

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards

Docket Number: (n/a)

Location: teleconference

Date: Wednesday, March 3, 2021

Work Order No.: NRC-1424

Pages 1-171

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

+ + + + +

683RD MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

WEDNESDAY

MARCH 3, 2021

+ + + + +

The Advisory Committee met via
Teleconference, at 9:30 a.m. EST, Matthew W. Sunseri,
Chairman, presiding.

COMMITTEE MEMBERS:

MATTHEW W. SUNSERI, Chairman

JOY L. REMPE, Vice Chairman

WALTER L. KIRCHNER, Member-at-Large

RONALD G. BALLINGER, Member

DENNIS BLEY, Member

CHARLES H. BROWN, JR., Member

VESNA B. DIMITRIJEVIC, Member

JOSE MARCH-LEUBA, Member

DAVID PETTI, Member

PETER RICCARDELLA, Member

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

ACRS CONSULTANTS :

MICHAEL L. CORRADINI

STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL :

DEREK WIDMAYER

CONTENTS

1

2 Opening Remarks 4

3 Intergrated Human Event Analysis System -

4 General Methodology Report Preparation 9

5 Regulatory Guide 1.240, "Fresh and

6 Spent Fuel Criticality/Analyses" 12

7 Gateway for Accelerated Innovation in

8 Nuclear (GAIN) and Advanced Reactor

9 Demonstration Program (ARDP) 93

10 Adjourn 171

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

P R O C E E D I N G S

9:30 a.m.

CHAIRMAN SUNSERI: Good morning, everyone, it's 9:30 a.m., we will convene the meeting. The meeting will now come to order. This is the first day of the 683rd meeting of the Advisory Committee on Reactor Safeguards.

I am Matthew Sunseri, Chair of the ACRS. I'll now call the roll and verify communications.

Ron Ballinger?

MEMBER BALLINGER: Here.

CHAIRMAN SUNSERI: Dennis Bley?

CHAIRMAN BLEY: I'm here.

CHAIRMAN SUNSERI: Charles Brown? Charles let me know he might be disposed for a few minutes at the beginning of this so he expects to join soon. Vesna Dimitrijevic?

MEMBER DIMITRIJEVIC: Here.

CHAIRMAN SUNSERI: Walt Kirchner?

MEMBER KIRCHNER: Here.

CHAIRMAN SUNSERI: Jose March-Leuba?

MEMBER MARCH-LEUBA: Yes.

CHAIRMAN SUNSERI: David Petti?

MEMBER PETTI: Here.

CHAIRMAN SUNSERI: Joy Rempe?

NEAL R. GROSS

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

1 VICE CHAIRMAN REMPE: Here.

2 CHAIRMAN SUNSERI: Pete Riccardella?

3 MEMBER RICCARDELLA: Here.

4 CHAIRMAN SUNSERI: All right, very good,
5 we have a quorum. The ACRS was established by the
6 Atomic Energy Act and is governed by the Federal
7 Advisory Committee Act.

8 The ACRS Section of the U.S. NRC public
9 website provides information about the history of the
10 ACRS and provides documents, such as our charter
11 bylaws, Federal Register notices for meetings, letter
12 reports, and transcripts of all full and Subcommittee
13 meeting, including the slides presented at the
14 meeting.

15 The Committee provides its advice on
16 safety matters to the Commission through its publicly
17 available letter reports.

18 The Federal Register notice announcing
19 this meeting was published on February 12, 2021 and
20 provided an agenda and instructions for interested
21 parties to provide written documents or request
22 opportunities to address the Committee.

23 The designated federal officer for this
24 meeting is Mr. Derek Widmayer.

25 At today's meeting, the Committee will

1 consider the following. We will be preparing a letter
2 report on the integrated human event analysis system
3 general methodology.

4 Following that, we will have two
5 briefings, one on the Regulatory Guide 1.24, fresh and
6 spent fuel criticality analysis. And the second, the
7 gateway for accelerated innovation in nuclear and
8 advanced reactor demonstration program. We will
9 finish the day with continuation of the report writing
10 if necessary.

11 A bridge line has been opened to allow
12 members of the public to listen in on presentations
13 and Committee discussions. We have received no
14 written comments or requests to make oral statements
15 from members of the public regarding today's session.

16 I just want to remind everyone that
17 members of the ACRS Staff monitor the remote aspects
18 of the meeting so there is no need for participants to
19 intervene if there's problems with open mics,
20 feedback, or other communication problems.

21 There will be an opportunity for public
22 comment. We will set aside time for comments in the
23 agenda from members of the public attending or
24 listening to our meeting.

25 Written comments may be forwarded to Derek

1 Widmayer, the designated federal officer. A
2 transcript of the open portion of the meeting is being
3 kept and it is requested that the speakers identify
4 themselves and speak with sufficient clarity and
5 volume so that they may be readily heard.

6 And lastly, participants should mute
7 themselves when not speaking. I have a couple of
8 comments to make before we get started with the
9 agenda.

10 First, I want to acknowledge we are
11 approaching the ten-year mark since the great East
12 Japan earthquake. The earthquake and associated
13 tsunamis were triggers for the accidents at Fukushima
14 Daiichi Nuclear Station and emergency responses at
15 several other nuclear facilities.

16 The global nuclear industry response was
17 broad indeed. Corrective actions are enduring and we
18 see examples in our work ten years after the event.

19 There was an additional toll on society as
20 a result of the earthquake. In Japan, it was reported
21 that over 120,000 buildings were totally collapsed,
22 280,000 half collapsed, and nearly 700,000 others
23 damaged.

24 There were over 16,000 reported deaths,
25 6000 injuries, and 2500 people reported missing. So,

NEAL R. GROSS

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

1 here we are ten years later and I can't tell how broad
2 or deep the global response was to this part of the
3 tragedy. I do see the actions we can take though.

4 Today, we are facing another issue
5 associated with natural forces, and that's climate
6 change. The nuclear industry is promoting the
7 advancement of nuclear energy as part of the solution
8 to the threat of carbon emissions to our atmosphere.

9 I anticipate that we will see a wide
10 variety of designs and concepts seeking approval to
11 operate, and I look forward to our role in ensuring
12 the safety of these reactors.

13 Next, on a sad note, I want to pay
14 respects to a former ACRS member that recently passed
15 away. Don Barton was appointed in 1996. He was a
16 retired executive at General Public Utilities
17 Corporation, and a graduate of the U.S. Merchant
18 Maritime Academy.

19 John began his career in the nuclear
20 industry in 1960 working in a nuclear program before
21 joining GPU in 1971. Regarding Barton's work on ACRS,
22 former ACRS Chair John Stetkar said, and I quote, John
23 read everything, much more than I could ever hope to
24 digest.

25 We all know Stetkar so I can't think of a

NEAL R. GROSS

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

1 better testament to John Barton's commitment and hard
2 work in support of ACRS than those words. Thank you.

3 Now, I'd like to open the floor to Members
4 for input, comments, or questions regarding today's
5 agenda. No comments, all right. So, we will now
6 transition into the first item of the agenda and that
7 is report-writing for human event analysis system
8 general methodology report.

9 Dennis Bley will be leading us through
10 this part of the session and I will turn it over to
11 Dennis.

12 CHAIRMAN BLEY: Thank you very much, Mr.
13 Chairman. Matt, I've been having my sound get
14 intermittent. If I should get cut off, if you'd
15 continue reading I'd appreciate it. I'll come back in
16 on the phone line if I need to.

17 PARTICIPANT: Dennis, I just want to say
18 I thought Matt was cutting in and out as well so it's
19 not as crisp as in the past.

20 CHAIRMAN BLEY: We'll do the best we can.
21 Before I read through the letter, you're going to
22 notice it's a little different in format than we
23 usually use.

24 I adopted the same format we used on two
25 previous letters on this issue and I think it works

NEAL R. GROSS

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

1 better this way because it puts the focus right on the
2 2006 SRM. So, that's why it's a little different.

3 I'm hearing people talking or noise.

4 CHAIRMAN SUNSERI: There is some feedback
5 going on so if you're not speaking, close your mic,
6 please. Mute yourself. Go ahead, yes. Dennis, did we
7 lose you?

8 Are you there?

9 CHAIRMAN BLEY: Somebody muted me.

10 CHAIRMAN SUNSERI: Yes, I think the Staff
11 did. When we get those problems back, once the staff
12 do so when they do that, they can't unmute you, you
13 have to unmute yourself.

14 CHAIRMAN BLEY: Thanks for telling me
15 because I had no idea. This letter is to the Chairman
16 and the subject is NRC Human Reliability Methods for
17 Chairman Hansen.

18 In November 8, 2006 Staff requirements
19 memorandum resulting from the October 20, 2006 meeting
20 with the Advisory Committee of Reactor Safeguards, the
21 Commission directed us to work with the Staff and
22 external stakeholders to evaluate the different human
23 reliability models in an effort to propose either a
24 single model for the Agency to use or guidance on
25 which models should be used in specific circumstances.

NEAL R. GROSS

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

1 (Whereupon, the above-entitled matter went
2 off the record at 9:36 a.m. and resumed at 9:39 a.m.)

3 CHAIRMAN SUNSERI: All right, there was a
4 bunch of shuffling and it was quite loud on my end.
5 Yes, okay, so we will call the roll now starting with
6 Ron Ballinger?

7 MEMBER BALLINGER: Here.

8 CHAIRMAN SUNSERI: Dennis Bley? You can
9 unmute now. Charles Brown?

10 MEMBER BROWN: Here.

11 CHAIRMAN SUNSERI: Vesna Dimitrijevic?

12 MEMBER DIMITRIJEVIC: I am here.

13 CHAIRMAN SUNSERI: Walt Kirchner?

14 MEMBER KIRCHNER: Here.

15 CHAIRMAN SUNSERI: Jose March-Leuba?

16 MEMBER MARCH-LEUBA: Yes.

17 CHAIRMAN SUNSERI: David Petti?

18 MEMBER PETTI: Here.

19 CHAIRMAN SUNSERI: Joy Rempe?

20 VICE CHAIRMAN REMPE: Here.

21 CHAIRMAN SUNSERI: Pete Riccardella?

22 MEMBER RICCARDELLA: Here.

23 CHAIRMAN SUNSERI: And I'll go back to
24 Dennis, I know you're there, Dennis.

25 CHAIRMAN BLEY: You're right.

NEAL R. GROSS

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

1 CHAIRMAN SUNSERI: So, we're going to
2 reconvene the sessions here for today. Our afternoon
3 topic is regulatory guide 1.24, Fresh and Spent Fuel
4 Criticality Analyses.

5 Ron Ballinger will be facilitating this
6 part of the discussion.

7 I just want to let those that are
8 listening in that we do have a -- I'll call it for
9 lack of a better term a carryover item from our last
10 full Committee meeting planning and procedures
11 session, where we are going to propose writing a
12 letter on control of access, digital INC control of
13 access.

14 So, we will use the time in agenda slide
15 for report preparations, like for example, 3.3, 4.3,
16 et cetera, and we'll use that time management to make
17 sense today. So, I just wanted to give everyone a
18 heads-up on that.

19 Any questions before we move on? All
20 right, I will yield the floor to Dr. Ballinger.

21 MEMBER BALLINGER: Thank you, Mr.
22 Chairman. This presentation relates to actually a new
23 Reg Guide, which is a summation and recommendations
24 related to performing criticality analysis for spent
25 or fuel storage.

NEAL R. GROSS

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

1 And the Reg Guide endorses, with a few
2 exceptions, NEI 12-16. It turns out that the spent
3 fuel pool criticality analysis has evolved, if you
4 want to use that word, over time, actually, from the
5 earlier note that I could find.

6 It's the so-called Kopp memo in 1998,
7 which described the Staff's thoughts related to
8 performing this analysis.

9 But spent fuel pools have evolved with
10 time, storage density has gone up and everything. And
11 so the analysis that's required has evolved, if you
12 will, with that.

13 And it's resulted in a number of analysis
14 go back and forth between the Staff every time
15 analysis is done to go back and forth and make sure
16 it's in agreement with the Staff's idea of what goes
17 on.

18 So, this Reg Guide basically incorporates
19 all of this guidance into one place for this type of
20 analysis. So, I would turn it over to -- if he's on,
21 I hope -- Mr. Lukes to give us some opening remarks as
22 well.

23 And he can correct something I may have
24 said incorrectly.

25 VICE CHAIRMAN REMPE: Ron, before we

NEAL R. GROSS

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

1 start, I thought you were going to make the
2 announcement, but I do have to recuse myself from this
3 discussion because of conflict of interests concern.

4 MEMBER BALLINGER: I didn't know.

5 VICE CHAIRMAN REMPE: I did copy you on
6 the emails, but anyway, I've made the announcement.
7 If there's a better way to say it, Chris, please speak
8 up and say it.

9 MR. BROWN: You're correct, Joy, and we
10 did note it on the conflict of interests memo.

11 MEMBER BALLINGER: It's my cognitive
12 impairment. Okay, so Bob Lukes, are you there?

13 MR. LUKES: Yes, can you hear me?

14 MEMBER BALLINGER: Yes.

15 MR. LUKES: First of all, you said
16 everything correctly. So, my name is Bob Lukes, I am
17 the Branch Chief for the Nuclear Methods and Fuels
18 Branch in NRR.

19 We appreciate the opportunity to present
20 to the ACRS our new Reg Guide. As you stated, it's
21 GG1373 Fresh and Spent Fuel Criticality Analyses.

22 As was said, this Reg Guide endorses with
23 clarification any guidance document, 1216, guidance
24 for performing criticality analysis of spent fuel
25 storage and lightwater reactor power-plants.

NEAL R. GROSS

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

1 The NRC is issuing this Reg Guide to
2 describe and approach that is acceptable for
3 Applicants and licensees under 10 CFR Part 50 and 52
4 to demonstrate that the NRC regulatory requirements
5 are met for subcriticality, appeal assemblies, stored
6 in new fuel vaults and spent fuel pools.

7 This Reg Guide is the culmination of
8 several years of work by both the NRC and NEI. This
9 new Reg Guide will provide clarity and certainty to
10 the life expectancy regarding spent fuel criticality
11 analysis.

12 As always, we look forward to your
13 questions and comments on the Reg Guide. Thank you,
14 that's it.

15 MEMBER BALLINGER: This is Ron again. I
16 might add that I reviewed this document back, I think,
17 in June or July and recommended against the letter but
18 that we should wait until we get the public comments
19 back to make a decision.

20 So, one of the decisions we need to make
21 today amongst the Committee is do we want a letter or
22 not? So, I think that's all I needed to say
23 additionally.

24 So, I guess Ben Holtzman is here,
25 hopefully.

1 MR. HOLTZMAN: Yes, I'm here, can you guys
2 hear me?

3 MEMBER BALLINGER: Yes, the floor is
4 yours.

5 MR. HOLTZMAN: Wonderful, thank you, good
6 afternoon. My name is Ben Holtzman from the Nuclear
7 Energy Institute. I'm joined today by Hatice Akkurt
8 and Bob Hall from EPRI.

9 On behalf of the industry presentation
10 team and the industry in general, I'd like to thank
11 the ACRS for their interest in this important topic.

12 Additionally, I'd like to thank both ACRS
13 and the NRC in their efforts in putting together this
14 meeting and giving us the opportunity to share our
15 perspective for NEI 1216 and the associated guidance
16 development process in general.

17 The issues addressed in NEI 1216 and the
18 related documents have a long history of strong NRC
19 engagement and we look forward to reaching a
20 conclusion that provides regulatory certainty and
21 predictability for both industries and NRC.

22 Looks like that's working. So, the origin
23 of this work dates back to 2006 when NRC Staff brought
24 additional oversight to criticality issues associated
25 with spent fuel pools.

NEAL R. GROSS

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

1 This created uncertainty in the regulatory
2 framework and resulted in utility LARs submissions
3 being held to a shifting regulatory standard as NRC
4 questioned existing regulatory practice that was not
5 formally documented, such as the Kopp memo.

6 NRC then issued interim Staff guidance in
7 2010 that applied to additional conservatisms,
8 compared to the Kopp memo, but did not give industry
9 regulatory certainty and predictability for spent fuel
10 criticality LARs.

11 In response, EPRI sponsored work to
12 qualify the depletion and uncertainty and determine
13 whether the uncertainty used in the Kopp memo was in
14 fact conservative.

15 Simultaneously, NEI began the effort to
16 develop guidance on acceptable methods for performing
17 spent fuel pool criticality safety analyses, NEI 12-
18 16.

19 The goal of this effort was and remains to
20 provide durable guidance that enables consistent
21 criticality analyses for Applicants and reviewers.

22 Historically, spent fuel pool criticality
23 analyses were straightforward but over time they
24 became more complicated because of the implementation
25 of new fuel types and multiple burnable absorbable

NEAL R. GROSS

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

1 materials.

2 Furthermore, utilities began to use more
3 complex arrangements within the spent fuel pool, such
4 as having pools that consisted of multiple regions.
5 I want to stress that while these previous analyses
6 were simple, they were very safe, just less complex.

7 It was the implementation of these more
8 complex spent fuel pool management strategies that led
9 to more complex criticality analyses and that, in
10 turn, led to the need for more guidance.

11 So, as I mentioned, this issue has a long
12 history of engagement between NRC, industry, and EPRI.
13 These interactions have taken the form of numerous
14 public meetings, RAIs, even a full week audit by NRC
15 back in October of 2016.

16 This has resulted in very detailed
17 guidance backed by technical justification. The work
18 from the beginning was two parallel efforts that were
19 being done in tandem, the NEI 1216 guidance and that
20 work which was informed by the EPRI benchmark reports.

21 So, a little bit of the timeline or
22 history of this was first we had NEI 1216 Rev 0 and
23 the EPRI benchmarks that were initially being
24 developed and then submitted to NRC back in March of
25 2013.

NEAL R. GROSS

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

1 This led to extensive public dialog with
2 NRC through a series of four-day public meetings NRC
3 Staff and management that took place between September
4 of 2013 and February of 2014, resulting in alignment
5 on acceptable methodologies for criticality analyses,
6 which were documented in meeting summaries and then
7 reflected in a revised NEI 1216, which was submitted
8 as Rev 1 to NRC in April of 2014.

9 We also had then Revision 2, which was
10 submitted in January of 2017. So, part of the reason
11 for this revision was that the neutron-absorbing
12 monitoring section had been removed and moved to NEI
13 1603 based on agreement with NRC.

14 NEI 1603 was submitted as the topical
15 report in August of 2016 and a final safety evaluation
16 or SER was received in March of 2017.

17 I want to highlight that this is a great
18 success story for both industry and NRC as it took
19 less than a year from submission to approval of NEI
20 1603.

21 We also then subsequently had NEI 1216
22 Revision 3, which was submitted in March of 2018, and
23 then Revision 4 which was submitted in September of
24 2019.

25 The EPRI benchmarks received final

1 approval in January of 2020. Next, I'd like to
2 highlight a few important topics that are noted in the
3 documents that will be further elaborated on in the
4 EPRI portion of the presentation that's coming up.

5 Specifically, the calculation of the
6 maximum K effectives, the depletion code validation,
7 and the criticality analysis checklist.

8 So, with that, I will transition to the
9 EPRI portion. Hatice? Hatice, you're on mute if you
10 can hear me.

11 MEMBER BALLINGER: Well, we've already
12 achieved something that I've learned and I've now
13 learned how to pronounce her name. Is she on?

14 PARTICIPANT: If you're on the phone, you
15 can star 6 to umute yourself.

16 MEMBER BALLINGER: She's logged in.

17 MS. AKKURT: Can you hear me now?

18 MEMBER BALLINGER: Yes, you're a little
19 soft.

20 MS. AKKURT: Okay, I will try to speak
21 louder.

22 MEMBER BALLINGER: Thank you.

23 MS. AKKURT: Very much. I didn't realize
24 I had to star 6 and unmute myself. Thank you, Ben,
25 I'm Hatice Akkurt from EPRI. I will get started with

NEAL R. GROSS

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

1 my notes from EPRI and then Bob from EPRI will take
2 over from that.

