SFR-DC, MHTGR-DC 17 Electric Power Systems
 - ARDC, SFR-DC, MHTGR-DC 26 Reactivity Control Systems

MHTGR – DC 10

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
MHTGR-DC 10	SARRDL should be replaced with SAFDL. SARRDL would be difficult for designers to implement. SAFDL can be adapted in MHTGR designs using tristructural isotropic (TRISO) fuel.	Staff does not plan to modify MHTGR-DC 10 to replace SARRDL with SAFDL. Staff notes that the RG is flexible and that a designer could apply the SAFDL to TRISO fuel if desired. The following excerpt demonstrates this flexibility, <i>“...Applicants may use this RG to develop all or part of the PDC and are free to choose among the ARDC, SFR-DC, or MHTGR-DC to develop each PDC after considering the underlying safety basis for the criterion and evaluating the rationale for the adaptation described in this RG.”</i> ¹	1. RG page 12, “Intended Use of This Regulatory Guide,” paragraph 2.

MHTGR-DC 10 (cont.)

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
MHTGR-DC 10 (cont.)	SARRDL should be replaced with SAFDL. SARRDL would be difficult for designers to implement. SAFDL can be adapted in MHTGR designs using tristructural isotropic (TRISO) fuel.	The SARRDL concept was developed for the MHTGR to illustrate a method that a designer could use for this specific design type, i.e., modular High Temperature Gas-cooled Reactor which is defined in the RG as, “... <i>the category of HTGRs that use the inherent high temperature characteristics of tristructural isotropic (TRISO) coated fuel particles, graphite moderator, and helium coolant, as well as passive heat removal from a low power density core with a relatively large height-to-diameter ratio within an uninsulated steel reactor vessel. <u>The MHTGR is designed in such a way to ensure that during design basis events (including loss of forced cooling or loss of helium pressure conditions) radionuclides are retained at their source in the fuel and regulatory requirements for offsite dose are met at the exclusion area boundary.</u></i> ” ^{2,3}	<p>2. RG page 11, “Key Assumptions and Clarifications Regarding the non-LWR Design Criteria,” bullet 8.</p> <p>3. RG page C-1, “Modular High-Temperature Gas-Cooled Reactor Design Criteria,” paragraph 1.</p> <p>NOTE: the second sentence of the definition of MHTGR was added from the DOE Report.</p>

SFR – DC and MHTGR-DC

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
SFR-DC and MHTGR-DC	<p>These design criteria are highly design specific. They may cause confusion for designers with similar technology but not the same design features.</p>	<p>Staff agrees that the RG needs clarification regarding the design specific features of the SFR and MHTGR design criteria and a footnote was added in three places to provide clarification. The footnote reads, <i>“The technology-specific design criteria were developed using available design information, previous NRC pre-application reviews of the design types, and more recent industry and DOE national laboratory initiatives in these technology areas (see Reference 17). It is the responsibility of the designer or applicant to provide and justify the PDC for a specific design.”</i>⁴</p>	<p>4. Footnotes 3 (page 9), 13 (page B-1), and 14 (page C-1)</p>

SFR – DC and MHTGR-DC (cont.)

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
SFR-DC and MHTGR-DC (cont.)	These design criteria are highly design specific. They may cause confusion for designers with similar technology but not the same design features.	<p>Staff notes the maturity of the SFR and MHTGR designs is discussed in the RG on page 11 bullet 9 of the section titled, “Key Assumptions and Clarifications Regarding the non-LWR Design Criteria,” which reads, <i>“The SFR-DC and MHTGR-DC were developed because the designs were mature and the design features diverse for these technologies. Additional sets of technology-specific design criteria (e.g., MSRs, LFRs) may be developed in the future as more information about the designs becomes available.”</i>⁵</p> <p>This reinforces the concept that the SFR-DC and MHTGR-DC were developed from “mature designs.” It also notes that design criteria for other technologies may be developed in the future.</p>	5. RG page 11, “Key Assumptions and Clarifications Regarding the non-LWR Design Criteria,” bullet 9.