3 Next slide, please, Ben. So, one of the
4 most challenging problems in this review for us was
5 how to handle the decision of uncertainty and bias.

6 And if you know spent fuel is mostly the
7 trap of spent fuel and if you are going to apply burn-
8 out credit, then it can cause detonation and depletion
9 of uncertainty, it needs to be addressed.

10 So, going back one step, fresh fuel
11 normally can call the experiment from intonation of
12 the focus for experiment used for code validations.
13 There are hundreds of applicable experiments that can
14 be looked at.

15 When it comes to spent fuel, there are
16 many experiments moving spent fuel, and performing
17 critical experiments using spent fuel is very
18 expensive and there are not many supposed to be there.

19 MEMBER BALLINGER: Pardon me, but there's
20 somebody that has their microphone on and we're
21 getting a fair amount of background noise. Can you
22 mute your microphone, please?

23 Thank you.

24 MS. AKKURT: We are hearing a lot of
25 background. Can you mute yourself?

NEAL R. GROSS

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

1 MEMBER KIRCHNER: Ron? This is Walt.
2 We're getting a lot of cross --

3 (Simultaneous speaking.)

4 MEMBER KIRCHNER: Somebody has a number
5 410-768-1803 needs to mute their phone. We had that
6 --

7 (Simultaneous speaking.)

8 MR. BROWN: That's the bridge line.
9 There's another 980 number that's showing a lot of
10 static on it too.

11 MS. AKKURT: 980 is myself. I am talking.

12 MEMBER BALLINGER: The static has
13 disappeared so somebody's done something, thank you.

14 MS. AKKURT: Sorry about that. I hope the
15 audio quality is improved now.

16 So, as I mentioned, for bridge fuel you
17 have options. You can use the critical experiments in
18 the handbook but when it comes to spent fuel, there
19 are no critical experiments and performing critical
20 experiments is very expensive.

21 And using the bridge fuel assumption is
22 overanalyzing, obviously. Then the question of
23 uncertain bias and bias for spent fuel criticality
24 analysis is a big one.

25 So, in 1990, Ron, earlier you mentioned in

NEAL R. GROSS

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

1 your opening remarks, NRC Staff Kopp issued a memo and
2 basically, it stated that in the absence of any other
3 data or methodology, an uncertainty that equals five
4 percent of the reactivity cb4 used.

5 And this uncertainty, five percent, is
6 accounting for I just saw the data and everything else
7 for all those uncertainties.

8 Given that this was easy to justified, it
9 has been used by utilities in many of the
10 applications. So, around 2009, this company was
11 challenged for the technical justification behind the
12 Kopp memo.

13 So, at that time, NRC sponsored the
14 Oakridge Lab, which is based on chemical and same
15 measurements.

16 Chemical and same measurements is the fact
17 that it contains a lot of measurement uncertainty,
18 therefore, it is propagated into the methodology and
19 at least preliminary industry that Kopp memo means not
20 necessarily conservative or close to burnup range.

21 EPRI also sponsored the development and
22 methodology. EPRI methodology is based on actual
23 practical data from four operating reactors using the
24 44 cycle flux map data.

25 The good thing is that flux map data

NEAL R. GROSS

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

1 contains much smaller measurements of uncertainties.
2 So, EPRI was developed in the two reports that are
3 listed at the bottom of the flight.

4 And these two reports have been submitted
5 for NRC review and topic report until the NEI
6 umbrella, as Bob mentioned earlier.

7 Next slide. So, EPRI then goes through
8 the review cycle and we had multiple rounds of REI and
9 public meetings, and eventually, we got the final test
10 evolution report in July of 2019 and published the
11 report in September.

12 The report influenced all the rounds of
13 REIs, the REI responses, the draft and final SVA.
14 Now, the important thing to note here is EPRI
15 benchmarks as a result of uncertainty and bias values
16 that are determined as a function of burnout.

17 The first thing that has ever been on the
18 table that is on this slide is uncertainties are much
19 less than five percent so the technical basis for Kopp
20 memo is now demonstrated.

21 And also for those who would like to get
22 additional margins, there is additional margins as a
23 function of burnup.

24 MEMBER MARCH-LEUBA: Can I ask you a
25 question? This is Jose March-Leuba. It's interesting

NEAL R. GROSS

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

1 that the uncertainty seems to grow with the lower
2 gigawatt burnout.

3 Granted, there are very few bundles with
4 10 gigawatts in the spent fuel pool but you never
5 found the peak. You would expect there to be a peak.
6 It could have grown greater than 5 at 5 gigawatts.

7 Do you understand why it goes up? I
8 suspect that it's because of the aluminum modeling.
9 Do you know the uncertainty is larger on the lower
10 burnout?

11 MS. AKKURT: So, this is in percentage so
12 in percentage it's larger but if you look at the
13 absolute values, the uncertainty is higher for higher
14 burnout.

15 MEMBER MARCH-LEUBA: So, this is percent
16 of delta K, not percent of delta K over K?

17 MS. AKKURT: Yes, this is percent of
18 reactivity. It's in percentage but if you have the
19 absolute values in the report too, but for delta K,
20 percentage is found to be easier to implement.

21 So, the first thing is in terms of
22 absolute value, it is lower. And the second reason
23 you exactly answered the question, part of the issue
24 is that obviously you don't have many values at ten so
25 the data is relative there.

NEAL R. GROSS

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

1 And also, at zero it is delta zero so we
2 are starting at zero.

3 MEMBER MARCH-LEUBA: That was my point,
4 there will be a peak that doesn't feel like it's going
5 to hit five percent but maybe at 5 gigawatts, could it
6 have been 5 percent?

7 MS. AKKURT: I don't think so. Then you
8 look at the thread of the data and the report itself,
9 it is no linear but it is doesn't change in direction
10 in causing a peak.

11 Do you get it?

12 MEMBER MARCH-LEUBA: Yes, could you
13 explain to me for my location what are the units of
14 the percentage? What's the percent in? What is it?

15 Typically, we talk percent delta K over K.

16 MS. AKKURT: Yes, delta K over K.

17 MEMBER MARCH-LEUBA: Is that the percent
18 that you're talking about?

19 MS. AKKURT: Yes.

20 MEMBER MARCH-LEUBA: So, the K of a low
21 burnup fuel would be higher, wouldn't it? Never mind.

22 You have confidence that if you had done
23 a finer mesh and gone down all the way to 5 gigawatts,
24 it doesn't feel like if I set it up linearly, it would
25 hit 5 percent. And you have confidence that will

NEAL R. GROSS

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

1 happen.

2 MS. AKKURT: We have confidence in that
3 because if you look at the spread of the data and the
4 shifts of the data, you will not have sudden changes
5 in shape.

6 MR. HALL: Could I weigh in on that?

7 MS. AKKURT: Yes, please.

8 MR. HALL: So, the five percent or the
9 three percent or all those numbers are the percentage
10 of the worth of the burnout, not the K itself.

11 So, it's the reactivity change from fresh
12 fuel to burn fuel.

13 So, the less burnout, the less change in
14 K from fresh fuel to burn fuel so these percentages
15 become less meaningful as you go to lower burnouts
16 because the reactivity detriment, relative to fresh
17 fuel, keeps getting smaller the closer you get to zero
18 burnout.

19 MEMBER MARCH-LEUBA: Thanks, now I
20 understand what the units are.

21 MS. AKKURT: Okay, thank you very much,
22 Bob, for the clarification.

23 So, for the EPRI benchmarks, the final
24 approval was received in January of last year and they
25 are now approved for use in future licensing actions.

NEAL R. GROSS

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

1 So, as that mentioned earlier, we had multiple things
2 going in parallel.

3 1602 was resolved a while ago and the
4 benchmark portion, we have final approval and now it
5 is -35.

6 Next. For the depletion uncertainty, the
7 1216 basically offers multiple options. EPRI
8 benchmarks show that for PWR and PWR 5 percent is
9 conservative so it continues without doing any
10 additional work.

11 And if Applicant choose to take benefits
12 of the additional ones listed in the previous slides,
13 then they will model the 11 benchmarks that has been
14 described in the reports and take the additional
15 margin. But some additional work is needed.

16 And 1216 also, there is the method like
17 reactivity. One thing that is obviously clear is this
18 being guidance, you can't choose to pursue an
19 alternative approach then they can do it.

20 They are not limited to these options but
21 they need to provide the technical data because then
22 they come in exceptions, as we will discuss later.

23 Next slide. The other topic that we spent
24 some time in collaboration with the NRC Staff and the
25 industry members were part of the Work Group is what

NEAL R. GROSS

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

1 are the parameters to consider of uncertainty and what
2 are the parameters that should be considered biased?

3 So, we did go through the potential
4 parameters and put them in corresponding buckets. Why
5 is this important?

6 Because for the uncertainty, for final
7 calculation, biases are added, whereas the
8 uncertainties are supposed to be combined, and the
9 list is given here.

10 The other important thing is what are the
11 important factors? And the importance is based on the
12 overall effect on the total uncertainty.

13 So, if an Applicant shows that individual
14 parameters of uncertainty are below the ten percent of
15 the total uncertainty, then they can consider it
16 insignificant.

17 That means that if it is shown, then they
18 don't have to repeat this analysis for all scenarios
19 in their application so they can focus on a more
20 safety-significant parameter evaluation.

21 Next slide.

22 MEMBER KIRCHNER: Hatice, this is Walt
23 Kirchner. Before you go on, could you go back one
24 slide? When I look at that list of uncertainties,
25 which ones are dominant?

NEAL R. GROSS

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

1 It would seem to me that fuel
2 manufacturing and such wouldn't be -- I mean the fuel
3 is produced, manufactured to a pretty good QA
4 standard.

5 It would seem to me that burnup
6 uncertainty, you mentioned earlier flux maps and so
7 on, again, I don't think the uncertainties are in the
8 code.

9 It would it seem to me the burnup
10 uncertainty would be dominant but I may be completely
11 wrong. Which of those factors do you see for a
12 typical spent fuel pool analysis is dominant?

13 MS. AKKURT: I would agree with you.

14 First of all, some of the manufacturing
15 tolerances are small and that's why we said
16 safety-significant versus a word for showing that they
17 are much less than ten percent and showing one and
18 saying these are significant.

19 The most significant ones, if I were to
20 list, are going to be your burnup uncertainty and
21 depletion codes uncertainty and bias and motivation
22 uncertainty.

23 Obviously, for lightwater reactors there
24 are a good number of principal experiments and areas
25 of applicability, quite good candidates for

NEAL R. GROSS

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

1 uncertainty and biases, which is something already in
2 the approval.

3 But if you are using Monte Carlo
4 confirmation for your calculations, for example, you
5 can use that uncertainty provided that you have the
6 computations.

7 The codes are now so good and
8 computational and even the SFARs are so in terms of
9 reaching good precision in terms of the uncertainty
10 reduction, the biggest one is going to be they're not
11 uncertainty and education for uncertainty.

12 MEMBER KIRCHNER: I would agree. I
13 wouldn't think that criticality code uncertainty, if
14 you're using MCMP, for example, at this point in its
15 deployment over many decades, there's not a large
16 uncertainty.

17 That's been benchmarked many, many times.
18 Yes, I would think depletion code and burnup
19 uncertainty would be dominant in this analysis that
20 you're showing in the equation.

21 MR. HALL: Can I jump in, real quick?

22 MS. AKKURT: Sure.

23 MR. HALL: So, part of the criticality
24 analysis occurs for fresh fuel which also gets stored
25 in the spent fuel pool. So, in those cases, the

NEAL R. GROSS

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

1 dominant factors would be things like rack
2 manufacturing tolerances and eccentric positioning
3 within the rack cells and those sorts of things.

4 If you have, for example, a flux trap
5 rack, the K effective can be fairly sensitive to the
6 dimensions of the flux trap. It's between two sheets
7 of poison material.

8 As you deplete now, the depletion code
9 uncertainty and the burnup uncertainty are of the same
10 order of magnitude and add up pretty quickly to
11 overwhelm the rest of the uncertainties.

12 The validation uncertainty is not
13 insignificant.

14 MEMBER BALLINGER: This is Ron.

15 Some of the earlier absorber materials
16 that are used, which are now being phased out, I
17 guess, their degradation might also introduce
18 something which I guess would fall under the facility,
19 structural, and materials uncertainties.

20 MR. HALL: We would probably take that as
21 a bias if it's a known degradation.

22 MEMBER BALLINGER: Got it, okay.

23 MEMBER KIRCHNER: Bob, this is Walt
24 Kirchner again. Nominally, for the fresh fuel
25 storage, don't you pretty much have -- I'm searching

NEAL R. GROSS

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

1 for the right word? -- overly conservative poison for
2 that particular aspect of the fuel staging?

3 MR. HALL: One of the references earlier
4 was to multi-region pools.

5 When fuel storage got more dense, for
6 example, if you're going to put fresh fuel next to
7 fresh fuel in a set of racks, those are the highest
8 reactivity fuel assemblies you have in the pool for a
9 PWR.

10 And so they would need the most poison or
11 the most spacing or what have you, whichever way
12 you're going to control K. So, as you put depleted
13 assemblies in the pool, they're lower reactivity but
14 they're higher uncertainty.

15 So, it's an interplay between what's the
16 K and what's the uncertainty in the K, and what is the
17 orientations in which I'm storing them? Am I storing
18 burned fuel all by itself, am I storing mixtures of
19 fresh and burned?

20 Am I storing all fresh fuel together?

21 So, there's Region 1 and Region 2 is the
22 normal terminology for those sorts of REC differences,
23 where highest reactivity fuel would go into Region 1
24 and lower reactivity fuel would go into Region 2.

25 MEMBER KIRCHNER: Thank you.

NEAL R. GROSS

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

1 MS. AKKURT: Thank you, Bob. Next slide.

2 MR. HALL: Next slide. There we go. So,
3 one of the things that we added as an appendix to NEI
4 1216 was a criticality analysis checklist. And the
5 intent here was to capture the guidance in short form.

6 The checklist is six pages long and it's
7 organized in a sequence of what you might expect for
8 a typical new fuel or spent fuel pool criticality
9 analysis report.

10 It's effectively a laundry list of all the
11 things that you would expect to see described and
12 calculated or otherwise presented in a complete
13 analysis.

14 And that would be from the perspective of
15 demonstrating completeness but it's also from the
16 perspective of the reviewer being able to replicate
17 some or all of your results.

18 So, I said it was a laundry list of
19 possible content items. That's true, not every item
20 would apply to every analysis. Some people would have
21 certain types of poisons or certain types of racks or
22 certain types of fuel.

23 Others would not so there's a yes-no there
24 that is a quick reference, okay, when you look at the
25 checklist, you can get a quick idea of what the scope

NEAL R. GROSS

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

1 is of the submittal.

2 There's a lot of uses for this. The first
3 time would be in pre-application meetings, the
4 Applicant and NRC has a discussion of we're going to
5 bring this application, this is what our scope's going
6 to be, this is how we intend to do it.

7 If you bring the checklist to the pre-
8 application meeting, now it can be very directed as to
9 specific items that jump off the page. How come you
10 checked no for this?

11 Or okay, explain to me more about this
12 multiple legions within the pool, for example.

13 It's useful for the Applicant to know that
14 based on all the collective RAIs and discussions
15 between industry and NRC, what we'll process for NEI
16 1216 development, if you've satisfied all the items on
17 this checklist, you're pretty sure that you have a
18 complete robust application.

19 For the reviewer, the reviewer can quickly
20 turn the scope of the application and the key items
21 are addressed without having to hunt and search for
22 them.

23 And then along those lines as well, some
24 applications have come in where the notes and
25 explanation column can be used to actually point to

NEAL R. GROSS

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

1 where in the document the license limit request, the
2 reviewer can find that information.

3 So, it's a nice roadmap for the reviewer
4 as well as another possibility. So, it's six pages,
5 it was finalized with the Staff over a week-long audit
6 to ensure it was complete.

7 It intended to head off necessary RAIs and
8 bring consistency towards the content for Applicant
9 and reviewer.

10 MEMBER BALLINGER: This is Ron. So,
11 you're satisfied this checklist -- whenever I see a
12 checklist I wonder whether or not it becomes something
13 that gets assumed to be almost biblical.

14 Are you satisfied that the unknown
15 unknowns are taken care of here, are there aren't any?

16 MR. HALL: There can always be unique
17 situations.

18 Part of what NEI 1216 says is if you want
19 to deviate from this methodology or you have something
20 unique and different than what's described here,
21 submit it and it will be reviewed but it's not
22 necessarily covered in this guidance.

23 So, that's always a possibility, that it's
24 not complete. So, the checklist was intended to be
25 for the majority of submittals, this would be

NEAL R. GROSS

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

1 complete.

2 And of course, for new things that are
3 coming down the road, there can always be revisions
4 when those things begin to come into use, to add
5 things to the checklist and to the guidance that need
6 to be added to continue to make it complete.

7 MEMBER BALLINGER: Thank you.

8 MS. AKKURT: I will just add that, as Bob
9 mentioned, the checklist is six pages long and it was
10 developed in coordination with NRC Staff during the
11 one-week long audit.

12 And part of it was gather the experiences
13 from technicians and so on. That's partially why it's
14 six pages long. We tried to cover possible scenarios.

15 Obviously, they may not all be there but
16 then that will be the exception deviation.

17 MR. HALL: Next slide. I think this is
18 going to go back to Ben?

19 MR. HOLTZMAN: Thank you. So, again, I'd
20 like to highlight all the positive efforts between all
21 the parties that have led us to this point.

22 As was alluded to before, we're nearing
23 the finish line regarding this ten-year-long effort,
24 which would be the endorsement of NEI 1216 through Reg
25 Guide 1.240.

NEAL R. GROSS

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

1 Although I do want to mention that we were
2 surprised by the number of exemptions and
3 clarifications in the Reg Guide, considering to
4 overall level of engagement with NRC regarding each
5 word of the documents.

6 As we noted in our October 23rd comment
7 letter, absent additional clarification, we see one
8 particular exemption, Exemption A, being problematic.

9 Specifically, our concern is that
10 exemption A does not provide the regulatory certainty
11 or predictability desired when we began the ten-year-
12 long effort.

13 First, we don't understand the principal
14 by adding the neutron absorber example as part of the
15 double contingency principal.

16 Second, we would like clarity on what is
17 meant by controls or documents. Specifically, using
18 the neutron absorber example, we would like details on
19 how the licensee would demonstrate correct
20 installation.

21 Industry has controls and procedures. Is
22 the intent that is long as a utility can show that
23 they followed their existing controls or procedures,
24 that that alone is sufficient to demonstrate the
25 neutron absorber panels were correctly installed?

NEAL R. GROSS

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

1 Third, if utilities cannot demonstrate
2 through controls or documentation, it's not clear what
3 analysis an assumptions must be made. Moreover, it's
4 not clear what it refers to in the last sentence of
5 the exemption where it says treat it as part of the
6 normal condition.

7 Industry would like to get clarity on this
8 exemption, either during this meeting or in subsequent
9 public meetings before the Reg Guide is formally
10 issued.

11 Industry currently feels the proposed
12 guidance lacks direction for resolving this proposed
13 situation and we want the Reg Guide to be finalized to
14 endorse NEI 1216 to conclude this multi-year effort.

15 But we want durable, robust guidance that
16 enables consistent criticality analyses for Applicants
17 and reviewers. We don't want to finish the process
18 only to have a result that does not meet the goal that
19 we spent all this time to achieve.

20 MEMBER MARCH-LEUBA: This is Jose, go back
21 there, go back on your slide. Can you give us a
22 summary of what Exception A says? I know I read them
23 all but I don't remember them.

24 Could you explain what Exception A says?

25 MR. HOLTZMAN: Yes, but I'm going to have

NEAL R. GROSS

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

1 to refer to Hatice because I can't pull it up while
2 sharing my screen.

3 (Simultaneous speaking.)

4 MR. EUDY: I think that's all we need to
5 do, is just pull up the draft guide. I don't have an
6 option to share.

7 MS. AKKURT: So, Exception A says a
8 licensee or other company considers certain conditions
9 to be unlike the conditions, such as possible closing
10 and the turn absorber panel may not have been
11 correctly installed.

12 However, if no controls or documents
13 exist, preclude such a condition, then the licensee or
14 Applicant should treat it as part of the normal
15 condition.

16 MEMBER MARCH-LEUBA: Okay, I remember it
17 now. Maybe we'll have the discussion when the Staff
18 is on the microphone. Because it sounds pretty recent
19 to me.

20 If you have controls and documents that
21 show that you installed everything correctly, you can
22 take care of it. If you don't have them, you cannot.
23 That makes quite a lot of sense to me.

24 But let's have the discussion when the
25 Staff is in the microphone.

NEAL R. GROSS

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

1 MR. HOLTZMAN: Okay, I'll continue then.
2 So, we wanted to highlight some lessons learned, both
3 because as part of the nuclear industry continues
4 improvement is very important.

5 And also because we believe that
6 additional work is going to be needed in this area to
7 address accident-tolerant fuels with increased
8 enrichment to realize higher burnout. And as such, we
9 anticipate a subsequent Revision 5 to NEI 1216 and
10 continued engagement with NRC.

11 All parties have spent significant
12 resources to reach this point. These interactions
13 have taken the form of numerous public meetings, RAIs,
14 and even a full week-long audit, as we had discussed
15 before.

16 This has yielded very robust, detailed
17 guidance backed by technical justification where every
18 word has been discussed and reviewed.

19 Separating the SUs into standalone
20 documents was a successful strategy that improved
21 regulatory stability and predictability but extended
22 the overall duration because it reduced the urgency to
23 reach a final conclusion.

24 The long delays in finalization of NEI
25 1216 and the Reg Guide does not demonstrate a

NEAL R. GROSS

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

1 transformation or risk-informed regulatory process, in
2 our opinion.

3 Additionally, we'd like to put on the
4 record that industry feels a double standard was
5 applied to NRC contractor work compared to industry
6 work.

7 The NRC contractor work was not performed
8 under a QA program but was accepted and implemented.
9 Conversely, the industry's non-QA report on the same
10 subject was not implemented.

11 In summary, industry was surprised by the
12 number of clarifications and exceptions in Reg Guide
13 1.240 due to the detailed hands-on development between
14 industry, NRC, and EPRI on the guidance and technical
15 documents.

16 Industry currently feels the proposed
17 guidance lacks the direction for resolving the
18 proposed situation in exemption A and we want to
19 ensure the endorsement of NEI guidance through the
20 approval of the Reg Guide achieves the desired
21 objectives of having clear and direct guidance that
22 can be used by both the Applicant and the reviewer to
23 bring regulatory stability and predictability to this
24 important subject area.

25 And with that, thank you for your

1 attention. We will take any additional questions at
2 this time.

3 MEMBER BALLINGER: This is Ron, I don't
4 hear any questions and we'll have a time at the end
5 for additional questions as well from the public. But
6 if there aren't any additional questions, can we
7 transition to the Staff presentation?

8 Are you guys ready to go?

9 MR. EUDY: Kent Wood will be presenting
10 for the Staff. This is Mike Eudy from Research.

11 MEMBER BALLINGER: I'm assuming that he'll
12 be talking about the last slide that the industry
13 presented?

14 MR. EUDY: Yes, he's prepared to talk
15 about the exemptions.

16 MEMBER BALLINGER: Okay, so I see the
17 slide, I guess we're okay? Kent, the floor is yours.

18 MR. WOOD: Let me make sure I've got
19 everything ready to go and am off mute. My name is
20 Kent Wood, I've been the lead reviewer for spent fuel
21 pool criticality analysis at NRR DSS now for over a
22 decade.

23 I was instrumental, along with Bob Hall
24 and Akiche with developing and working together with
25 developing NEI 1216. So, I'm going to go through some

NEAL R. GROSS

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

1 comments on here.

2 So, the first thing I've got, I'm going to
3 talk a few minutes about background and history, then
4 I'm going to talk about our clarifications. There
5 were 17 of them, I don't want to go into each one.

6 If you have a question about specific
7 ones, I'll go into that but I'll talk about the three
8 exceptions that we took and the three clarifications
9 that we got comments on.

10 And then just a few comments that Ben
11 alluded to was going forward, what we might expect in
12 the future.

13 So, the background is the initial design
14 construction of spent fuel pools were low density, a
15 lot of room and spacing between each fuel assembly for
16 a flux trap analysis were done at the fresh fuel.

17 It seemed like they were low on regiments
18 for initial startup back in the '60s, late '60s, early
19 '70s. There was no 10 CFR 5068, the guiding
20 regulations were 10 CFR 7024, which everybody got an
21 exemption to because they did the criticality
22 analysis.

23 And there was GDC 62 predecessors.

24 The 98, the pool was going to be low
25 density, relatively few number of fuel assemblies in

NEAL R. GROSS

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

1 them because they were going to be shipped off for
2 reprocessing after a year or two.

3 And then the first re-rack wave came along
4 because re-processing didn't happen. So, they started
5 putting more racks in, higher density racks in, and to
6 get that higher density, they had to go to using
7 neutron-absorbing materials it would be the fuel
8 assemblies to maintain the subcritical requirement.

9 And that's when they started putting in --
10 the PWR was put in what we referred to as a two-region
11 setup, where Region 1 would have a smaller flux trap
12 with two poison panels on each fuel assembly with the
13 idea of that's where you put in your fresh fuel before
14 it went into the reactor.

15 Or if you have lightly burned fuel coming
16 out of the reactor, that's where it went. And then
17 there was Region 2, which only had a much tighter
18 density, racks, with only one neutron-absorbing
19 material panel in between each fuel assembly. But
20 this fuel was considered to be either a second burn or
21 end-of-its-life burn.

22 And there was a generic letter that came
23 out in 78, Reg Letter 7811. It talked about this re-
24 racking process and it talked about the estimate of
25 information on criticality but it talked about

NEAL R. GROSS

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

1 everything, including disposal, sizing calculations
2 for the racks. It covered a lot of information.

3 And then the second re-rack analysis wave
4 came along primarily due to a boraflex degradation,
5 which was a material that was put in when the high-
6 density racks were put in.

7 It's a silicone rubber-based material
8 impregnated, basically, with B4C and it's sort of
9 dissolving or cracking or shrinking and causing
10 problems. So, there was some guidance that came out
11 in the mid '90s, a generic letter about it.

12 A lot of licensees stopped taking credit
13 for the boraflex that was in it because to take credit
14 for it required a monitoring program which started
15 introducing a lot of biases and uncertainties in the
16 monitoring, a lot of isotope tribes continued to take
17 credit for it.

18 And also about this timeframe, that's when
19 they started allowing soluble boron credits in the
20 pools for the PWRs for normal operations. Before
21 that, it was just they gave credit for the soluble
22 boron that was in the PWR pools or like an accident
23 condition.

24 Of course, BWRs don't have soluble boron
25 so they can't take any credit there. And then towards

NEAL R. GROSS

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

1 the end of this phase in late 1998, the NRC issued 10
2 CFR 5068, which basically says stop regulating by
3 exemption to the 7024 because here, by '98, from '68
4 to '98, you're talking 30 years worth of exemptions on
5 spent fuel criticality analysis requirements.

6 The third rack analysis wave has been
7 ongoing probably since -- I would consider it to be
8 about the mid 2006, 2007 timeframe where people were
9 realizing the people who still had boraflex were
10 realizing that they couldn't continue to live with
11 that, that they're degradation was getting too high.

12 And so they were coming for reanalysis and
13 re-racks and then we came up with the guidance, the
14 ISG and 2010. We issued that.

15 That was some lessons learned. It didn't
16 cover necessarily everything but I thought we improved
17 on what we needed there with that ISG.

18 But then we also wanted to, since it's an
19 interim Staff guidance, we wanted to get permanent
20 guidance and that's when we started with the idea of
21 working on a more permanent guidance out.

22 And unfortunately, it's taken longer than
23 anybody would like.

24 The Reg Guide, we worked with EPRI, NEI,
25 and other industry representatives to develop all 16.

NEAL R. GROSS

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

1 There was Ben and Hatice and Bob all led the meetings
2 we had, the numerous meetings, week-long audits. And
3 the intent was to improve regulatory certainty.

4 Regulatory certainty has always been, in
5 my view, a two-way street. In order to achieve
6 regulatory certainty, we need to know at the NRC what
7 we're going to get from the licensees.

8 And so that enables the licensee to know
9 what to expect to get back from us. So, the idea is
10 that 1216 in the Reg Guide is to establish that common
11 understanding of what's going to be in the package so
12 that we can get regulatory certainty.

13 If we endorse 1216 with 17 clarifications,
14 a lot of those clarifications are forewarnings or
15 warnings to not do certain things or like, hey, a
16 couple of them we've talked to you about.

17 We talked about the ATF, higher
18 enrichment, higher burnup. There's a couple in there
19 that talked about, hey, future changes aren't covered
20 here and things like that.

21 There was three exceptions that I'll talk
22 about next and then we got serious public comments on
23 three of the clarifications and I'll talk about those
24 in a little bit of detail, and then I'll revisit.

25 And one of them is the one that has got

NEAL R. GROSS

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

1 the industry's main comment from NEI. The three
2 exceptions that we took, one was to an EPRI position
3 statement in there.

4 We agree with the EPRI position is treated
5 as a bias and needs to be calculated. There are some
6 words in there that once we thought needed some
7 clarification because they talk about doing a six-by-
8 six array of fuel assemblies.

9 And each fuel assemblies can have
10 hundreds, if not thousands, of potential locations
11 within each cell.

12 If you just talk about five main points
13 that the fuel assembly could be in the center, and
14 then the four corners, and you do a six-by-six array
15 of those assemblies, you're talking about billions of
16 possible combinations.

17 And there's words in there that allude to
18 the idea that the worst possible combination is so
19 unlikely that my concern was that somebody down the
20 road would come in and say, well, it's so unlikely
21 that we don't have to analyze it.

22 The flip side of that coin is the idea
23 that you found the limiting or 9595 configuration is
24 also very improbable. So, you need to look at this
25 and so that's the reason why we got Exception 1 in

NEAL R. GROSS

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

1 there.

2 We didn't get any comments on these
3 exceptions actually so I don't think they're
4 controversial and I don't think they changed the way
5 we're doing business.

6 The next one is the idea of using boiling
7 water, what's called four critical measurements, as
8 benchmarks. We take an exception to this because we
9 don't think there's enough detail in the guidance to
10 actually implement something like this.

11 It doesn't stop somebody from trying to do
12 it, it's just we don't think there's enough
13 information in the guidance to actually do it.

14 This is something that we've actually
15 agreed upon at that week-long audit. The industry and
16 NEI wanted to keep that section in there. We told
17 them we would take exception to it. It was like we'll
18 agree to disagree and move on.

19 The second thing, the second exemption,
20 was the code-to-code comparison as validation for
21 criticality codes. This is something that's not
22 accepted in criticality safety analysis.

23 And again, there's not enough information
24 in there and I've never seen it done in my 12, 15
25 years of doing this. I've never seen it done so we

NEAL R. GROSS

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

1 didn't know exactly what it would look like so we took
2 exception to it.

3 If somebody wanted to try it, it would be
4 a first of a kind event. And this is another one that
5 was agreed upon to be an Exception A that week-long
6 audit.

7 Now, those are the exceptions part of the
8 17 total comments in that clarification exemption
9 section. The next three things I want to talk about
10 are where we got the significant comments on from the
11 industry.

12 And the first one is the one that is this
13 double contingency principal. It's actually based on
14 -- sorry, got to keep up with the slides -- an actual
15 license amendment we got.

16 A licensee came in and told us that --
17 with reanalysis of an existing rack and that they had
18 indications that they maybe have missing panels of
19 their absorber.

20 So, this is based on reality of something
21 that happened and that's why it's in there. Now, the
22 comment takes exception to using a misinstalled
23 neutron-absorbing panel as the example.

24 Because licensees have controls to ensure
25 that a misinstalled panel does not go undetected. But

NEAL R. GROSS

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

1 the clarification also says that if you have controls
2 to prevent it, you don't have to consider it as part
3 of the normal condition.

4 So, we thought, when we got the comments
5 back from the industry, that the example is correct
6 and in its entirety, considering both the example and
7 then the clarification that if you have controls and
8 documents to say that it's precluded, you wouldn't
9 have to calculate or consider it during the design
10 phase.

11 MEMBER MARCH-LEUBA: This is Jose, let's
12 talk about this. Is this the exception that the
13 industry was complaining about?

14 MR. WOOD: Yes, sir.

15 MEMBER MARCH-LEUBA: Okay, so I've been
16 reading it, Samuel 1 Alpha, and I'm with you. It
17 clearly says what you say it says. I don't understand
18 what the concern from the industry is.

19 It says as long as you have controls, you
20 can take credit for this absorber, for example. But
21 if your controls are missing or you do an audit and
22 you find your controls were incorrectly applied, then
23 you have to analyze it.

24 I don't understand what the problem is.

25 MR. WOOD: I would have to agree with you

NEAL R. GROSS

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

1 to a large extent there. In an analyses, I would say
2 it's kind of like if you remember back to the piping
3 stubber issues that we had, they were supposed to be
4 originally installed, say, every six feet but they
5 were cut to fit during actual installation.

6 And some of them had a spacing greater
7 than six feet. And so basically, this contingency is
8 telling us that you have to deal with the -- when
9 you're doing analysis, especially when you're doing a
10 reanalysis, you have to consider the as-is condition,
11 not just the design.

12 Now, during the design phase, the
13 presumption is that everything will be installed in
14 accordance with the safety-related quality assurance
15 and maintenance procedures that every licensee has for
16 doing these types of modifications.

17 And a part of those would be the licensee
18 had to assure themselves whether the modification is
19 on the spent fuel pool, the reactor coolant pumps, the
20 steam generators. They have to assure themselves that
21 it was done and installed correctly.

22 And if they can assure themselves that
23 it's not done and installed correctly, then they have
24 to take corrective action.

25 And if it's not installed correctly, there

NEAL R. GROSS

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

1 could be some fallout from if they have a missing
2 panel, we wouldn't say this during the licensing phase
3 when they submit this that they would have to consider
4 it, but if they find they have missed one, depending
5 on what is, depending on how they disposition that,
6 then that's going to -- it depends on what their next
7 course of action is going to be.

8 Now, we talk about some of these panels,
9 they're neutron-absorbing inserts that go into the
10 storage cell with the fuel assemblies. If you're
11 missing one of those or it's installed incorrectly and
12 you find that, you just take it out and put it in
13 right.

14 Some of the other designs, where the
15 neutron-absorbing panels are encased, that's a lot
16 more problematic. But it's up to the licensee, if
17 they find they have this condition, that they would
18 have to deal with it.

19 But during the design phase, the
20 presumption is, like any license amendment that comes
21 in for anything that they do at the plant, they have
22 to ensure that it's installed correctly.

23 And if it's not installed correctly, they
24 have to disposition it. So, we didn't think we were
25 saying anything different that applied in this regard

NEAL R. GROSS

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

1 to anything else they do at the plant.

2 What we're trying to say is you really
3 need to consider things that you rely upon that might
4 affect your double contingency analysis, might affect
5 your analysis, besides just what was in the tech
6 specs.

7 MEMBER BALLINGER: This is Ron. I think
8 I'm in agreement with Jose.

9 There's such a difference between what
10 you're saying and what we just heard from the industry
11 folks that it's almost an logical inconsistency here,
12 that I must be missing something, that some discussion
13 which has not been had, which connects the two.

14 MR. WOOD: You'd have to ask the industry.
15 To me, we thought it was clear.

16 We got this comment, we talked amongst
17 ourselves and several people at the NRC and we
18 thought that it was clear that you have to consider --
19 if you don't have something that precludes -- a double
20 contingency is you don't have to take something --
21 consider two independent items as mutually occurring.

22 But what we're saying is, well, if you
23 don't have something that prevents something from
24 occurring that you would take credit for, then how do
25 you know it hasn't already happened and it's become

NEAL R. GROSS

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

1 the as-is condition?

2 And so when the accident happens, it's not
3 two independent things, the as-is condition has
4 already happened and been sitting there because you
5 don't know that it hasn't happened.

6 MEMBER MARCH-LEUBA: This is Jose again.
7 This is the equivalent of the unanalyzed condition,
8 the operating domain.

9 If you assume your panels are six feet
10 apart and they happen to be six feet and one-eighth of
11 an inch, you're one-eighth of an inch off. You
12 overanalyzed.

13 You have to come up with a quick
14 calculation in that case that would show one-eighth of
15 an inch doesn't make any difference or do another
16 analysis or fix it. But clearly, you're in an
17 analyzed condition.

18 I'm with you guys.

19 MEMBER BALLINGER: This is Ron again. The
20 only thing I can think of is could there be an issue
21 with very old pools where there might not have been
22 the same quality controls or there may be some
23 unanalyzed degradation that's going on. I still can't
24 figure it out.

25 MR. WOOD: This came out of an actual

NEAL R. GROSS

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

1 license amendment request. So, getting the final
2 words that are actually in NEI 1216 were agreed upon
3 years ago, several years ago.

4 And perhaps this license amendment came
5 through after we redefined the words in 1216 because
6 we were still waiting on the EPRI topical report to be
7 finished before we could start work on the Reg Guide.

8 So, it was lessons learned. It was
9 actually somebody was re-analyzing an old rack, they
10 weren't installing a new rack, and they went through
11 and they believe they had potentially missing panels.

12 And if you have a missing panel, that
13 needs to be considered. Where is it? What is it?
14 How many are there missing? So, that was a large part
15 of the analysis and the questioning with the licensee.

16 Now, I would expect somebody's putting in
17 new, fresh racks or putting in these inserts into the
18 design phase. They would take credit for, hey, we
19 have a modification, we're putting new equipment in,
20 we're going to install it with our procedures.

21 We expect our procedures will ensure it's
22 done correctly. And if they find an issue, the
23 licensee has to disposition that. If they decide to
24 accept it as is, missing panel, well, that's going to
25 lead them down one path of resolution.

NEAL R. GROSS

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

1 Another path, like I said, for an insert,
2 those can be pulled out and put back in. We consider
3 those, essentially, maintenance items for the inserts
4 because they can be accessed and removed and new ones
5 installed, as opposed to a neutron-absorbing panel
6 that's encapsulated.

7 But it's inherent on the licensee, we
8 didn't really with this aspect as far as that goes
9 because we put the controls and documents in place to
10 preclude it. But we were saying anything different
11 than would apply to any other modification at the
12 plant.

13 MEMBER BALLINGER: I think we'll probably
14 come around on this on the discussion part but can we
15 keep going?

16 MR. WOOD: Yes, sir. So, that leads me to
17 the next one, which is the graded approach margins and
18 control. A graded approach is an older term that
19 tries to incorporate the idea of before risk was --
20 where it is now.

21 And once the analysis of what the guidance
22 says is that, hey, if you have a lot of margin, you
23 might be able to streamline your analysis.

24 And what we're saying with this exception
25 or clarification -- it's not really an exemption, it's

NEAL R. GROSS

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

1 a clarification. It's a reminder to the licensee that
2 if you streamlined your analysis because you've got
3 1000 parts per centimeter mil, PCM, percent milrow, to
4 the regulation, you've got 1000 PCM margin to the
5 regulatory requirements.

6 And with that margin you used to
7 streamline analysis, if you go back and decided, well,
8 I made some changes so I have to do something not as
9 streamlined as what I did before, that large margin is
10 part of that and they need to be cognizant that using
11 all of that margin may not be appropriate.

12 And that's what that clarification is. We
13 still expect the licensee to control the margin in
14 their analysis, again, like we pretty much do for
15 other plants but we want it to be clarified that if
16 you use the large margin to get a graded approach,
17 that margin provides some of the basis for that graded
18 approach.

19 And using all of that of a large part of
20 that could cause a problem. We got a comment on that
21 and we think we're good there.