ARDC 16

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
ARDC 16	<p>Clarify how the “essentially leak-tight” requirement would apply to non-LWRs. Include a reference to Appendix J. Include the reference to offsite dose limits in 50.34 similar to SFR-DC 16.</p>	<p>A sentence was added to the rationale of ARDC 16 to clarify the performance of the leaktight barrier. The sentence reads, <i>“The assumed degree of leak tightness for a containment is used within safety analyses and plant performance requirements to confirm onsite and offsite doses are below limits as specified in 10 CFR 50.34.”</i>⁶</p> <p>Reference to Appendix J was not included since it is specific to LWRs. Staff notes that this design criterion may be modified in the future to incorporate the Commission’s decision on the, “Functional Containment Performance Criteria for Non-LWR Designs,” SECY Paper.</p>	<p>6. RG page A-5, ARDC 16 - Containment Design Rationale.</p>

ARDC 17, SFR-DC 17 and MHTGR-DC 17

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
ARDC 17, SFR-DC 17, MHTGR-DC 17	The use of “important to safety” to describe non-safety related functions (i.e., post-accident monitoring, control room habitability, emergency lighting, etc.) is not consistent with the NRCs use of this term.	<p>In response to this comment, the <u>rationale was modified</u> and ARDC 17 now reads, <i>“<u>In this context, important to safety functions refer to the broader, potentially non-safety related functions such as include post-accident monitoring, control room habitability, emergency lighting, radiation monitoring, communications and/or any others that may be deemed appropriate for the given design.</u>”</i>⁷</p> <p>This is consistent with the use of this term throughout the RG.</p>	7. RG pages A-6, B-8, and C-11 – ARDC, SFR-DC, and MHTGR-DC 17, Electric Power Systems Rationale.

ARDC 26, SFR-DC 26 and MHTGR-DC 26

Applicability	ACRS Comment	Discussion/Proposed Resolution	Modifications/Supporting Citations from the RG
ARDC 26, SFR-DC 26, MHTGR-DC 26	Provide a definition of “safe shutdown.”	The rationale for ARDC 26, SFR-DC 26, and MHTGR-DC 26, provides the characteristics of a “safe shutdown,” as described in SECY-94-084. The sentence reads, “SECY-94-084, “Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs” (Ref. 32), describes the characteristics of a safe shutdown condition as reactor subcriticality, decay heat removal, and radioactive materials containment.” ⁸	8. MHTGR-DC, ARDC, and SFR-DC 26, Reactivity Control Systems Rationale. RG pages A-12, B-14, and C-17,