22 The next comment -- do I have a question?
23 Okay, the next comment we got was about the soluble
24 boron modeling during the reactor completion phase.
25 Criticality analysis for spent fuel in the pools are

NEAL R. GROSS

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

1 really two separate analyses.

2 The first one that was talked about was
3 the depletion analysis and that generates the post-
4 radiated isotopics that are in the fuel assembly.

5 That's modeled on the reactor and you have
6 to model the depletion of that fuel and the operation
7 of that fuel assembly in the reactor. And then you
8 come up with a set of isotopics that then get modeled
9 in that fuel assembly, when that fuel assembly is in
10 the spent fuel pool.

11 Typically, the depletion analysis are done
12 with standard reload codes, and then typically, the
13 spent fuel pool criticality analysis is done using a
14 Monte Carlo code. In the U.S. people use either MCMP
15 or scale.

16 Next screen? I keep on forgetting to
17 advance my slides. So, we relied on NMSS as doing
18 criticality analysis for the casks for a long time,
19 and they had a lot of work done by Oak Ridge National
20 Laboratory and they publish a lot of NUREG Crs.

21 And the idea to simplify the analysis by
22 using a constant soluble boron in the depletion
23 analysis phase to simplify the analysis rather than
24 trying to model an actual boron letdown curve.

25 And there was a paper that was published

NEAL R. GROSS

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

1 by individuals at Oak Ridge National Laboratory that
2 said that using a cycle-average soluble boron would
3 result in a conservative post-life reactivity of the
4 fuel assemblies.

5 And as far as I know, that's the only
6 published work on that. It's been accepted by the
7 industry, it's been accepted by NMSS as using for this
8 concept. And the concept makes sense, I could explain
9 it if somebody wants me to in more detail.

10 But this is again based on an actual
11 license amendment request, a couple actually.
12 Somebody came in and tried to use an average other
13 than the cycle average.

14 They wanted to use the lifetime soluble
15 boron average of the spent fuel assembly based on its
16 burnout. And we had accepted this a couple times, but
17 we consider this to be a deviation from the guidance.
18 We've accepted it more than two times.

19 There are some other times where we
20 accepted it and somebody would go back and say, hey,
21 look, we have an old cycle that we shutdown early,
22 maybe they transferred it from 18-month to 24-month
23 cycles or vice versa.

24 And so they have a cycle that was
25 unusually high with soluble boron and we would

NEAL R. GROSS

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

1 disposition that on a case-by-case basis.

2 But going forward, you don't know -- for
3 the lifetime average going forward, you don't know if
4 that average is climbing or declining to the fuel
5 assembly going forward. And you'll get radically
6 different answers.

7 So, we put a clarification in there to
8 make sure the licensee is clear that we're only
9 talking about cycle average in the guidance document
10 and what we've endorsed.

11 They can do other things and we'll review
12 it and like I said, on case-by-case we'll approve
13 them.

14 MEMBER MARCH-LEUBA: Can I ask a question?
15 What they call the EPRI uncertainty benchmark, didn't
16 they use the two boron concentrations cycle dependent?
17 I would have used the two depletion as doing the core
18 follow, right?

19 MR. WOOD: I'm sorry, could you restate
20 the question?

21 MEMBER MARCH-LEUBA: Yes, so when EPRI
22 calculated the uncertainties, the percent value that
23 we were talking about an hour ago, I'm 90 percent sure
24 they did a core follow and they actually used the
25 actual boron concentration at every time step.

NEAL R. GROSS

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

1 That's the easy calculation to perform
2 because you already have the data in the plan
3 computer. You've already done it.

4 MR. WOOD: What they've done for the EPRI
5 depletion is they're calculating -- what they've
6 calculated there is they have taken a flux map
7 measurements throughout the core's life.

8 And certainly, those measurements were
9 taken at the actual soluble boron concentration that
10 were done. Now, in order to do that, they were
11 deriving a method to calculate a bias and an
12 uncertainty on essentially, the isotopic predictions
13 of the depletion code.

14 When it comes down to soluble boron
15 concentration, what we're talking about is licensees,
16 depending on their cycle operating, one cycle could be
17 800 PPM as the cycle average and in the next cycle it
18 could be 900.

19 So, what we're using as cycle average, if
20 every cycle is below the cycle average in the
21 analysis, then you know you're conservative. If you
22 cannot find that, then you have to spend extra time
23 looking.

24 MEMBER MARCH-LEUBA: The actual boron
25 concentration ranges from 1200 to 100 but it's

NEAL R. GROSS

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

1 linearly in the whole cycle.

2 MR. WOOD: Actually, I can range from 2200
3 down to 0 but what was shown is that in this paper I
4 mentioned -- I guess I could pull it up and show you
5 the graph.

6 MEMBER MARCH-LEUBA: No need to go into
7 detail. You have some basis to calculate that by
8 using a cycle average of boron concentration, you
9 produce a bias on the reactivity of the discharged
10 fuel that is conservative. I just don't see the need.

11 (Simultaneous speaking.)

12 MR. WOOD: -- completes its full cycle,
13 then it is conservative to use a cycle average soluble
14 boron. Actually, if a fuel assembly shuts down mid-
15 cycle, it's actually non conservative.

16 MEMBER KIRCHNER: Yes, I was going to make
17 that point. How do you --

18 MR. WOOD: There's a clarification in the
19 beginning of NEI 1216 about potential mid-cycle
20 shutdowns.

21 MEMBER KIRCHNER: How do you define the
22 average? It seems to me that may not be in all cases
23 conservative.

24 MR. WOOD: Well, the cycle average is a
25 line on a graph. You plot your slot in your reactor

NEAL R. GROSS

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

1 soluble boron concentration as a function of burnup
2 and then you just calculate the average. It's just a
3 simple calculus problem.

4 (Simultaneous speaking.)

5 MEMBER KIRCHNER: I'm just trying to think
6 through whether that is always a conservative result.

7 MR. WOOD: The idea is that it's
8 conservative if you complete the cycle. If the fuel
9 assembly completes the cycle and goes from the 2200
10 all the way down to 0.

11 But the physics of what's happening is for
12 this modeling is that during the first portion of the
13 cycle that you're modeling for that type of depletion,
14 you don't have as much soluble boron in the model as
15 in practical.

16 So, that's actually non-conservative.

17 MEMBER KIRCHNER: Right.

18 MR. WOOD: So, therefore, what the paper
19 shows is the cause of the poisons and everything that
20 are in a fuel assembly, it kind of balances out and
21 you don't see much of an effect until you get to the
22 end of the cycle.

23 And at the end of the cycle, the first
24 cycle, you have more soluble boron that what is
25 actually present. So, in that case, that's

NEAL R. GROSS

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

1 conservative.

2 And so you're building up conservatism
3 towards the end of that cycle, and then that fuel
4 assembly would be discharged in the model.

5 And then in the model it starts out at the
6 beginning of the second cycle having this conservatism
7 built into it. And as the first starts off, that
8 conservatism is slowly taken up by the lower soluble
9 boron concentration.

10 And then it goes down to at some point
11 it's a wash, you get back to where it would be if you
12 had modeled it explicitly.

13 But then it becomes non-conservative, I
14 can echo out to at some point where now you've turned
15 up, you've turned the tables on it, and you've started
16 back up the other side where now you have more soluble
17 boron in the model than what's in the life and you
18 start building conservatism back in.

19 And so by the time you get to the end of
20 the cycle for that fuel assembly, you've built the
21 conservatism back up, it's above zero so now you're in
22 positive conservatism space, if that's a way to think
23 about it.

24 And so at the end of the second cycle, and
25 then you start the third cycle and you repeat that

NEAL R. GROSS

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

1 kind of a process, where it starts high.

2 It starts conservative, gets down where it
3 will be non-conservative and then it comes back up to
4 being conservative at the end.

5 But that stipulation is that you have to
6 finish the cycle and go from the full 2200 at the
7 start, cold zero power down to power cold down at the
8 end of a cycle.

9 So, you have to complete that and that's
10 part of what's showed in the paper or the graph. If
11 you shutdown halfway through, you may have some amount
12 of non-conservatisms in there.

13 And there's a caveat in NEI 1216 that
14 says, hey, if you have to shutdown mid-cycle you have
15 to consider that.

16 But once again, this is what's part of
17 what's been expected as industry guidance and what
18 we've been doing for years, using some other average.
19 We haven't established those, the limit may or may not
20 be appropriate, what else might need to be done?

21 So, we took clarification that we're only
22 talking about this one average way of calculating the
23 cycle average.

24 MEMBER KIRCHNER: It just seems to me,
25 Kent, that an average like that makes sense if the

NEAL R. GROSS

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

1 fuel has gone thoroughly through three cycles and
2 burned up to a high burnup.

3 Anything less than a high burnup then
4 perhaps -- I'm doing this mental construct in real
5 time -- we would perhaps be less conservative.

6 MR. WOOD: Excuse me while I pull this
7 paper up. Where's it at?

8 MEMBER MARCH-LEUBA: It's okay, we don't
9 need to know the details. If you could send the ACRS
10 via the proper channels of that paper so we can review
11 it, that would be fantastic.

12 MR. WOOD: I've asked Chris to get us the
13 paper.

14 MEMBER MARCH-LEUBA: For God's sake, we
15 live in the 21st century. Why are we using -- in 1970
16 when you had to use the site rules, it makes sense to
17 make these approximations.

18 But now? Just do the two core follow for
19 the operations. You already have it. At the end of
20 the operations cycle, you have the isotropics of every
21 in a bundle, adjusted by the measurements that you've
22 done three times a year in BWRs.

23 Why do you need to do a new calculation?
24 You've already done it.

25 MR. WOOD: To do what you're saying could

NEAL R. GROSS

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

1 be done but that means that K effective would have to
2 be calculated for each fuel assembly as it's
3 discharged each time.

4 And the point of the current industry
5 method of controlling this is to calculate relatively
6 bounding analysis that would consider, well, what if
7 I had this cycle soluble boron concentration is higher
8 -- it will vary from cycle to cycle.

9 You try to pick one that will be bounding
10 going forward and do the analysis, assuming that's the
11 cycle average soluble boron you have, and then when it
12 comes around, you don't have to calculate each fuel
13 assembly each time.

14 What you're suggesting would be possible
15 but would be a change to the way it's done in the
16 industry is what you're guessing would require
17 actually in the K effective of each fuel assembly each
18 time it's discharged.

19 MEMBER MARCH-LEUBA: We are scraping the
20 bottom of the barrel to get margin for the spent fuel
21 pools when they were throwing away a lot of margin by
22 not doing the analysis properly.

23 Okay, that's my personal opinion. I would
24 do it right.

25 MR. WOOD: Somehow I've got to the screen

NEAL R. GROSS

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

1 I wanted to. Going forward here, I'll echo what Ben
2 Holtzman and NEI and EPRI have said.

3 The NEI 1216 Reg Guide, 1.240 will
4 increase regulatory certainty with regards to fraction
5 spent fuel criticality analysis for the operating
6 reactors. To a certain extent, it already has.

7 We have several licensees that have
8 already used NEI 1216 in their applications that we
9 have reviewed and approved. That's without the
10 endorsement from the Reg Guides.

11 Now, this was alluded to earlier and I
12 mentioned it before.

13 When we get into accident-tolerant fuel,
14 increased enrichment, higher burnup levels, we'll need
15 to be evaluating whether we need to any changes to the
16 12 -- well, we're not going to evaluate 1216 but the
17 Reg Guides are necessary.

18 The next one of the clarifications I put
19 down there is we say a lot of what we have in here is
20 based on our experience based on looking at hundreds
21 of analyses at the NRC.

22 And we've seen dozens and dozens of
23 different applications coming in that we've reviewed.
24 So, we would track what's important, what's not.
25 Sometimes an uncertainty for one licensee may be

NEAL R. GROSS

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

1 insignificant and for the next person it would be
2 significant.

3 And we can get into the here's or why's
4 but we had a database that we track a lot of these
5 things on to see when they're outliers, are they
6 always the same, are there always high, are there
7 always low?

8 And usually and quite often we find for
9 whatever reason we didn't take the time to go into it
10 and determine why those people were higher than
11 others, mostly because we don't have the resources and
12 we also don't have the detailed information and the
13 analysis to make that determination.

14 But we would see an outlier in some of
15 these uncertainties. One licensee is like, oh, never
16 mind, and another licensee was like 500 PCM. And
17 we're like, oh, well, you can't ignore that.

18 So, there's a lot of statements like that
19 that are in NEI 1216. Every time there's a list of
20 things to consider, the licensee always has to make
21 sure that list is their list and they don't have
22 anything to add or they can take anything off.

23 But they have to make that decision on
24 their own when they're making that. We got a
25 clarification in there, I think we missed one that

NEAL R. GROSS

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

1 talked about the lattices for the BWRs so we put that
2 clarification in and that's another one.

3 But going forward, I would expect there
4 will be some changes we'll need to make, depending on
5 what forms of accident-tolerant fuel actually make it
6 into the reactors, when and how high the increased
7 enrichment is and the burnouts.

8 And we keep on mentioning this every time
9 we go to an ATF increased enrichment higher burnup
10 level meeting that these things will need to be
11 addressed and so far as we'll get to that.

12 The answer we get is we know and we'll get
13 to it.

14 MEMBER MARCH-LEUBA: This is Jose again.
15 How does the guy handle lead test assemblies? So, you
16 had three or four fuel bundles that need to go into
17 the pool under ATF maybe coming in and cutting, for
18 example.

19 MR. WOOD: That would be any lead test
20 assembly they would use. There's the caveat, I
21 shouldn't say caveat, but there's statements in there
22 that say the licensee has to make this analysis.

23 The licensees, they're doing a lead test
24 assembly whether it's an ATM or something else. You
25 have to say does this meet all my criteria?

NEAL R. GROSS

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

1 The guidance for an ATF, for one of the
2 lead test assemblies that's in ATF, that's one of the
3 things. We're not going to revise the guidance for a
4 lead test assembly but those might have to be
5 addressed on a case-by-case basis if we figure it out.

6 MEMBER BALLINGER: This is Ron. With
7 respect to Bullet 2, I think the industry is in
8 agreement with that. I think they said the same thing
9 in their conclusions.

10 But with regards to Bullet 1, are you
11 saying this has already been used? Does that include
12 the exceptions?

13 MR. WOOD: Yes, to a certain extent, it
14 does include the exceptions. Like I said, the one
15 exception, 1A, that was based on an actual license
16 amendment.

17 And we reviewed that with somebody that
18 had a missing panel and they had to address it. So,
19 that was something that we have that actually
20 happened.

21 MEMBER BALLINGER: I understand that was
22 the precipitating event but what about since then?

23 MR. WOOD: We haven't had anybody come in
24 with that situation since then. That was a one off.

25 That was just used as an example more to

NEAL R. GROSS

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

1 say when they're thinking about double contingency,
2 they need to think beyond the tech specs and not just
3 the tech specs, what the point of that clarification
4 is really.

5 MEMBER BALLINGER: I just need it to be
6 clear. Thank you. Is this your last slide? Yes, it
7 looks like it.

8 MR. WOOD: Yes, sir, it's my last slide if
9 anybody has questions.

10 MEMBER BALLINGER: Okay, I don't hear any
11 questions. We've got a half of an hour, which is very
12 good because what we need to now have -- we need to
13 make some time for public comments.

14 But it would be nice to have enough time
15 to have a discussion about this because we're trying
16 to make a determination of whether or not we should as
17 a Committee do a letter or not.

18 So, I would like very much to hear
19 Members' thoughts related to this so that we can get
20 a little bit of an idea of the direction that we might
21 go in.

22 So, for Members, would you please provide
23 any discussion you think is relevant?

24 MEMBER MARCH-LEUBA: Ron, this is Jose, I
25 would like to ask the Staff and the industry the value

NEAL R. GROSS

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

1 of ACRS providing a letter to them? What does the
2 staff want to do?

3 Do you care whether we write a letter or
4 not?

5 MEMBER BALLINGER: That was actually part
6 of the discussion we had some time ago when we were
7 actually thinking about whether or not we should even
8 have a meeting.

9 So, that is a good discussion to have and
10 we didn't get, at least in my mind, a definitive
11 answer, which is why we're having this meeting. So,
12 maybe the Staff can give us a better answer?

13 MEMBER MARCH-LEUBA: So, the question to
14 Staff is if ACRS writes a letter, let's assume it's a
15 positive letter, does that have value for you? Or is
16 that going to delay you too much?

17 MR. EUDY: This is Mike Eudy from
18 Research, I'm the Project Manager for the Reg Guide.

19 Based on my recent experience with the set
20 points Reg Guide, if we don't hear there are any
21 significant issues with issuing a final guide, no
22 serious issues are presented by ACRS or concerns, then
23 our prerogative is to move forward with issuing the
24 Reg Guide as quickly as possible.

25 So, I guess I haven't heard. And the

NEAL R. GROSS

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

1 value of a letter, if the letter is going to be go
2 ahead and issue, then the sooner we know that the
3 better.

4 But unless we hear something today, we
5 won't really wait around to hear from ACRS unless you
6 tell us that something serious needs to be addressed.

7 So, the value of a letter to us would be
8 if it points out there's issues that we need to come
9 back and work on with respect to content of this Reg
10 Guide.

11 MEMBER MARCH-LEUBA: Unless our letter is
12 negative in one of two points, all we would do is
13 delay your publication by a couple of months. And
14 therefore, we will be hurting you.

15 Let me ask you a different question, there
16 are some areas of contention with industry, like that
17 Exception A. Would a position from ACRS on that
18 exemption help or delay you for nobody?

19 MR. EUDY: I think we have to figure out,
20 and anyone else from the NRC Staff can chime in, what
21 a remedy to that situation would be if we think we
22 shouldn't issue this Reg Guide because we haven't
23 resolved that issue.

24 We feel we've resolved it through the
25 public comment but NEI doesn't agree. So, I'm not

NEAL R. GROSS

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

1 sure what the remedy for that is other than we can
2 issue the Reg Guide and pursue a revision or they can
3 pursue a revision to the NEI document and we can
4 incorporate it in a future rev.

5 But I don't know what decision would need
6 to be made if that's going to be a sticky issue for
7 us. At this point, to halt issuing this Reg Guide, is
8 there anything from management if you could chime in?

9 MR. RAHIMI: This is Meraj Rahimi, Branch
10 Chief for the Regulatory Guide in the Research. I
11 have this Reg Guide and Mike is the Project Manager.

12 So, I think really the intent is that
13 you've seen the final Reg Guide, you've seen the
14 clarifications and those exceptions.

15 And in my opinion, if the ACRS can weigh
16 in, either at this meeting or actually in a letter
17 saying that it is sort of the way it's written. It is
18 you recommend the issuance.

19 I think that sort of carries weight in
20 terms of we know an independent body, technical
21 people, ACRS, has looked at it and they agree with the
22 Staff. And then we can go ahead and issue the final
23 Reg Guide.

24 MEMBER BALLINGER: This is Ron again. It
25 probably is my ignorance, but I still don't understand

NEAL R. GROSS

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

1 the nub of the argument between the industry and the
2 Staff with regards to that exception.

3 Can somebody explain that to me a little
4 bit better? Probably the industry, I guess, because
5 they're the ones that are upset with this.

6 MR. RAHIMI: Yes, I would say at this
7 point, that's right, maybe Bob Hall or Ben Holtzman
8 can really articulate what is specifically -- maybe
9 elaborate on what they already talked about.

10 And again, these experts would be more
11 than happy to respond.

12 MR. HOLTZMAN: This is Ben Holtzman from
13 NEI. Thank you guys for the opportunity to elaborate
14 a little bit more on what our point was.

15 So, the NRC's presentation has a couple of
16 points I'd like to comment on, the first of which I
17 would like to correct a statement that was made. The
18 previous LARs and Hughes referencing's precedent was
19 not that the utilities believed that they failed to
20 follow their procedures or controls.

21 Rather, the utility had a legacy analysis
22 that assumed missing panels as part of the off-nominal
23 condition in their analysis, which again, is not part
24 of the normal condition, as you guys know.