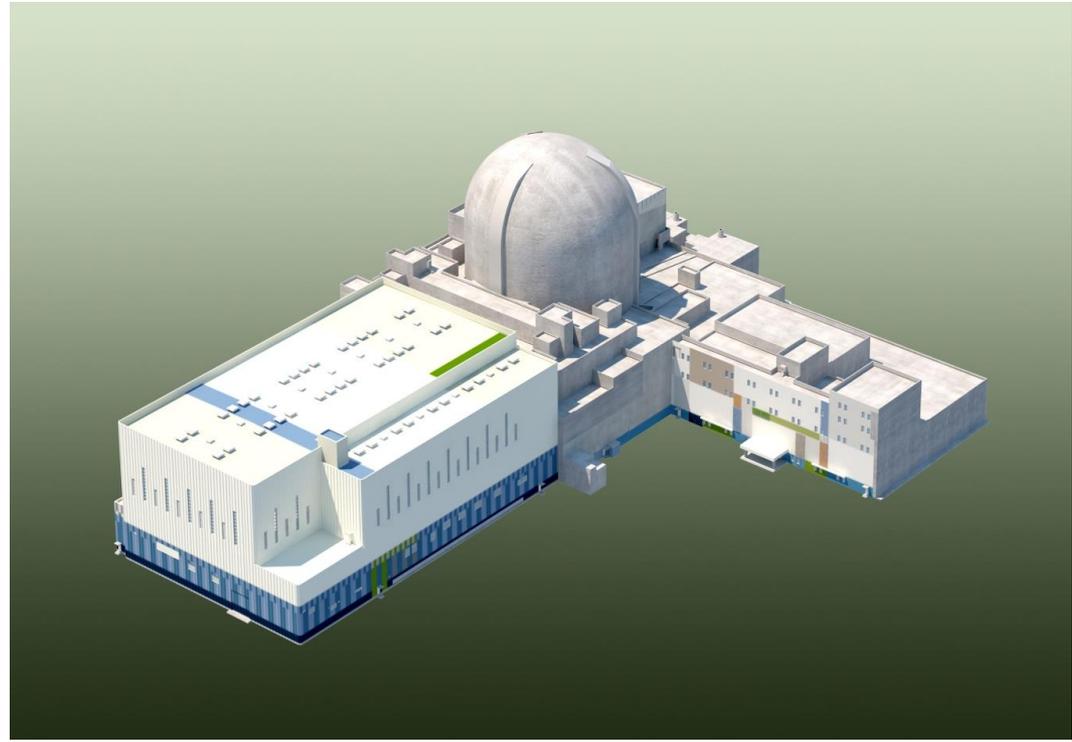
ARDC 26, SFR-DC 26 and MHTGR-DC 26

Applicability	ACRS Comment	Discussion/Proposed Resolution
ARDC 26, SFR-DC 26, MHTGR-DC 26	Clarify staffs response to public comment number 70. Does staff agree with the industry comment that reactors with passive or inherent shutdown capability can justify that a second means of shutdown is superfluous? Also clarify why design basis events were replaced with AOOs and postulated accidents.	<p>The staff did not agree with the industry comment that one reactivity system is adequate. As noted in ARDC 26 (2), “A means which is independent and diverse from the other(s) shall be shall be capable of controlling the rate of reactivity changes...” Therefore, a single means is not acceptable even when an inherent or passive means of reactivity control is present.</p> <p>The term design basis events was used (in DG-1330) consistent with the definition given in SRP 15.0. GDC 27, and hence ARDC 26, deal with normal operation, AOOs and design basis accidents and not external or natural events. The public comment stated that the meaning of design basis events was unclear (perhaps based on the inclusion of external events) and that the current GDCs don’t use or define the phrase design basis events. The staff does not agree that design basis is undefined or confusing in the case of ARDC 26, however, the commenter was correct that the GDCs use the phrase normal operation, including AOOs and postulated accidents to describe non-external events which form part of the licensing basis. Therefore, ARDC 26 was changed to AOOs and postulated accidents to be consistent with the current GDC language.</p>

Acronyms

ACRS	Advisory Committee for Reactor Safeguards
ARDC	Advanced Reactor Design Criteria
AOO	Anticipated Operational Occurrence
CFR	Code of Federal Regulations
DiD	Defense in Depth
DOE	U.S. Department of Energy
DC	Design Criteria
EPRI	Electric Power Research Institute
EP	Emergency Planning
EAB	Exclusion Area Boundary
GDC	General Design Criteria
LBE	Licensing Basis Event
LWR	Light Water Reactor
MHTGR	Modular High Temperature Gas Reactor
ONT	Other Nuclear Technologies
PDC	Principal Design Criteria
PRA	Probabilistic Risk Assessment
PRISM	Power Reactor Innovative Small Modular
RG	Regulatory Guide
SMR	Small Modular Reactor
SFR	Sodium-Cooled Fast Reactor
SAFDL	Specified Acceptable Fuel Design Limit
SARRDL	Specified Acceptable System Radionuclide Release Design Limit
SRM	Staff Requirements Memorandum
SSC	Structures, Systems, and Components

APR1400 DCA PLUS7 Fuel Design Topical Report



KEPCO/KHNP
March 8, 2018

ACRS FC Meeting (Mar. 8, 2018)

Contents

- **PLUS7 Fuel Design Features**
- **PLUS7 Fuel Experience**
- **Summary of Topical Report**
- **Progress Review**
- **RAI Status**
- **Attachments**
 - Acronyms