25 We're not trying to dispute if there was

NEAL R. GROSS

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

1 an actual incorrect installation we would have to
2 ensure the analysis and reality are made consistent
3 with each other.

4 If the utility realized the spent pool
5 racks' as-built conditions is different from the
6 analyzed analyses, then the analysis and actual
7 physical racks need to be brought into alignment.

8 On this point we agree. There's a
9 challenge, of course, for new installations because
10 this analysis needs to be done before the
11 installation.

12 And then as such, we interpret the
13 statements of NRC to be that we would not need to
14 assume any incorrect installation because the utility
15 has controls in place to ensure correct installation.

16 And secondly, we want to explicitly
17 confirm what I think I heard Kent starting to talk
18 about, which is if a utility has no indication that
19 there was a deviation from the existing controls or
20 procedures.

21 Or in other words, that we assumed that
22 the controls and documents that are in place, and we
23 have controls and procedures in place of course, then
24 that is sufficient to demonstrate that we are meeting
25 this assumption in the guidance.

NEAL R. GROSS

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

1 I just want to re-highlight that there is
2 no case where there was any indication that a panel
3 was either missing or was only done as part of an
4 accident assumption in that legacy analysis.

5 MEMBER BALLINGER: So, what I'm hearing is
6 that for a new pool the design is presented before the
7 pool is built in accordance with QA procedures and
8 everything.

9 But once it's built, it's the same QA
10 procedures that have to be used to verify that it was
11 constructed as intended. So, is this just a paperwork
12 problem?

13 MR. HOLTZMAN: So, the question you're
14 essentially asking, if I understood it correctly, is
15 what is the paperwork to demonstrate that we installed
16 everything correctly?

17 MEMBER BALLINGER: I guess that's one way
18 to put it but somebody else might be able to say it
19 more clearly.

20 But it sounds to me like all the Applicant
21 needs to do is to verify the pool was constructed in
22 accordance with the design and QA.

23 MS. AKKURT: It's not necessarily for pool
24 construction. For a negative spent pool, for example,
25 if you are going for reracking you submit your

NEAL R. GROSS

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

1 application prior to the reracking.

2 If you are getting insurance on units of
3 observed materials. So, at that point, you have no
4 way of showing, you are saying I'm going to to do this
5 and I'm going to do this under my QA.

6 Suppose after the installation you become
7 aware of this, there are control mechanisms in place
8 to remedy that.

9 MEMBER KIRCHNER: This is Walt Kirchner.

10 Since this Reg Guide seems to hang around
11 primarily the analysis of the pool and the storage, is
12 this tantamount to assuming a single failure that
13 would require industry to assume that one of these
14 boron absorber panels is missing?

15 I see an analogy with using a very
16 conservative Appendix K approach to analyzing locus
17 but, Ron, I'm at something of a loss to discern here
18 what the disagreement is.

19 Both sides present a reasonable position
20 but I haven't discerned yet what the problem is.

21 MEMBER BALLINGER: I'm with you there too.
22 I just can't figure out why it wouldn't be a very
23 simple thing to verify. Even for older spent fuel
24 pools, anything that's done with these pools is done
25 under a QA program. So, unless there's a mistake

NEAL R. GROSS

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

1 that's been made, I don't know.

2 MR. HOLTZMAN: This is Ben. If I may,
3 maybe if we reframe the question as explicitly simple
4 as I can, maybe that would help.

5 MEMBER BALLINGER: That would be good for
6 me.

7 MR. HOLTZMAN: So, if we installed under
8 procedures, which we agree we have, if we install
9 under procedures, is that enough to demonstrate that
10 we meet this?

11 MR. WOOD: This is Kent Wood. The answer
12 would be yes.

13 MEMBER BALLINGER: Case closed?

14 MR. WOOD: I thought that's what the
15 example said. If you have controls to preclude it,
16 you wouldn't have to consider it as the normal
17 condition.

18 And to me, you were taking exception
19 because we mentioned this because you have controls to
20 prevent it. So, I was having trouble understanding
21 the disagreement as well.

22 MR. HALL: This is Bob Hall. I'll take a
23 shot here as a former spent fuel pool criticality
24 analyst. Part of the concern was how the words could
25 be read by a future reviewer who didn't write them.

NEAL R. GROSS

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

1 What does it mean, controls and documents?
2 How many controls, which controls, what documents, how
3 many, what would be sufficient to satisfy that
4 requirement?

5 And then the second part of it is, if, and
6 we're not aware of any situation where this is true,
7 but if someone couldn't satisfy that requirement, then
8 the last sentence, it needs to be considered part of
9 the base analysis.

10 Does that mean that the analysis has to be
11 redone assuming no panels at all in the fuel pool?
12 One missing panel? 100 missing panels? How many?
13 There's no guidance.

14 So, part of our concern was that it
15 created a hypothetical situation from which there was
16 no clear way out.

17 MEMBER BALLINGER: Again, I keep coming
18 back to the plant being designed and built in
19 accordance with the design and checked with the QA.

20 Are we running the risk of basically
21 contriving an issue that is I'll never say impossible
22 but precluded by the existing procedures and designs?

23 MEMBER KIRCHNER: It would seem to me,
24 Ron, that something like this, which I'll use the term
25 at risk, safety-related, would come under Appendix B.

NEAL R. GROSS

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

1 So, that would suffice to define the
2 controls, design controls, recordskeeping, other
3 checks and balances, if it's a maintenance, if it's a
4 repair kind of issue.

5 Since double contingency was mentioned
6 somewhere along the line, I had the feeling almost
7 like it was requiring the Applicant to just go ahead
8 and assume that one of these absorber panels is
9 missing and then demonstrate that you still had that
10 sufficient margin.

11 So, the words seem ambiguous to me as to
12 what is expected versus what would actually be done in
13 the plant, notwithstanding the fact that a mistake
14 could be made and so on and so forth, but then you
15 hope that your corrective action program promptly
16 addresses that.

17 MR. LUKES: This is Bob Lukes on the
18 Staff. Again, this is an interesting question and
19 something we thought was, as some of the other Members
20 said, was pretty clear.

21 And anywhere in the plant, if you don't
22 know the condition of a piece of equipment and you're
23 doing an accident analysis, you have to assume the
24 worst case for that condition.

25 So, in the idea of the spent fuel pool,

NEAL R. GROSS

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

1 for example, if you didn't know how your panels
2 stalled, you don't know the condition of your panel,
3 it would not be appropriate to just assume that panel
4 is just functioning normal.

5 So, I think that's what this part gets to
6 the heart of and I was trying to understand the NEI's
7 concern.

8 And we thought maybe it had to do with old
9 plants where panels were installed, where they lost
10 the records, where they've never done any surveillance
11 but they still want to take credit for these panels.

12 And they're doing things to evaluate these
13 panels, whether it be these badger inspections or
14 visual inspections, to make sure the panels are laying
15 on the bottom of the pool in dust like the boreflex
16 panels.

17 So, I think that we're coming at it from
18 the reasonable assurance that it's reasonable to
19 assume that you know the status of your panel. It's
20 reasonable to assume that you know it was installed
21 and is functioning.

22 If not, it would be reasonable to assume
23 also that you already either have a procedure in place
24 to verify it correctly or you have some type of
25 documentation for your EXP program because it's

NEAL R. GROSS

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

1 safety-related and shows it was installed correctly.

2 I'm a little confused on the concern also.

3 MR. HALL: This is Bob Hall, I think based
4 on Kent's clarification to Ben's very direct question
5 we're back to agreement.

6 MR. HOLTZMAN: So, Bob, I just want to
7 follow up with what you just said because I want to
8 make sure that I didn't mishear you on that.

9 So, if we install the panels under
10 procedures, we meet the requirements for this
11 exception, is that correct?

12 MR. LUKES: I'm trying to read your
13 question for something cryptic that I may be missing
14 but I would assume that if you followed your Appendix
15 B quality procedures in installing the panels, it
16 would be acceptable to assume the panel is installed
17 correctly, right?

18 I agree with that.

19 MEMBER BALLINGER: I'm not sure what else
20 you could do.

21 MR. LUKES: Right, I don't either. You
22 could do everything, you could install a reactor
23 coolant pump. They have a procedure, Appendix B,
24 double sign-offs to make sure it was done correctly
25 and the case is closed.

NEAL R. GROSS

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

1 We don't go back later and assume the pump
2 was installed incorrectly.

3 MR. WOOD: If we're talking about during
4 the design phase was the problem that they would have
5 to consider this during the initial design phase
6 before implementing and installing the modification.

7 And when you're in the design phase, I
8 agree that you're following the plan to establish
9 maintenance and quality assurance procedures for
10 making safe modifications for the plant would be
11 sufficient to say this does not need to be considered
12 during the design phase initial licensing.

13 Like I said in my presentation, if during
14 those installation and during that verification of
15 installation you discover that for whatever reason a
16 mistake has happened or something's happened, that
17 would need to be dispositioned under your quality
18 assurance program.

19 And which path you chose, it would have
20 different potential outcomes but those are so varied
21 that we can't be prescriptive in the guidance document
22 about what you could or might do.

23 You could reinstall, you could fix, you
24 could accept as is, you could make a repair. I think
25 the specificity on how you would disposition something

NEAL R. GROSS

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

1 you might find during your post-installation
2 verification or confirmation, then...But during the
3 design phase, we expect licensees to be following
4 their procedures.

5 And we wouldn't be expecting to see this
6 on an initial design for new pools or reracks or
7 inserts. But we might expect to see something like
8 this on a reanalysis some place.

9 MR. LUKES: But to follow Kev's logic
10 there, maybe this is what NEI is kind of getting at?

11 If you followed your procedures and you
12 installed these panels and everything is good and then
13 you go to install the panels and for some reason you
14 notice that one of the panels was installed correctly,
15 of course you couldn't assume that every panel was
16 installed correctly because you just found a flaw in
17 your QA program.

18 So, that would have to be addressed. How
19 do you address that?

20 Normally, as I've seen this done in the
21 industry, when they find a flaw that their QA program
22 said something was done correctly and in actuality it
23 wasn't, you would have to go sample or do some type of
24 corrective action to analyze what went wrong in your
25 quality assurance program.

NEAL R. GROSS

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

1 And you would have to have whatever was
2 part of that QA as treated as not correct and you have
3 to go look at it. But that's standard nuclear QA,
4 right?

5 MEMBER BALLINGER: We have to allow for
6 some time for public comments. So, for the record,
7 what I'm hearing is that based on this discussion, we
8 now believe there's no difference between the industry
9 concern and the Staff's exception, if you will.

10 In other words, if the racks are installed
11 in accordance with procedures and in accordance with
12 design and there's QA that's the end of the problem.
13 It would be nice if I had a yes or no answer on that.

14 MR. LUKES: Yes from the NRC. That's
15 correct.

16 MEMBER BALLINGER: Thank you very much.

17 MR. HOLTZMAN: This is Ben Holtzman from
18 NEI. We still are a little confused about the wording
19 but we received the clarity we need.

20 Thank you for the discussion and for the
21 clarification. We vote for this to be moved forward
22 and issued as quickly as possible. Thank you.

23 MEMBER BALLINGER: Hallelujah. Okay,
24 thank you very much. So, unless there's other
25 discussion --

NEAL R. GROSS

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

1 MEMBER PETTI: I just think in light of
2 this I'm not convinced we need a letter.

3 MEMBER BALLINGER: Well, that was my next
4 question. We don't normally have extensive public
5 comments but we may. But I'd like to get feedback
6 from the Members with regards to whether we think
7 there needs to be a letter.

8 So, I take it that we have one.

9 CHAIRMAN SUNSERI: Ron, make that two. I
10 don't see we'd add anything.

11 MEMBER BALLINGER: Jose?

12 MEMBER MARCH-LEUBA: Yes, I'm for not
13 writing a letter. I think this transcript has more
14 value to the industry and the Staff than a letter
15 would.

16 MEMBER BALLINGER: Okay, we're rapidly
17 approaching a majority. Anybody else? Let me ask the
18 question, are there any Members that would say we need
19 a letter?

20 MEMBER KIRCHNER: I'll give you another
21 not needing a letter. I think the discussion amongst
22 the Committee with the Applicant and the Staff was a
23 worthwhile contribution.

24 MEMBER BALLINGER: For sure, and so it's
25 clear enough so that we don't need anything enshrined

NEAL R. GROSS

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

1 in a letter, that would be my vote. Okay, any other
2 Members?

3 Okay, thank you very much, this has been
4 a very valuable discussion. I think we need to now
5 look and see if we could get the public line open.
6 It's hard for me to tell.

7 PARTICIPANT: The public line is now open
8 for comments.

9 MEMBER BALLINGER: Thank you. Are there
10 any members of the public that would like to make a
11 comment? If you would, please state your name and
12 make your comment.

13 PARTICIPANT: You're okay, Ron, go ahead.

14 MEMBER BALLINGER: I think we're okay.
15 So, not having any public comments and getting a clear
16 direction from the Members, I'll turn it back over.

17 Thank you very much for the presentations
18 and the discussion and I'll turn it back over to
19 Chairman Sunseri.

20 CHAIRMAN SUNSERI: Thanks, Ron, and thanks
21 for the Members and the presenters on that, a very
22 good, lively discussion. I think we reached some
23 mutual common grounds on that thing.

24 All right, so it's 2:55 p.m. What I would
25 like to do is inform the next presenters that we need

NEAL R. GROSS

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

1 to take a break so let's take a 20-minute break.
2 We'll reconvene at 3:15 p.m. and we'll start with the
3 gateway for accelerated innovation.

4 And we will give them back 15 minutes at
5 the end if they need the additional time past 5:00
6 p.m. Members, any other comments? All right, we're
7 recessed until 3:15 p.m. when we will resume the
8 presentations. Thanks.

9 (Whereupon, the above-entitled matter went
10 off the record at 2:56 p.m. and resumed at 3:15 p.m.)

11 CHAIRMAN SUNSERI: Okay, it's 3:15. We
12 will reconvene the ACRS meeting. We'll start with the
13 roll call. Ronald Ballinger?

14 MEMBER BALLINGER: Here.

15 CHAIRMAN SUNSERI: Dennis Bley?

16 CHAIRMAN BLEY: Here.

17 CHAIRMAN SUNSERI: Charles Brown?

18 (No audible response.)

19 CHAIRMAN SUNSERI: Vesna Dimitrijevic?

20 MEMBER DIMITRIJEVIC: Here.

21 CHAIRMAN SUNSERI: Walt Kirchner?

22 MEMBER KIRCHNER: Here.

23 CHAIRMAN SUNSERI: Jose March-Leuba?

24 MEMBER MARCH-LEUBA: Here.

25 CHAIRMAN SUNSERI: Dave Petti?

NEAL R. GROSS

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

1 MEMBER PETTI: Here.

2 CHAIRMAN SUNSERI: Joy Rempe?

3 VICE CHAIRMAN REMPE: Here.

4 CHAIRMAN SUNSERI: Peter Riccardella?

5 MEMBER RICCARDELLA: Here.

6 (Simultaneous speaking.)

7 CHAIRMAN SUNSERI: Wow, that was weird.

8 I'm sorry, Pete Riccardella?

9 MEMBER RICCARDELLA: Yes -- yes, I'm here.

10 CHAIRMAN SUNSERI: Yes, when I said that,
11 my cell phone actually thought -- woke up Siri and she
12 started talking to me. But anyway -- sorry about
13 that. And let's go back to Charles Brown?

14 (No audible response.)

15 CHAIRMAN SUNSERI: All right, well we have
16 a quorum, so we will get started. This is the gateway
17 for accelerated innovation in nuclear --

18 (Simultaneous speaking.)

19 MEMBER BROWN: I'm here. I'm here, Matt.

20 CHAIRMAN SUNSERI: Okay, thank you --

21 (Simultaneous speaking.)

22 CHAIRMAN SUNSERI: And advanced reactor
23 demonstrations program. At this point I'll turn it
24 over to Dennis Bley.

25 CHAIRMAN BLEY: Thank you very much, Mr.

NEAL R. GROSS

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

1 Chairman. Before we begin, two things. One, this is
2 an information briefing. It's not something in lieu
3 of a subcommittee or full committee meeting. I'd like
4 to thank Derek Widmayer our Senior Scientist who helps
5 our future reactor subcommittee. He had gone to a
6 talk by these folks and thought the committee would be
7 very interested in hearing how these programs are
8 moving forward.

9 We are going to be hear about the DoE
10 Office of Nuclear Energy-funded Gateway for
11 Accelerated Innovation in Nuclear -- GAIN -- and the
12 National Reactor Innovation Center, NRIC, programs.
13 GAIN and NRIC are complimentary and coordinated
14 efforts to support the nuclear industry towards
15 commercialization of nuclear innovations. Our
16 speakers today are Lori Braase, who is Program Manager
17 for GAIN; and Dr. Ashley Finan, who is the program --
18 who is the Director of the NRIC. Lori will go first.
19 Lori, please go ahead.

20 MS. BRAASE: Well thank you very much for
21 this opportunity to present to you. Christine King,
22 the Director, she was looking forward to doing this
23 today but she's had a family medical emergency this
24 week and is still out. She does want to tell
25 everybody hello, though, and certainly would love to

NEAL R. GROSS

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

1 have been here and -- and I will not do her justice.
2 She has a very good way of presenting GAIN. So
3 forgive me for that.

4 But I've been with GAIN since the
5 beginning. Kemal Pasamehmetoglu hired me to start
6 GAIN on January 2, 2016. It was announced at the
7 White House in November of 2015. And it's an
8 initiative that was envisioned to help the U.S.
9 nuclear industry connect with the national lab systems
10 to further and accelerate their commercialization
11 activities. It was born out of some university
12 workshops where industry said, hey -- you know --
13 there are things that we can't do without a national
14 lab, but you're so hard to work with. We're -- we
15 have a really hard time getting in the door. And when
16 we do, we're not really treated maybe like we're
17 important work. So the program work often took
18 precedence over the industry work. So out of that,
19 GAIN was born. So next slide, please.

20 Our mission and vision really focuses on
21 industry. So the vision is that the U.S. nuclear
22 industry is equipped to lead the world in deployment
23 of innovative nuclear technologies to supply urgently
24 needed, abundant clean energy, both domestically and
25 globally. Our mission then is to provide the industry

NEAL R. GROSS

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

1 with access to cutting-edge R&D along with the
2 technical, regulatory and financial support necessary
3 to move innovative nuclear energy technologies toward
4 commercialization in an accelerated and cost-effective
5 fashion.

6 So with this vision and mission in mind --
7 next slide, please. So what does it really mean,
8 then, for the United States? If we -- if we can
9 retain and regain our U.S. leadership, then industry
10 and DoE will lead global technology commercialization.
11 The supply chain will be able to enable global
12 industrial leadership. And our end users and
13 utilities will be able to optimize their domestic
14 energy portfolio using various sizes and types of
15 nuclear power and other clean energy sources. Next
16 slide, please.

17 So we're often asked, what's the
18 difference between NRIC and GAIN? And we're very
19 complimentary, as was stated earlier. GAIN was
20 established in 2015 as a resource for accelerated
21 development of nuclear innovations with lab partners.
22 We -- it -- we enable comprehensive nuclear innovation
23 ecosystems at all development stages. We provide
24 streamlined access to testing, experimental
25 facilities, lab expertise, and legacy data. And we

NEAL R. GROSS

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

1 also provide a connection to the regulatory expertise,
2 whether it's at the labs or through NRC. And we
3 actually manage the NE voucher program.

4 Ashley is going to tell you more about
5 NRIC. This slide shows you what -- that NRIC is a
6 little different. They are focused on demonstrating
7 reactor concepts, getting the lab facilities up to
8 speed, providing those sites -- demonstration sites.
9 But she will -- she will go into much more detail. So
10 I won't take that away from her. Next slide, please.

11 So this is our GAIN wheel. And we
12 developed this wheel and we have associated goals for
13 the wheel. But we wanted to show everyone that we are
14 not just NE vouchers. We're not just a funding
15 opportunity. GAIN has five main focus areas. And at
16 the top is that we are a private-public partnership.
17 And we take that very seriously with our national
18 labs, with NRIC, with other federal agencies, with our
19 nuclear industry, and EPRI, NEI, USNIC, et cetera.

20 We also have a big outreach,
21 communication, education arm to GAIN. Conferences,
22 workshops -- through social media. We have GAIN
23 directories. We have a very large, information-rich
24 website. But we take that piece seriously --
25 workshops for GAIN are a means to connect with our

NEAL R. GROSS

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

1 industry and to listen to them. We've connected 2,000
2 or more needs or requirements from industry over the
3 last five and a half years. So we use these methods
4 to stay connected and to listen.

5 We have an information part of this wheel.
6 And that is -- is a little harder to do, in a way.
7 But we have a -- we have documents with links to OSTI
8 on the GAIN website. We have a data preservation
9 effort going on to collect legacy information and get
10 it into industry's hands. We have been working on
11 this for five years. And we -- we are scanning
12 documents. We are getting them reviewed and trying to
13 get them into industry in a way that's useful to them.

14 It's a rather large effort and we are
15 moving somewhat at a snail's pace, but we're certainly
16 trying. I can tell you a little more about that
17 later. We have a modernization part of this wheel,
18 which is focused on modernizing contracts for industry
19 -- helping them get into the labs easier. We have
20 made some progress in that area which is -- it's
21 pretty good.

22 We have a standard CRADA for our vouchers
23 as well. And that's been very useful to get them out
24 -- get them signed, to get industry the information
25 they need from the labs. So our contract

NEAL R. GROSS

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

1 modernization effort has -- has done quite well. And
2 that includes our policy and regulation.

3 So then, finally, our collaboration and
4 funding opportunity part of the wheel. And this
5 includes our voucher, and the industry FOA, and -- and
6 other types of funding opportunities that we can talk
7 about later, too. So our goals, then, are really
8 focused on that wheel. And goal one we've talked
9 about all ready, is to give the nuclear industry
10 access to financial support, lab capabilities and
11 facilities. Goal two is, we work with industry to
12 identify their gaps and their needs and to develop the
13 path forward to inform DoE research programs and
14 remove barriers for industry.

15 The needs that we identify during those
16 workshops are typically as a result of a program
17 request. So many of our workshops are program related
18 so that they can talk to industry, build those
19 relationships with industry, and adjust their programs
20 going forward to focus on those industry needs -- and
21 build the capability and the expertise that's needed.

22 Goal three is our regulatory goal. And we
23 work with our stakeholders at NRC to communicate and
24 resolve common issues through regulatory interactions.
25 Jim Kinsey is our regulatory interface and Jim -- Jim

NEAL R. GROSS

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

1 and GAIN have been working together on a regulatory
2 webinar series. So we just -- we did the first one
3 with -- it was really quite enjoyable, it's Phil
4 Hildebrandt and Roger Mattson and they were talking
5 about the history of regulation and -- it was -- it
6 was very good. The video is on the GAIN website, if
7 you're interested.

8 Goal four is access to -- industry access
9 to their technology commercialization efforts which
10 contract modernization, and that type of thing. And
11 goal five is really focused on our legacy information.
12 And we have added an aspect to that, which is the
13 clean energy area. We are -- are out now developing
14 a new webinar series that's tailored to carbon-free
15 discussions. And so we've -- we just finished our
16 first webinar yesterday. It will also be on the GAIN
17 website, if you're interested.

18 We actually had a New York State
19 representative and Energy Northwest talking about
20 their energy goals. And it was very interesting how
21 different they were. And they had a -- a little
22 banter going back and forth that was very -- very good
23 about being technology-neutral, for New York, and
24 technology-specific for Northwest -- for the
25 Washington area. So it was very interesting webinar.

NEAL R. GROSS

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

1 Next slide, please.

2 VICE CHAIRMAN REMPE: Lori?

3 MS. BRAASE: Yes?

4 VICE CHAIRMAN REMPE: This is Joy. Could
5 I interrupt you with a question about this slide and
6 the prior slide?

7 MS. BRAASE: Sure.

8 VICE CHAIRMAN REMPE: I'm just trying --
9 historically, a lot of times we think of GAIN
10 associated with deployment, or accelerating technology
11 for future plans. But when I look at what's on this
12 slide and the prior slide, it seems like there's
13 nothing to preclude an innovative methodology for the
14 operating fleet. So let me give you a couple of
15 examples and tell me, yes, if -- if things -- if the
16 conditions were right, maybe that could have been --
17 GAIN might have assisted with it. For example, if
18 some BWR owners wanted to try an innovative way to
19 improve their training process for -- looking at
20 severe accidents. Or if -- if both PWRs and BWRs as
21 well as, like, an advanced small module LWR wanted to
22 do some SRV relief valve testing because, for example,
23 recently some Fukushima investigations that indicate
24 that there might be fatigue that would allow those
25 valves to be opening up below their set point

NEAL R. GROSS

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

1 pressure.

2 So it's something that would be useful to
3 both advanced as well as operating reactors. Could
4 folks bring a proposal to the GAIN platform and ask
5 for funding?

6 MS. BRAASE: We have had two or three --
7 I can't remember exactly how many -- vouchers that
8 were focused on light water reactors, yes. The best
9 thing to do is get a hold of us and talk through the
10 idea. We -- we really are focused on innovative new
11 ideas. You know, so if there was an innovative pump,
12 or something that would make a big difference for the
13 light water industry. But I can certainly find those
14 examples and let you know what vouchers they were.

15 We're going to come up to the vouchers
16 here in a minute. I can't remember exactly which
17 vouchers. But we have provided funding to light water
18 efforts, yes.

19 VICE CHAIRMAN REMPE: Okay. Again, I'm
20 interested in safety and research for safety -- and I
21 am not trying to propose anything. I just --

22 MS. BRAASE: No, no -- no.

23 VICE CHAIRMAN REMPE: -- trying to
24 understand what's in and what's out with this program.

25 MS. BRAASE: It's -- it's really all about

NEAL R. GROSS

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

1 innovative technology. And so if it's something -- a
2 new heat exchanger or, you know that type of thing --
3 that's really more what the vouchers are for. Yes.

4 So next slide. This is a document that
5 John Jackson and I put together that has the contract
6 mechanisms on one side and funding opportunities on
7 the other. It is a general document that's applicable
8 across the National Lab System. So it talks about the
9 different funding mechanisms and how you can access
10 those. It's been -- it's been a good guide for us,
11 and for industry. So it's on the GAIN website. If
12 you're interested, I can also email it to you. We
13 just wanted to show you this slide so that you knew
14 some of the available information we have for
15 industry.

16 John Jackson is our -- currently our
17 technical interface. And he's very good at putting
18 pieces and parts together for industry when they have
19 certain needs from the National Lab System. And so
20 these funding opportunities can be used in a way to
21 help industry get to -- get further down the road to
22 commercialization. Next slide.

23 So vouchers -- vouchers are very unique.
24 And for our GAIN Nuclear Energy Voucher -- I'll just
25 tell you a little bit about what they are. They're a

NEAL R. GROSS

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

1 competitively awarded access to facilities and staff
2 in the DoE National Laboratory complex. They are not
3 a financial award to a company. The funds go directly
4 to the National Lab to do the work, and there is a 20-
5 percent cost share involved.

6 The awardee then becomes the customer, so
7 to speak, for the National Lab. And they're --
8 they're about 500k. So they're not large amounts and
9 they have a year time period from when the CRADA is
10 signed to -- to completion. They've turned out to be
11 a very good way for a National Lab to get to know a
12 certain industry company. And they make relationships
13 that then help that company in other areas of their
14 progression -- of their research, or their engineering
15 efforts. So it's been -- it's been really good for
16 the National Labs to connect with industry in this way
17 as well.

18 There aren't any size restrictions on
19 companies. We have large companies and small
20 companies. But we do have an extra consideration if
21 the companies are smaller. So around one voucher
22 awards -- our round-one voucher rewards just ended, we
23 just announced. And these are the winners for round
24 one. Right now we are reviewing the vouchers with
25 round two, which closed February 1st. And all of the

NEAL R. GROSS

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

1 voucher information is on the GAIN website and you can
2 click on the links there and read the little summary
3 for the vouchers.

4 TerraPower -- this year TerraPower is the
5 first voucher awarded for work at LANL. And it
6 involves characterization of plutonium chloride salt
7 properties, using their neutron beam imaging facility
8 at LANSCE. So Oak Ridge, Argonne and INL get the bulk
9 of the vouchers, it seems, because we have the
10 connections with industry. But our other national
11 labs can do this as well.

12 So we have interactions with Lawrence
13 Berkeley, with Lawrence Livermore, with Sandia,
14 Savannah River, Brookhaven -- they're just not as
15 tied-in with the industry as we would like. So we
16 continue to work with them as much as we can. Next
17 slide, please.

18 So this is a listing of our vouchers from
19 last year. And it gives you an idea of some of the
20 proposals that we had. We've been talking more and
21 more lately with industry about graphite. And that
22 seems to be coming up quite a bit. So we're taking a
23 look and seeing if we need to do a little more
24 communication with industry on their graphite needs.
25 So that was one of the vouchers for Ultra Safe Nuclear

NEAL R. GROSS

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

1 Corp.

2 Oklo had a voucher to address gaps in
3 legacy data on fuel-steel interactions. And we had a
4 new company, Natura Resources, they're in Abilene
5 Texas. And so they're looking at Abilene Christian
6 University building a molten salt reactor. So there's
7 quite a range of companies and needs that the vouchers
8 help with. And every -- every cycle -- every three
9 months, we have five to ten companies apply for
10 vouchers. And that's been pretty steady through the
11 last five years. Next slide, please.

12 So we do some statistics the best we can.
13 And for -- including our round one, 2021 vouchers,
14 we've had a total of 57 awarded. Twenty-eight
15 vouchers have been completed. And then that results
16 in \$20 million to the National Labs with a total
17 project cost of \$25.3 million because there is that
18 20-percent cost share. The graph just kind of gives
19 you a bit of an idea of the National Lab involvement
20 in the vouchers. Next slide.

21 So on the contract modernization piece of
22 the GAIN wheel, we have -- we have approved -- we went
23 to DoE and worked with the legal entities at DoE and
24 others to -- to develop a nuclear energy advanced
25 class patent waiver. And in this waiver, DoE foregoes

NEAL R. GROSS

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

1 taking the title to the patent-able inventions. They
2 are available when the contract negotiations begin.
3 They're applicable to the large domestic businesses
4 interested in DoE-NE funding. Small businesses have
5 other paths. And the waiver really was geared to
6 accelerate negotiations for the industry funding
7 opportunity award and the events reactor demonstration
8 awards -- and to reduce uncertainty in negotiations.

9 We are currently working on a GAIN Access
10 CRADA. And this is kind of unique where an industry
11 partner works with the National Lab to sign a CRADA.
12 But that CRADA grants them access to other labs in the
13 -- in that agreement. So we're working with Argonne
14 and INL on a voucher where both labs can use that one
15 CRADA. This is something we're working on in 2021.
16 We are -- we are close to having at least one signed.
17 So we -- we should be reporting success on that by the
18 end of 2021. But it will be really good for industry
19 because they don't have to contract with only one lab
20 to get the work done.

21 So conceptually, industry partner has the
22 work scope that crosses multiple labs. The lead lab
23 puts the CRADA together. The partner labs sign the
24 CRADA. So this is -- this is very good and it crosses
25 the offices of NE science, and NNSA.

NEAL R. GROSS

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

1 MEMBER PETTI: Hey, Lori?

2 MS. BRAASE: Yes?

3 MEMBER PETTI: This is Dave.

4 MS. BRAASE: Hello Dave.

5 MEMBER PETTI: So in terms of a patent
6 waiver, this is for any assistance -- a CRADA or a
7 voucher -- anything under the GAIN umbrella?

8 MS. BRAASE: I believe so, yes.

9 MEMBER PETTI: Okay, yes. Okay.

10 MS. BRAASE: And I can get you more
11 information if you're -- if you're interested. Okay,
12 next slide.

13 This is more in my area here. Legacy
14 documents. One -- when we met with industry in July
15 of 2016 we had three different meetings. We had
16 meetings with the fast reactor technology companies,
17 molten salt reactor technology companies, and high-
18 temperature reactor companies. And so we had these
19 three industry-focused meetings, and in those meetings
20 they identified their initial set of needs. And those
21 -- that report is on the GAIN website if you're
22 interested. And I can send it to you as well.

23 And so the -- they were -- they were the
24 initiating contact that we had with all of these
25 companies. From that meeting they identified their

NEAL R. GROSS

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

1 top cross-cutting needs. So one was access to
2 regulatory connection. One was access to modeling and
3 simulation tools from the National Lab system. The
4 third one was access to HALU, high-assay low-enriched
5 uranium. And the fourth one was access to legacy
6 documents. Those were their top four items. And --
7 and in five years we've made progress on all four.

8 Legacy documents have turned out to be
9 much harder to do -- especially in this -- this day in
10 age with working with some other countries. So
11 finding these documents -- the applied technology
12 designation was an issue back in, I think, November of
13 2016 John Kotek issued a statement -- issued a
14 directive saying there will be no more applied
15 technology designation. So that went away, which is
16 good. The problem is, though, we still have to have
17 all of those documents reviewed. And OSTI provided us
18 a list of almost 12,000 applied technology documents
19 that they have.

20 So it -- we've been working with industry
21 to identify the documents they want. They have to go
22 through the export and classification reviews. And
23 right now we have request for new production reactor
24 documents that we found in -- in storage in Idaho
25 Falls, and they're being scanned and reviewed. And

NEAL R. GROSS

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

1 there's several other classes of documents that
2 industry is interested in. It's getting them in their
3 hands, and getting them released when their export
4 control as been a little more difficult.

5 MEMBER PETTI: Hey, Lori?

6 MS. BRAASE: Yes?

7 MEMBER PETTI: The CBF documents, I was
8 the manager involved when those programs closed. So
9 many boxes crossed my desk. You know, the piece of
10 paper you get after 25 years -- what do you want to do
11 with it? I thought most of the critical data was in
12 the database at NEA. Isn't that -- is that still
13 true?

14 (No audible response.)

15 MEMBER PETTI: Does industry know that?
16 I mean -- the actual raw data was sent to NEA and sits
17 in big validation databases for -- for many of the
18 experiments.

19 MS. BRAASE: Well I don't think I knew
20 that, David.

21 MEMBER PETTI: Okay.

22 MS. BRAASE: I -- I think I have a couple
23 of great big binders with information on Loft. So --

24 MEMBER PETTI: Well we should talk offline
25 here.

1 (Simultaneous speaking.)

2 MS. BRAASE: Okay.

3 VICE CHAIRMAN REMPE: Actually, I had a
4 question about those documents too. Was this
5 motivated -- there was a couple years ago when some
6 folks like Corradini and Fauske -- and I am trying to
7 remember who else reached out and had an ANS session
8 concerned about the loss of thermal hydraulics data.
9 And I was going to ask before this was brought up --
10 is this related -- is that -- wait, I don't know if
11 you've looked at the proposal, Lori, but did it tie
12 back to this ANS -- Neil Todreas is involved too, as
13 I recall. But anyway, they were asking for support in
14 identifying where data -- be of most interest to the
15 industry. And was this tied to that -- or an
16 outgrowth of this ANS session?

17 MS. BRAASE: You know, that I don't know.
18 They actually -- Fauske and company actually contacted
19 us and put a proposal together. We've funded them for
20 a couple of years to do a couple different things.
21 They -- they identified sort of an outline of
22 documents the first time of -- of what might be of
23 interest. And then they just finished a report -- I
24 think, just -- boy, it's just been within the last
25 month of the next effort.

NEAL R. GROSS

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

1 So yes, we've -- we've -- they're very
2 good about identifying data out there. It's not
3 necessarily data that we think the advanced nuclear
4 industry might be interested in at this time. And the
5 -- and the -- some of the data is at, I think it said
6 IAEA. So it's not always that easy to get. But there
7 is some information on the GAIN website about the Loft
8 data from -- that Fauske did. So --

9 (Simultaneous speaking.)

10 VICE CHAIRMAN REMPE: I'm guessing there's
11 a coordinated effort and I'm just -- again, thinking
12 about NRC research folks that -- I'm hoping that
13 everybody -- I hope this is part of that bigger
14 effort. And so it would be good to find out a little
15 bit more about the motivation for it.

16 MS. BRAASE: I'm happy to send you some
17 information, Joy.

18 VICE CHAIRMAN REMPE: Thank you.

19 MS. BRAASE: You bet --

20 (Simultaneous speaking.)

21 VICE CHAIRMAN REMPE: Just go through --
22 because of ACRS -- I know we know each other, but
23 anyway, go through ACRS to make this all official.

24 MS. BRAASE: Okay.

25 VICE CHAIRMAN REMPE: Thank you.

NEAL R. GROSS

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

1 MS. BRAASE: Whatever I need to do, just
2 let me know and I can get you some information.

3 MEMBER PETTI: So Lori, Mike is on the
4 line. Maybe he -- he knows something of this history,
5 too, having spent his career in thermal hydraulics.

6 DR. CORRADINI: Yes, this is Corradini.
7 I guess I wanted just to give some information. So
8 there was a group of five of us -- Bob Henry from
9 Fauske and Associates, Neil Todreas, Bob Budnitz,
10 myself, and Frank Ron from -- formerly of EPRI --
11 retired. And we put in a -- I'll call it a thought
12 piece on how this should be done. The -- the small
13 grant was awarded to Fauske and Associates because it
14 had to be to an industry. And we focused on three
15 example experimental series, Loft, the containment
16 experiments at Battelle in Germany and now the third
17 one escapes me. But we used Loft as the example. And
18 I think to Dave's original question, we found that NEA
19 had a great deal of most of this data already in its
20 books.

21 (Simultaneous speaking.)

22 MS. BRAASE: Yes.

23 DR. CORRADINI: We had changed -- we had
24 also checked with NRC, in particular Richard Lee's
25 branch as well as -- now I -- escapes me. But Steve

NEAL R. GROSS

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

1 Bajorek, the branch that he is in. And we identified
2 all of those in the final report that went into GAIN
3 from the Fauske and Associates team.

4 VICE CHAIRMAN REMPE: So Mike, as a
5 follow-up, since NRC is involved, does that report get
6 back to Steve and folks at NRC Research? Because
7 Chris Richards retired.

8 DR. CORRADINI: Right. And I think the
9 answer to your question is yes, but it has to flow
10 through the GAIN office since they're the one that had
11 provided the original voucher money for the effort.
12 It was all -- originally thought of as an example --
13 that is, the Loft data, as an example of what one
14 would do. And we listed -- as you're well aware, I
15 think, Joy, you answered some of the questionnaires
16 that we had put out -- both the industry as well as
17 the universities and labs -- as to a whole range of
18 experiments that ought to be considered in this
19 regard.

20 VICE CHAIRMAN REMPE: And so are you
21 making progress as it's continuing? Because -- I'm
22 sorry, this is a side thing. But I just am curious --

23 (Simultaneous speaking.)

24 DR. CORRADINI: No -- no, I just wanted to
25 -- I just wanted to give you more background. That is

NEAL R. GROSS

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

1 being led, again, by Bob Henry at Fauske and
2 Associates. And they made a second proposal and that
3 -- after that point, I guess I've lost track of it.

4 VICE CHAIRMAN REMPE: Okay, thank you.

5 MS. BRAASE: We did fund a second effort,
6 and they just finished. And I can give you that
7 information. I'm not sure we'll have a third effort,
8 but we do have -- we do have the second effort. And
9 we do have the report.

10 Okay, next slide. The other thing that
11 we've been working on -- Argonne, Sandia, a little bit
12 INL and ORNL -- the database's experimental
13 information are out there and we started an effort --
14 really back in early with -- with Argonne on the TREAT
15 experimental relationship -- relational database,
16 excuse me. They were working on this database and
17 then they ran out of funding. And they only needed a
18 little bit more to finish. And so GAIN provided them
19 enough money to finish the TREXR database -- is what
20 it's called.