PLUS7 Fuel Design Features

● PLUS7 Fuel Design Development

- PLUS7 fuel design was jointly developed with Westinghouse for PWRs including APR1400 (1999~2002).
- PLUS7 fuel was developed to improve the fuel performance compared to Guardian.
 - Guardian : Standard fuel design for System80+
- KEPCO/KHNP submitted PLUS7 Topical Report to the NRC for approval in 2013.
 - PLUS7 Fuel Design : APR1400-F-M-TR-13001

PLUS7 Fuel Design Features

Reconstitutable top nozzle



- Guide post, holddown spring, holddown plate and adapter plate remains one piece

Inconel top/bottom grid

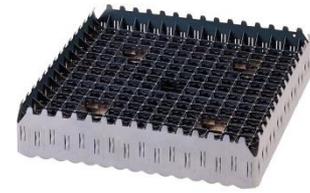


Mixing vaned mid grid



- Mixing vanes
→ Enhancing thermal margin
- Straight grid straps
→ Improving Seismic Resistance
- Conformal spring/dimple
→ Reducing GTRF

Protective grid for debris filtering



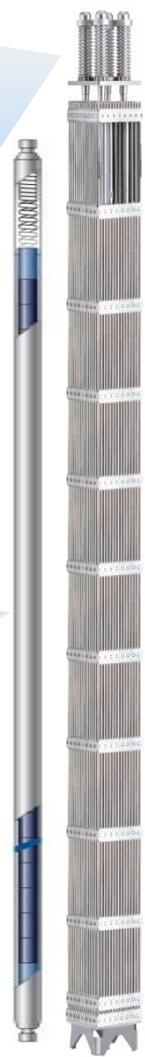
bottom nozzle



- Increasing debris filtering efficiency
- Small hole/slot bottom nozzle

Fuel rod

- Advanced cladding tube
→ ZIRLO tube
- Optimized rod OD
→ STD rod OD
- Axial blanket
→ Improving neutron economy



ACRS FC Meeting (Mar. 8, 2018)

PLUS7 Fuel Design Features

- PLUS7 incorporated the proven Guardian structure and the proven Westinghouse type fuel features.

Items		Guardian	RFA	PLUS7
Cladding		Zry-4	ZIRLO	ZIRLO
Rod Diameter		0.382"	0.374"	0.374"
Axial Blanket		No	Yes	Yes
Mid Grid	Spring	Cantilever	Diagonal	Conformal
	Dimple	Arched	Horizontal	Conformal
	Strap	Wavy	Straight	Straight
	Mixing Vane	No	Yes	Yes
Top Nozzle		Separated	Assembled	Assembled
Bottom nozzle		Large Hole	Small Hole	Small Hole & Slot

ACRS FC Meeting (Mar. 8, 2018)

PLUS7 Fuel Experience

● Operating Experience (5,244 FAs as of 2017)

Items	Year	2002	2006	2010	2017
PLUS7 In-Reactor Tests					
LTA's PSE (Hanul Unit 3 Cycle 5-7)		4 FAs			
CSA's PSE (Hanbit Unit 5 Cycle 5-7)			4 FAs		
PLUS7 Commercial Supply (13 Plants)					
Hanbit 3 (Cycle 11 ~ 17)			468 FAs		
Hanbit 4 (Cycle 10 ~ 17)			527 FAs		
Hanbit 5 (Cycle 5 ~ 12)			536 FAs		
Hanbit 6 (Cycle 5 ~ 12)			533 FAs		
Hanul 3 (Cycle 8 ~ 14)			532 FAs		
Hanul 4 (Cycle 7 ~ 13)			475 FAs		
Hanul 5 (Cycle 4 ~ 11)			529 FAs		
Hanul 6 (Cycle 3 ~ 10)			635 FAs		
Shinkori 1 (Cycle 2 ~ 4)			266 FAs		
Shinkori 2 (Cycle 2 ~ 3)			185 FAs		
Shinwolsong 1 (Cycle 2 ~ 4)			193 FAs		
Shinwolsong 2 (Cycle 2)					124
Shinkori 3 (Cycle 1)					241