21 And with that effort, Argonne has a really
22 great database and a really great way of providing
23 data through the system. And so it's progressed.
24 Each one of these databases have had a story behind
25 them. And Argonne's been very good about getting the

NEAL R. GROSS

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

1 data in a place that industry can access. You have to
2 -- you have to put information in and apply for
3 access. So it is controlled. They're working on --
4 right now, they're working on some QA efforts with
5 some of the data. The interesting thing about the
6 Sodium System and Component Reliability database is
7 that that was an effort industry pushed for. About
8 three or four years ago when the vouchers -- Shane
9 Johnson announced that he was going to do something
10 different with the vouchers. And one of the ideas he
11 announced was that there was going to be a
12 comprehensive voucher available to industry where more
13 than one company could sign up and collaborate on a
14 voucher.

15 In the end, we couldn't do that. But what
16 happened was, industry decided to test Shane and so
17 they submitted a voucher -- a collaborative voucher
18 into GAIN to finish this database. And of course, we
19 couldn't give them a voucher. But what we did do is
20 we said, hey, this benefits all of industry. It
21 shouldn't be a voucher anyway. And because it
22 benefits all of industry we were able to get funding
23 through our -- our own coffers, so to say -- so to
24 speak -- to help finish that database -- to provide it
25 to industry. And -- and it was a great success. And

NEAL R. GROSS

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

1 as a result we've provided them some additional
2 funding to do phase 2 on this database.

3 So we call it walk-in work, but it's --
4 it's some funding we set aside to respond to needs
5 from industry when it benefits a bigger, broad set of
6 industry companies. So that -- that was really --
7 that was really a cool start to some -- some industry-
8 needed information. And we did it in a different way.

9 The molten salt folks out of Oak Ridge are
10 working on a component reliability database. And it
11 -- it's somewhat driven by industry requests. And as
12 industry requests information and they build up this
13 database. So we're working at making that available
14 the end of this year. Next slide, please.

15 So as part of our outreach, and during
16 COVID, we had to be creative. And so early on we had
17 a couple of workshops scheduled. And we couldn't do
18 it last year, so we turned them into webinars. And we
19 have webinar workshops, and then we have just webinars
20 for information. So again, I talked about this
21 earlier -- Jim Kinsey -- we've developed the
22 regulatory route to commercial nuclear deployment.
23 And he's -- he's -- he's finished two webinars. He's
24 got two more to go. All that information is on the
25 website under workshops.

NEAL R. GROSS

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

1 Christine's Shaping our Carbon-Free Future
2 -- the first one was yesterday and we have four to six
3 in the series on that one. And then we have three
4 workshops scheduled in the next few months. And when
5 I say workshop, that means it's industry-focused, it's
6 gathering needs to inform programs. The first one in
7 April will be related to the Advanced Reactor
8 Safeguards and Security program. And then in May
9 we'll do another microreactor workshop so that we can
10 let industry know what's going on in the microreactor
11 program and what their comments and needs are, and how
12 they would reshape what's being done, if they have
13 ideas and needs and feedback.

14 And then we have a face-to-face -- fingers
15 crossed -- a face-to-face workshop scheduled at the
16 end of August. And that's with the Advanced Methods
17 for Manufacturing workshop. And this one is a little
18 different because we're going to look at trying to
19 push the envelope on qualification processes --
20 materials qualification and different methods and
21 processes. And have a -- a look at how we can do this
22 differently to -- to -- so to speak, speed up the
23 process in qualification. So we'll see. We are
24 hoping we get to do it face to face so that we can be
25 creative and, you know, have a -- have a really great

NEAL R. GROSS

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

1 relationship-building workshop. Next slide, please.

2 GAIN outreach -- it is -- is a big deal
3 for us. We work very hard at it. And I know that
4 many people maybe don't think it's very important.
5 But we do stay in touch with our industry. So we have
6 an outreach effort that involves NGOs and industry
7 companies and states. We have an effort with Envoy
8 Public Labs where they do state engagement. Christine
9 and Ashley just presented to the Minnesota State
10 Legislature -- and Ashley can give you more
11 information on that, but Minnesota's got a vote in
12 front of their Senate -- there -- to repeal the
13 moratorium on nuclear power.

14 We have a -- a focused effort to reach
15 clean energy companies and the public and to talk
16 about nuclear as part of the renewable conversation.
17 We have a big social media effort NRIC and GAIN share
18 communication support, so we have some great
19 communication folks that are creative and -- and
20 really build off of both of our programs. So this
21 just gives you a little idea of our social media and
22 our web analytic. Next slide.

23 One of the other things that we did last
24 year -- we had a podcast with titans of nuclear. And
25 we had three podcasts. So Christine did the first one

NEAL R. GROSS

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

1 -- John Jackson, the second, and Nick Smith, the
2 third. So those podcasts are available on GAIN
3 website as well. So that -- that was quite an
4 experience. Christine -- Christine -- we have a quote
5 there from her. Connect with what excites you about
6 nuclear today, and imagine nuclear tomorrow. So if
7 you're interested in hearing what they had to say, the
8 podcast have some personal aspects to it, and
9 professional -- and they were very well done. Next
10 slide.

11 Right now, this is our GAIN organization.
12 This is not an typical org chart. People -- we are a
13 full-functioning team that really works together to
14 get anything done. But just to kind of tell you --
15 for how we've broken them out. We have Christine.
16 Our deputy is Andy Worrall. We have a new formation
17 of an executive leadership community which hasn't
18 started yet. Senior advisor is Hussein Khalil at
19 Argonne. So I run a lot of the aspects of GAIN on the
20 program management side. And the technical interface
21 is John Jackson. So -- but we do very much all work
22 together. And it -- and actually, many of these folks
23 are part-time and matrixed in. So we have a small
24 team. Next slide.

25 So this is the end of the presentation.

NEAL R. GROSS

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

1 But I did want to say that today, after, you know, six
2 years -- five years of doing the GAIN initiative, our
3 technology working groups for fast reactor, molten
4 salt reactor, and high-temperature reactor continue to
5 meet. Two of them meet, I think, monthly. And they
6 invite GAIN to participate. NEI is kind of a covering
7 for them -- gives them a platform to meet. But
8 they're fully functioning, independent groups. And
9 they provide input to us. They have a collective
10 voice when they need to resolve issues that apply to
11 all of them. It's -- it's really quite a statement
12 that these competitive companies continue to meet
13 together to work through these -- these issues and to
14 work with the National Labs. So it's a success story
15 for us.

16 EPRI and NEI are also part of this team
17 and together we have a means industry counsel that
18 focuses on both the light water aspect and the
19 advanced reactor aspect of modeling and simulation.
20 And HALU -- there's a report that's being finalized to
21 go to Congress on -- on HALU and how to start
22 providing quantities of -- of that to industry and
23 what the plan is. And so -- I think at the end of the
24 day, there's been a lot of progress made with GAIN and
25 with the industry. And we certainly look forward to

NEAL R. GROSS

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

1 the next five years and hope that we can reach some of
2 those goals that enable our industry to be world
3 leading.

4 So thank you very much for letting me
5 present and I hope I did Christine proud in some way.
6 But one she'll be back to present to you and answer
7 all your questions. But if you have any questions for
8 me, I'm happy to -- to help.

9 CHAIRMAN BLEY: Lori, thank you. This is
10 Dennis Bley. I really appreciated your talk. I -- I
11 heard something on GAIN some years back that had no
12 substance. And I didn't follow it. You've given us
13 a lot of substance and I'm -- I'm impressed. I just
14 really appreciate you coming. Members, if you have
15 any questions this would be a good time. If you
16 haven't already asked them.

17 (No audible response.)

18 CHAIRMAN BLEY: I guess not. So thank you
19 -- thank you very much. I guess it's time now to turn
20 the floor over to Dr. Ashley Finan. And as you heard
21 Matt say earlier, we got started a little late. So if
22 you go over a little bit, that's fine. But it looks
23 like we've mostly caught up. So I hope it works --
24 works out directly. So at this point, Dr. Finan, I'm
25 going to turn it over to you.

NEAL R. GROSS

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

1 DR. FINAN: Great, thank you very much
2 turning it over to me. All right, now hopefully just
3 one -- can you hear me okay?

4 CHAIRMAN BLEY: Yes, that's much better.

5 (Simultaneous speaking.)

6 DR. FINAN: Okay, good. Nobody ever wants
7 two of me. So I -- I really appreciate the
8 opportunity to speak with you today. It's -- it's
9 kind of pretty exciting. I was looking at the meeting
10 details here, and it's the 683rd meeting of the ACRS
11 full committee. So it's quite a history that you have
12 -- and an illustrious and important one. So I
13 appreciate the opportunity. I am going to take a few
14 minutes to talk about the Advanced Reactor
15 Demonstration program and about the organization that
16 I have the privilege of running -- the National
17 Reactor Innovation Center. So I will go ahead onto
18 the -- the next slide, please.

19 The National Reactor Innovation Center is
20 a national program run from DOE-NE. It's run by Idaho
21 National Laboratory. But again, it's a national
22 program. And our vision in the near term is to
23 support the demonstration of at least two advanced
24 reactors by the end of 2025, thereby really
25 reestablishing U.S. nuclear energy leadership --

NEAL R. GROSS

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

1 showing that we are the best in the world at advanced
2 nuclear technology.

3 And then continuing to develop and
4 demonstrate, and then deploy, commercial advanced
5 nuclear by 2030 so that is providing abundant clean
6 energy by that time. And then the next slide, please,
7 if you would.

8 A little bit more detail -- our five-year
9 program objective includes that -- that first vision.
10 Enabling demonstration of at least two advanced
11 reactors. We want to do that by making available
12 infrastructure, sites, materials, and expertise --
13 particularly across the lab complex. So we want to
14 provide regulatory support and coordination to
15 companies pursuing demonstrations, as well as develop
16 best practices in public engagement. And then it
17 doesn't end in 2025. We wanted to be working to also
18 prepare DoE an the labs for continued innovation and
19 demonstration -- not a one-time event, but ongoing
20 innovation. So we want to do that by developing best
21 practices and a competency within the DoE labs and the
22 U.S. nuclear industry for planning and construction
23 and demonstration at nuclear projects.

24 We also want to develop enduring
25 infrastructure and expertise that can enable industry

NEAL R. GROSS

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

1 to continue to innovate, as well as enable labs and
2 universities to continue to innovate and establish
3 methods for efficient coordination among the
4 laboratories. And we work very closely with GAIN on
5 that. I kind of skipped over the relationship between
6 GAIN and NRIC because Lori presented that. But I will
7 emphasize that we -- we work to be complimentary and
8 coordinated. So -- so Lori mentioned the access
9 CRADA. That's one of those methods for efficient
10 coordination. NRIC has developed a resource team so
11 another method. So we're -- we're working to open up
12 channels of communication so that we can all really
13 work together. This is going to take a village, the
14 way I see it, to get these reactors done in the -- the
15 time frame that DoE is pushing us to move. So we want
16 to be working together and all pulling in the same
17 direction. So next slide, please.

18 So we are committed to achieving our
19 vision through our mission to inspire stakeholders and
20 the public to empower innovators to test and
21 demonstrate their technologies, and to deliver
22 successful outcomes through efficient coordination of
23 partners and resources. And these are shown in -- in
24 sort of a circle here because I see them as -- as
25 being intricately related. I am convinced that as we

NEAL R. GROSS

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

1 empower the private sector to demonstrate their
2 technologies, we'll be able to deliver successful
3 outcomes. And I am confident that that will captivate
4 and inspire stakeholders and the public as they can
5 see what advanced nuclear technology can really do for
6 what we need as a -- as a society and as a world.
7 Next slide, please.

8 NRIC's key stakeholders include the public
9 and in particular the local public around the areas
10 where demonstrations might occur. INL is one of those
11 locations, but there are also locations around the
12 country that -- that we are focused on for a potential
13 advanced reactor demonstration. We have industry
14 stakeholders, which include the advanced reactor
15 developers, the supply chain for those developers and
16 then, on the other end, the potential users of those
17 reactors or the products of those reactors -- whether
18 that's electricity or heat or hydrogen.

19 And then on the government's side, we of
20 course have DoE as well as NRC, Congress and others --
21 and you see DoE -- DoD and NASA because there are
22 significant demonstration efforts being developed
23 within -- and actually pursued within the Department
24 of Defense and within NASA. And while we're not
25 directly supporting them, we are trying to prepare

NEAL R. GROSS

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

1 infrastructure that could be of use to them -- and
2 prepare those same competencies that could be of use
3 to them when they're ready, if that's -- if that's
4 helpful.

5 And then of course researchers at the
6 laboratories and at the universities. One of our key
7 functions is to try to -- you know, especially at the
8 laboratories -- connect the developers who are
9 demonstrating reactors with the subject matter
10 expertise and the people who can help them make those
11 projects successful throughout the lab systems. And
12 then, in the universities, we see some of that. We
13 also see the universities as a place where we can find
14 R and D in complimentary technologies that could
15 enable us to ensure that these technologies turn out
16 to be scalable. They need to be affordable. They
17 need to be constructed on schedule and on budget, and
18 they need to be relevant to the grid of the future and
19 the integrated energy systems that we envision in the
20 future. So that's another area where we see the
21 universities coming in. And of course the
22 universities are part of the talent pipeline.

23 Next slide, please. So the historical
24 context for this -- there -- there were historical
25 reactor demonstration programs that really proved that

NEAL R. GROSS

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

1 we can do this. And I know there are a lot of folks
2 who think that this is ambitious and -- and not going
3 to happen. But history counsels us to be more hopeful
4 because the Atomic Energy Commission demonstrated over
5 a dozen reactors in as many years with private
6 industry cost-share. At the National Reactor Testing
7 Station in Idaho, the nation built 52 reactors over a
8 period of about 25 years. And of course, we have a
9 lot of other history in the U.S. and internationally
10 of advanced reactor demonstration programs.

11 So we are really encouraged by our
12 history. And what we see recently is bipartisan
13 policy enthusiasm for moving forward with this in
14 recognition of our climate challenges and our global
15 energy needs. And we see the Nuclear Energy
16 Innovation Capabilities Act, which actually authorized
17 and called for the National Reactor Innovation Center.
18 And then the Nuclear Energy Innovation Modernization
19 Act, which of course you're very familiar with as it's
20 deeply concerned with modernization of nuclear
21 regulation.

22 And then the Advanced Reactor
23 Demonstration Program which showed up in
24 appropriations last year, but then has been authorized
25 further in the Energy Act of 2020. And sets up this

NEAL R. GROSS

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

1 really big demonstration program for advanced
2 reactors, which I will cover in detail in just a
3 moment. So a lot of, you know, strong, historical
4 context. We know that when we're faced with an urgent
5 need we can innovate and we can demonstrate in
6 advanced reactors. Maybe it's been a half century
7 since we really did that quickly. But we now have
8 this policy support to do it again. And we have -- if
9 you go to the next slide -- we have a U.S. advanced
10 reactor industry that is comprised of dozens of
11 companies and really is -- is developing a wide range
12 of technologies with different strengths. Sizes
13 ranging from around a megawatt to a gigawatt. And
14 coolants that span most of the -- most of the coolants
15 we've ever looked at, including gas, sodium, salt,
16 lead and water. And a significant private investment
17 interest in this space.

18 So it's an exciting time relative to the
19 current industry in the United States. The motivation
20 this time is really about clean, reliable energy with
21 increased efficiency and the potential for improved
22 resource utilization and reduced waste. And this
23 group of companies is looking at very diverse markets
24 -- and in fact, diverse products. So that
25 differentiates them from the current operating fleet

NEAL R. GROSS

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

1 right now. So of course, the operating fleet is also
2 looking to diversify into hydrogen and other
3 opportunities. So, I guess everybody is -- is moving
4 that way. Next slide, please.

5 VICE CHAIRMAN REMPE: Ashley, this is Joy.
6 Could you go back a slide? I just was curious about
7 some of the bullets under your demonstration programs.

8 I'm well aware of the Atomic Energy
9 Commission's advanced reactor deployment program and
10 I remember the production reactors and what of course
11 has gone on out here in Idaho, but when you get down
12 toward the end, I'm not sure why you included
13 international development. Are you talking about
14 their deployment programs?

15 And then, of course, the NGNP, I can
16 remember when they put a sign up out at the site
17 saying future site of the NGNP, and nothing else went
18 up along with that sign, so why is that one included
19 in your list of bullets?

20 DR. FINAN: Yeah, that's a good question.
21 I mean, it is part of our history here, and it's true
22 that it was not ultimately successful and I think
23 there are important reasons for that, and reasons that
24 we need to learn from really and I think we're working
25 to do that, but it's one of our more recent -- it was

NEAL R. GROSS

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

1 a demonstration program. It was not successful. You
2 are quite right.

3 In the international space -- oh, go
4 ahead, Joy.

5 VICE CHAIRMAN REMPE: Oh, go ahead and
6 finish and then I had a -- well, I'll follow up.

7 DR. FINAN: Okay.

8 VICE CHAIRMAN REMPE: I interrupted.
9 Well, Clinch River was another example, and Bill Madia
10 has a very good presentation that I saw that I'm sure
11 the slides are somewhere available online, but of the
12 history of DOE in recent years, deployment of programs
13 and some of the pitfalls, and there was a lot of good
14 lessons he cites on why some of them are way over
15 budget and were ultimately not successful.

16 DR. FINAN: Yeah, Clinch River was a
17 really interesting case study in continuing with a
18 project that had support from a variety of different
19 districts even in the face of decreasing policy need
20 for the project, right?

21 The initial reasons for pursuing the
22 project essentially became lower priorities, and yet
23 they continued because of political momentum. It was
24 really not a very good picture and I think that's
25 another one that we need to learn from, so, and I've

NEAL R. GROSS

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

1 studied that one, so I appreciate your bringing that
2 up. I agree with you. It's a good case study.

3 On the international development, we have
4 seen, for example, if you look back at the development
5 of BWRs and PWRs in the UK --

6 Well, so let's see, if you look at the UK
7 and Canada and the reactors that they developed, they
8 went from their very first reactor, very small reactor
9 to their commercial plants in a period of, if I'm
10 remembering correctly off the top of my head, 12 to 14
11 years, and that's going through several iterations of
12 demonstration projects of increasing size over, again,
13 you know, roughly a decade, decade and a half.

14 And that, to me, is kind of a staggering
15 pace of development that we don't always even aspire
16 to over the last half century in nuclear, but I think
17 the point is we're aspiring again to be innovative at
18 the kind of speeds that were achieved at the beginning
19 of the atomic energy movement.

20 So, that's what I would -- you know, I
21 guess I take your point on the slide and I can
22 probably make some edits there, but that's what I take
23 out of it.

24 VICE CHAIRMAN REMPE: I'm not really
25 concerned about the slide, but along the same theme,

NEAL R. GROSS

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

1 John Deutch led a task force, the SEAB Task Force,
2 jeppers, I guess it must have been about four years,
3 five years ago now, that talked about the fact that
4 it's not just getting a reactor, a new design up, the
5 first of a kind.

6 Because there will be problems just as
7 we've seen what's going on with the Vogtle plants and
8 any new technology, especially when you're trying to
9 recreate the industry where some of the folks who
10 supply nuclear grade components were no longer
11 available, so that one really needs to think about the
12 nth of a kind, that the government needs to take a
13 major role and perhaps even get past the first hump
14 before they have a viable technology. What are your
15 thoughts about that?

16 DR. FINAN: Yeah, absolutely, I am -- so
17 one of my -- my biggest fear, and I'm not really
18 afraid of this because I think we're working to make
19 sure this doesn't happen, but coming into this job,
20 right, my concern was, well, we don't want to just
21 build a reactor and have that be it, first of a kind
22 and last of a kind, right? That's not the idea here.