ACRS FC Meeting (Mar. 8, 2018)

Summary of Topical Report

● PLUS7 Fuel Design

- PLUS7 fuel design was developed for application to PWRs including APR1400 (1999~2002).
- Design evaluation was performed to comply with code of federal regulations and the NRC regulatory documents.
- The maximum fuel rod average burnup is 60 GWD/MTU.
- Fuel assembly met all the design criteria related to the in-reactor mechanical integrity.
- Fuel rod satisfied all the design criteria related to the rod thermal performance and mechanical integrity.
- Design was verified through the out-of-pile tests, in-reactor verification tests, and operating experiences.

Progress Review

- **PLUS7 Fuel Topical Report (APR1400-F-M-TR-13001)**

- 2013 : TR (Rev.0) was submitted.
- 2014 : The responses for the first RAIs (4-7542) were submitted.
- 2015 : For the TCD issue, applying penalty was recommended.
- 2016 :
 - ✓ The responses for the second RAIs (5-7954) were submitted except TCD issue.
 - ✓ More than 10 conference calls were conducted.
 - ✓ Face-to-face meeting for TCD penalty methodology was performed with the NRC staffs.

Progress Review

- **PLUS7 Fuel Topical Report (cont'd)**

- 2017 :
 - ✓ The TCD penalty methodology was developed.
 - ✓ Revised TR (Rev.1) including TCD penalty methodology was submitted.
 - ✓ The revised responses for RAI (5-7954) were submitted.
- ACRS SC for PLUS7 TR was held in January 2018.

RAI Status

- **No open Items**

- 24 Questions for PLUS7 fuel design were issued and KHNP responded as of 2017.
- Currently, no open items remain.

- **RAI Status**

Area	No. of Questions	No. of Responses	No. of Not Responded	No. of Open Items
Fuel Assembly	11	11	0	0
Fuel Rod	13	13	0	0

ACRS FC Meeting (Mar. 8, 2018)

RAI Status

- **The TCD (Thermal conductivity degradation) issue was complete.**
 - All the RAIs including impact of TCD have been resolved.
 - The revised TR (Rev.1) was submitted in 2017.
 - Changes in DCD in response to the RAIs are incorporated in the next revision of DCD (Rev.2).

Attachments : Acronyms

- APR1400 : Advanced Power Reactor 1400
- CSA : Commercial Surveillance Assembly
- DCD : Design Control Document
- FC : Full committee
- GTRF : Grid-To-Rod Fretting
- KHNP : Korea Hydro & Nuclear Power company
- LTA : Lead Test Assembly
- NRC : Nuclear Regulatory Commission
- OD : Outer Diameter
- PWRs : Pressurized Water Reactors
- PSE : Poolside Examination
- RAI : Request for Additional Information
- RFA : Robust Fuel Assembly
- SC : Subcommittee
- STD : Standard
- TCD : Thermal Conductivity Degradation
- TR : Topical Report

ACRS FC Meeting (Mar. 8, 2018)



Presentation to the ACRS Full Committee

Korea Hydro Nuclear Power Co., Ltd (KHNP)

PLUS7 Fuel Design for the APR1400 Topical Report Review

March 8, 2018

- **Technical Staff Presenters**

- ♦ Christopher Van Wert

- **Project Managers**

- ♦ Bill Ward – Lead Project Manager
- ♦ George Wunder – PLUS7 Topical Report Project Manager

Staff Review Team

- ♦ **Christopher Van Wert**
Reactor Systems, Nuclear Performance & Code Review Branch
- ♦ **Ken Geelhood**
Pacific Northwest National Laboratory

Technical Review Topics

Areas of Review

- The fuel system safety review provides assurance that:
 - ♦ the fuel system is not damaged as a result of normal operation and anticipated operational occurrences (AOOs)
 - ♦ fuel system damage is never so severe as to prevent control rod insertion when it is required
 - ♦ the number of fuel rod failures is not underestimated for postulated accidents
 - ♦ coolability is always maintained
- To provide these assurances, specified acceptable fuel design limits (SAFDLs) are established that should not be exceeded during any condition of normal operation, including the effects of AOOs
- Standard Review Plan (SRP) Section 4.2 establishes the criteria for fuel system damage, fuel rod failure, and fuel coolability

SRP Section 4.2 Criteria for Fuel System Damage, Fuel Rod Failure, and Fuel Coolability

- Fuel System Damage
 - Stress, strain, or loading limits for spacer grids, guide tubes, thimbles, fuel rods, control rods, channel boxes, and other fuel system structural members
 - Fatigue of structural members mentioned above
 - Fretting wear at contact points
 - Oxidation, hydriding and CRUD buildup
 - Dimensional changes and mechanical compatibility
 - Rod internal gas pressure
 - Worst case hydraulic loads
 - Control rod reactivity and insertability
- Fuel Rod Failure
 - Hydriding
 - Cladding collapse
 - Overheating of the cladding
 - Overheating of the fuel pellets
 - Excessive fuel enthalpy
 - Pellet/cladding interaction
 - Bursting
 - Mechanical fracturing
- Fuel Coolability
 - Cladding embrittlement
 - Violent expulsion of fuel
 - Generalized cladding melting
 - Fuel rod ballooning
 - Structural deformation

Assembly and Assembly Component Other Than Fuel Rod Design Basis, Criteria, and Evaluation

- All design basis, criteria, and evaluations were reviewed
 - ♦ One RAI was submitted for clarification
 - ♦ Sample calculations and other information was provided for audit to the staff in the electronic reading room
- The analyses were found to be based on previously approved methods and consistent with the guidance provided in SRP Section 4.2.

Fuel Rod Analysis Methodology Evaluation

- NRC approved codes and methods were used for fuel rod design analysis
- Review process identified non-conservatism in the handling of burnup dependent thermal conductivity degradation (TCD)
 - ◆ Staff concerns captured in IN-2009-23

Impacts of Thermal Conductivity Degradation

- KHNP evaluated the impacts of TCD on the fuel rod design analyses:
 - Cladding stress (✓)
 - Cladding strain (✓)
 - Cladding fatigue (✓)
 - Cladding oxidation and hydriding (×)
 - Fuel rod internal pressure (✓)
 - Internal hydriding (×)
 - Cladding collapse (×)
 - Overheating of cladding (Ch15)
 - Overheating of fuel pellets (✓)
 - Excessive fuel enthalpy (Ch15)
 - Pellet-to-cladding interaction (N/A)
 - Bursting (Ch15)
 - Cladding embrittlement (Ch15)
 - Violent expulsion of fuel (Ch15)
 - Generalized cladding melting (N/A)
 - Fuel rod ballooning (Ch15)

(✓) Potentially Impacted by TCD

(×) Not impacted by TCD

(Ch15) Are analyzed and reviewed as part of Chapter 15 of the DCD

(N/A) Less limiting than another analysis and therefore not performed

- KHNP addressed FATES3B TCD deficiencies by re-running affected analyses with either a modified NFI correlation or by applying a temperature penalty.

TCD Resolution

- Methodology was revised to include a burnup-dependent temperature penalty applied to FATES-3B results
 - ♦ Penalty is based on comparisons of FATES-3B predictions against available measured test data from Halden
- Staff review included confirmatory runs and the data set used to develop temperature penalty
- Staff concludes that the methodology ensures that fuel temperatures are appropriately modeled and that the revised analyses demonstrate that the impacted SAFDLs are not exceeded

Conclusions

- The staff concludes that APR1400-F-M-TR-13001, Revision 1 demonstrates that the PLUS7 fuel assembly design meets all regulatory requirements and that specifically:
 - ♦ the fuel system is not damaged as a result of normal operation and anticipated operational occurrences (AOOs)
 - ♦ fuel system damage is never so severe as to prevent control rod insertion when it is required
 - ♦ the number of fuel rod failures is not underestimated for postulated accidents
 - ♦ coolability is always maintained
- The review of fuel performance for postulated accidents covered by Chapter 15 will be presented during the Chapter 15 presentation.