23 We want something that's going to be
24 scalable and relevant to climate change, and so you'll
25 see when I get to two slides from here that DOE is

NEAL R. GROSS

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

1 focusing on the supply chain, so they are thinking
2 about that supply chain issue, some things for the
3 advance.

4 Another thing that I'm really working on
5 in the NRIC program is how do we develop the advanced
6 construction technologies, the digital engineering,
7 and the project management approaches that will enable
8 these projects to be scalable, to come in on schedule
9 and on budget, and not have those problems that you're
10 pointing to.

11 And I mean, granted, Vogtle is first of a
12 kind, so you expect to see some issues, but we've seen
13 a bunch of good literature over the last five years
14 that has identified what are the key cost drivers of
15 nuclear construction costs or, yeah, well, cost,
16 drivers of cost, sorry about that.

17 But anyway, what are the key cost drivers?
18 What do we need to address? And we've found that many
19 of them are in civil construction or are in the way
20 that we do design engineering and transition to
21 construction and operation, and so I think there are
22 opportunities there.

23 And I have another area where I'm trying
24 to grow an opportunity to address some of the project
25 management issues that we see in nuclear construction,

NEAL R. GROSS

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

1 and then there's one more which is integrated energy
2 systems where you're really making sure that you're
3 planning for the future market, not the past market.

4 So, I think that I'm very focused on that
5 issue and I'll get to it at a high level in this
6 presentation, but it's deeply important to me and it's
7 a top priority, so I welcome further conversation on
8 it, and maybe when we get to that slide, if you have
9 reactions, I'll welcome them then also.

10 VICE CHAIRMAN REMPE: Okay, thank you.

11 DR. FINAN: Sure, so I'm going to just
12 spend a couple of minutes here on the advanced reactor
13 demonstration program. This is not run out of my
14 organization. Rather, NRIC is really part of the
15 advanced reactor demonstration program.

16 So, DOE-NE has put together the ARDP and
17 there are a number of awards within it. NRIC is here
18 to help support those companies in their process and
19 help make them successful. NRIC is also here to help
20 other companies, even the ones who didn't win ARDP
21 awards.

22 So, we're working with companies who have
23 no government money or have government money from
24 other sources, but we're also supporting the advanced
25 reactor demonstration program whose objectives are to

NEAL R. GROSS

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

1 develop, construct, and demonstrate several advanced
2 reactors with beneficial capabilities, including
3 inherent safety features, superior reliability,
4 greater fuel utilization, and an ability to integrate
5 electric and non-electric applications, as well as
6 support a diversity of advanced designs that offer
7 significant improvements over the current generation
8 of operational reactors, and stimulate private sector
9 companies and those supply chains that will be crucial
10 to having nth of a kind development.

11 There are three funding pathways in the
12 advanced reactor demonstration program that are
13 aligned with a variety of maturity levels.

14 So, the first is the advanced reactor
15 demonstrations awards which DOE calls the demos, and
16 those are cost-shared demonstrations for two reactor
17 designs and they're a 50/50 cost share, and those
18 designs have the potential to be operational in five
19 to seven years.

20 And then the second category is risk
21 reduction for future demonstration awards and DOE
22 calls those risk reduction, and those support five
23 other advanced reactor designs that have the potential
24 to be operational in ten to 12 years.

25 And then finally, the advanced reactor

NEAL R. GROSS

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

1 concepts awards, there are several of these
2 partnerships focused on advancing reactor designs that
3 are moving towards the demonstration phase, but aren't
4 necessarily in a countdown phase with that kind of
5 firm timeline at this point. Next slide, please?

6 MEMBER PETTI: Hey, Ashley?

7 DR. FINAN: So, these are the -- yeah, go
8 ahead.

9 MEMBER PETTI: Ashley, this is Dave, just
10 a question on -- if we can go back. Are these like
11 one-time awards right now or like -- I see ARC-20. I
12 remember ARC-15. What's the frequency of these? Do
13 you know what DOE's thinking in this?

14 DR. FINAN: That's a good question, Dave.
15 Thank you. They made their initial awards in 2020.
16 Just at the end of 2020, they made these, and the
17 expectation is that they will continue to receive
18 incremental funding through their project.

19 And so when they made those awards in
20 2020, they awarded certain amounts, but it was not all
21 2020 dollars. So, for example, the demonstration
22 awards are up to \$4 billion at a 50/50 cost share.

23 So, DOE, hypothetically, if they committed
24 to \$2 billion, they only gave a portion of that, so
25 \$80 million in 2020, but their intent is to continue

NEAL R. GROSS

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

1 to fund those pending appropriations until those five
2 to seven years or ten to 12 years are complete.

3 MEMBER PETTI: Thanks.

4 DR. FINAN: Sure, so the next slide? This
5 just shows the awardees for the three categories, and
6 I'm going to go through each category in its own slide
7 so you can advance to the next slide, please.

8 So, the two technologies selected for the
9 advanced reactor demonstration demo pathway were the
10 TerraPower Sodium reactor and the X-energy Xe-100
11 reactor. The TerraPower Sodium reactor is a sodium
12 fast reactor and then the X-energy reactor is a high
13 temperature gas reactor.

14 These projects are both looking at the
15 Energy Northwest site in Washington State as one of
16 their possible sites, and X-energy has made clear that
17 that's their preferred site. TerraPower is also very
18 serious about that site, but they are doing a site
19 selection process during this first year, so they
20 haven't made a final selection.

21 So, again, the demonstration projects are
22 to actually build and operate these technologies.
23 These would be NRC licensed, and so they are working
24 with the NRC to move toward a license application.

25 VICE CHAIRMAN REMPE: So, in both cases,

NEAL R. GROSS

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

1 there's an organization that's willing to actually own
2 and operate the plant too. It's not just the vendor
3 that you're giving this award to?

4 DR. FINAN: That's my understanding, yes,
5 and Energy Northwest is a partner in both of these
6 projects --

7 VICE CHAIRMAN REMPE: Okay.

8 DR. FINAN: -- the utility there. Next
9 slide, please? The risk reduction pathway selected
10 five different technologies.

11 They include Kairos Power, and there, the
12 award is for the design, and construction, and
13 operation of their Hermes test reactor, which is a
14 precursor to their commercial reactor, and this is a
15 fluoride salt cooled TRISO pebble fueled small modular
16 reactor.

17 The next is the Westinghouse eVinci which
18 is a heat pipe cooled microreactor with TRISO fuel,
19 and there, their risk reduction award is for technical
20 risk reduction for moderator design, wick
21 manufacturing, refueling, and licensing. It doesn't
22 actually include the construction of the reactor at
23 this point.

24 And then BWXT has also a high temperature
25 gas reactor, microreactor, and they have an award to

NEAL R. GROSS

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

1 mature some of their technology focusing on their
2 uranium nitride TRISO fuel.

3 Holtec has their SMR-160 which is a light
4 water cooled natural circulation PWR, and they have an
5 award here for early stage design, engineering, and
6 licensing activities.

7 And then Southern Company, in partnership
8 with TerraPower but Southern Company is the lead here,
9 has a risk reduction award to design, construct, and
10 operate the molten chloride reactor experiment which
11 is a small demonstration reactor as a precursor to
12 their molten chloride fast reactor, and you can go to
13 the next slide, please.

14 MEMBER PETTI: So, Ashley, 180 megawatts
15 thermal is the definition of small?

16 DR. FINAN: That is their molten chloride
17 fast reactor, so I should have been more clear. The
18 first column, that's their commercial target reactor.

19 MEMBER PETTI: Oh, I see.

20 DR. FINAN: The actual risk reduction
21 project is about 100 kilowatt thermal --

22 MEMBER PETTI: Okay.

23 (Simultaneous speaking.)

24 MEMBER PETTI: Okay, that makes sense,
25 thanks.

NEAL R. GROSS

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

1 DR. FINAN: So, good point, yeah. Okay,
2 next slide, please? And then here under the ARC-20,
3 there were three awards. One is the advanced reactor
4 concepts for conceptual and preliminary design of
5 their sodium core reactor, and then one for General
6 Atomics for conceptual design of their gas cooled fast
7 modular reactor, and then for MIT for conceptual
8 design for the MIGHTR gas cooled high temperature
9 reactor.

10 So, those are the awards, and at this
11 point, you know, our goal is to help support them.
12 So, I will move on to talking a little bit more about
13 NRIC unless there are any more questions on those
14 awards. Okay, the next slide then, please?

15 So, part of our mission is to empower
16 these companies, right, and we want to support those
17 companies who DOE has entered into a public/private
18 partnership with, so I'm going to talk a little bit
19 about how we're empowering those companies. Next
20 slide, please?

21 So, first, we're working really closely
22 with GAIN, and with GAIN and NRIC together, I believe
23 that DOE-NE has worked, you know, in partnership with
24 Congress, of course, to set up the support that will
25 help companies move from their concepts to their

NEAL R. GROSS

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

1 commercial product. So, together, we're really trying
2 to help them cross this bridge. Next slide, please?

3 So, some details on what NRIC is doing to
4 support them, we're developing a demonstration
5 resource network which includes test beds and
6 demonstration sites first, and so those include a
7 couple of existing facilities.

8 And I'm not going into detail today, but
9 there are two facilities at INL that we've identified
10 as potential test beds for demonstration reactors, so
11 they are buildings.

12 One is the EBR-2 dome which you can see in
13 the slide and it's a dome shape, and the other is the
14 ZPPR cell which was the zero power physics reactor
15 cell, and that's kind of the cone shape in the picture
16 here.

17 Those two facilities both previously
18 hosted reactors. The EBR-2 dome hosted a 62.5
19 megawatt thermal reactor and then the ZPPR cell hosted
20 zero power critical reactor experiments, and those
21 both are still here and they're potentially places
22 where we could host reactors again.

23 So, we've done preconceptual design on
24 both of those facilities, for the EBR-2 dome in order
25 to host reactors up to 20 megawatts thermal or so, and

NEAL R. GROSS

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

1 then on the ZPPR cell, to host much smaller reactors
2 up to 500 kilowatts thermal.

3 And we are -- we've done some trade
4 studies on that design and we've run an RSP for the
5 conceptual design, and we're working to move that
6 forward over the next couple of months and initiate
7 the conceptual design on those facilities so that we
8 could begin construction within a year or so, or a
9 year or two.

10 So, that's one element of the resource
11 network. We want to have these facilities because
12 they represent existing infrastructure that we can
13 leverage to enable multiple innovators, and the model
14 is that you would have a demonstration reactor that
15 could come in.

16 Maybe it would take them about three
17 months to set up, six months to operate, and three
18 months to take down, and so nominally every year, you
19 could have a new experiment and we can have that
20 continuing innovation over time without each of these
21 short demonstrations requiring the investment of the
22 containment facility or the confinement and all of the
23 accouterments that come along with that.

24 We're also developing some characterized
25 demonstration sites at INL, as well as potentially

NEAL R. GROSS

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

1 some NEPA evaluated sites.

2 So, we've developed with Pacific Northwest
3 National Lab a plant perimeter envelop approach to
4 doing environmental evaluations in the absence of a
5 specific design, but instead enveloping all of the
6 different advanced reactors that we think could want
7 to demonstrate there so that we can get a little
8 further down the road on the site, do a NEPA
9 evaluation and be ready for a reactor, and then move
10 at the speed of business when we have a company that's
11 ready to demonstrate.

12 MEMBER BALLINGER: This is Ron Ballinger.

13 DR. FINAN: Yes, Ron?

14 MEMBER BALLINGER: I'll expose my
15 ignorance. What's the status of FFTF?

16 DR. FINAN: I don't know.

17 MEMBER BALLINGER: Anybody know?

18 DR. FINAN: That's a good question.

19 MEMBER BALLINGER: I mean, as far as I
20 know, they were, you know, they were there. It's a
21 facility. It's got a containment. It's got hot cells
22 that may or may not have been disassembled. I don't
23 know the status, but it --

24 VICE CHAIRMAN REMPE: So, Ron, years ago
25 -- I'm not the expert on FFTF, but I'll qualify this,

NEAL R. GROSS

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

1 but just to get to the question, years ago when I
2 visited, they had stripped the hot cells of the
3 windows and shipped them to other labs.

4 For many, many years, as you probably
5 know, they pumped around the sodium, but at one point,
6 they drilled some holes and they've quit pumping it
7 down.

8 Now, it depends on -- the last time this
9 question was asked, it depended on who you talked to
10 on whether you could restart it or not, and so I
11 wouldn't want to say you could or couldn't at this
12 point because I'm not an expert on it, but there were
13 a lot of questions and if it had been too long.

14 MEMBER BALLINGER: I think I recall that
15 to use this, you would have to assume the legacy cost
16 which was a couple hundred million dollars, but I
17 don't know.

18 MEMBER PETTI: I remember what Joy
19 remembers, a lot of DOE activity looking at advanced
20 reactor tests and demonstration, and that issue came
21 up, and I agree with Joy. It depends on who you talk
22 to as to whether or not you could come back after
23 they've drilled a hole in the vessel, so.

24 DR. FINAN: Yeah, and that's helpful.
25 That's also what I had heard, you know, from one

NEAL R. GROSS

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

1 source. Oh, they drilled holes. You can't do
2 anything, and then from another, well, actually, you
3 could, so it's a good question.

4 One of the -- we are actually looking at
5 that hot cell facility that Joy mentioned. So, one of
6 the gaps that we found -- we did a survey of advanced
7 reactor demonstrators to understand what their needs
8 were.

9 One of the major gaps is in fuel
10 fabrication for initial fuel for some of these initial
11 reactors, and we are working with PNNL to do a deeper
12 dive into understanding that gap and also --

13 And they've already drafted that deeper
14 dive, but then they're looking at how could we fill
15 that gap and is there a facility within the complex
16 existing that could fill that gap?

17 And one of the potential facilities
18 includes that hot cell facility whose acronym I can't
19 remember right now, but it's the one Joy was
20 referencing with the windows taken out.

21 You know, we do know there are significant
22 costs to refurbishing some of these facilities, and in
23 some cases, you know, we ought to be looking at new
24 facilities instead.

25 What we found with the EBR-2 dome is that

NEAL R. GROSS

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

1 that facility was fully decommissioned and, you know,
2 cleaned up as needed, and it's now really -- actually,
3 they've started to destroy it and started to cut
4 through the wall. That has since been repaired in
5 order to reuse it, and it's really, I think, a great
6 facility for this.

7 Our cost estimates right now for putting
8 in the minimum viable test bed as we see it are coming
9 in in the, at the high end is around \$31 million and
10 the point estimate is right around \$20 million.

11 So, that's actually a really, really
12 fantastic number for trying to be able to provide a
13 significant confinement function and everything that
14 we can have right there, but as far as fuel
15 fabrication, we are looking at the FFTF area there to
16 see if there's an opportunity.

17 We're also doing -- we've done a study
18 with Nevada national security site, which is still in
19 draft but will be finished up this spring, looking at
20 whether there are potential demonstration sites within
21 NMSS, perhaps in some of their tunnels or elsewhere
22 there.

23 So, we are looking at other options.
24 These are the ones that were, you know, clearly good
25 ones, and we've moved out on those, but there are

NEAL R. GROSS

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

1 others in the queue that we're considering.

2 So, in the experimental, I mentioned the
3 fuel facility issue already, that we're trying to
4 figure out how we make sure we can provide fuel
5 fabrication facilities for these advanced reactor
6 demonstrations.

7 On the experimental side, we're finding a
8 lot of demand for irradiation and characterization,
9 particularly molten salt characterization, so we're
10 developing a Molten Salt Thermophysical Examination
11 Capability facility called MSTEC. That's the acronym
12 for it.

13 We don't really have good capabilities in
14 the United States to characterize irradiated molten
15 salts, and so that was a gap that was identified by
16 the molten salt -- one of the technology working
17 groups that Lori referred to those earlier, and
18 they've been really useful to us in identifying key
19 needs, so we're pursuing that.

20 We've had a few other things come up over
21 the last few months that we're working to scope
22 solutions to. One is a helium component testing
23 facility that seems to be needed by several of the
24 high temperature gas reactors, and then some creep
25 frames that are needed for some of the materials

NEAL R. GROSS

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

1 qualification for some of the reactors, and we don't
2 have the adequate creep frames in hot cells in the
3 complex that are available right now.

4 So, we're trying to be agile, and when
5 needs come up, seeing how we can figure out to work
6 together with multiple companies and address those
7 needs in the experimental space, and also work
8 together with the R&D programs of DOE-NE.

9 MEMBER PETTI: Ashley, are you aware
10 there's a lot of work done under NGNP on a component
11 test facility that's exactly what you're talking about
12 for the helium test facility, initial cost estimates,
13 scope, and the like?

14 Those reports sit in the INL electronic
15 document storage, so you should be able to access
16 that, and there's still a few engineers who worked on
17 that still at INL if you need names.

18 DR. FINAN: I do. Thank you, Dave.

19 MEMBER PETTI: Okay.

20 DR. FINAN: I will reach out to you.

21 MEMBER PETTI: Okay.

22 DR. FINAN: That's great, appreciate it.

23 MEMBER BALLINGER: Now, this is Ron again.

24 Is there not a helium test facility now associated
25 with Sandia at some of the break and cycle test

NEAL R. GROSS

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

1 facilities and things like that?

2 MEMBER PETTI: No, that's supercritical
3 CO2 you're thinking about, Ron.

4 MEMBER BALLINGER: Oh, maybe that's it.
5 I'm sorry.

6 MEMBER PETTI: Yeah, and I'm not sure
7 where that is. DOE cut the funding.

8 MEMBER BALLINGER: I thought they had it
9 up and running there for a while, but it's probably
10 quite easily to check on.

11 DR. FINAN: Well, I'll check on that at
12 Sandia and just verify whether or not it exists. We
13 certainly don't want to duplicate it.

14 MEMBER BALLINGER: Dave, it is Sandia,
15 right?

16 MEMBER PETTI: Yeah, they were doing work
17 on supercritical CO2 and it was funded jointly between
18 EERE and NE, and NE pulled their side of the funding,
19 so I don't know what happened, whether they were able
20 to, you know, go forward with just EERE or not.

21 MEMBER BALLINGER: Okay.

22 DR. FINAN: Thank you. We have some
23 activities also, you know, for empowering innovators
24 and regulatory risk reduction, and I'll cover those in
25 more detail in the next slide.

NEAL R. GROSS

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

1 We have a virtual test bed, which is an
2 effort to take the various NEAMS modeling and
3 simulation tools, so that's the Nuclear Energy
4 Advanced Modeling and Simulation program within NE.

5 And so there's a great suite of different
6 tools, but what we're doing at NRIC is working with
7 the NEAMS team to take those tools and integrate them
8 into specific use cases, so a specific surrogate HTGR,
9 a surrogate FHR, and a molten salt reactor to catalog
10 some full demonstrations on how you would integrate
11 these tools to simulate an advanced reactor prior to
12 demonstration.

13 And it's a fairly small effort, but we
14 hope that it really leverages the investment that's
15 been made in mod/sim and makes it translatable to what
16 industry needs for their demonstrations.

17 And then the NRIC resource team is modeled
18 after the ARPA-E resource team or some of the DoD
19 resource teams, and the goal there is to provide some
20 very small levels of supports for demonstration
21 companies, the companies seeking to demonstrate
22 advanced reactors, and get them access to subject
23 matter experts across the lab complex with very little
24 paperwork and contracting and just try to be really
25 quick.

NEAL R. GROSS

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

1 We do a couple of different screens. They
2 can be done in, you know, a couple of hours really
3 assuming that the company has been developing things
4 like a project plan and a design, and then they're
5 just sharing those, showing us that they have those,
6 passing some restrictive party screening, and then we
7 have 200 hours of SME time to help them with basic
8 planning, and costing, and scheduling, and really help
9 them dive a little deeper than they can get into, you
10 know, in an initial conversation into what the lab
11 resources are and how they can use them, and so that's
12 the resource team. Next slide, please?

13 And then in the area of regulatory risk
14 reduction, so our objective here is to anticipate
15 required regulatory preparations that are common to
16 the NRIC stakeholders and take actions to increase
17 certainty, reduce risk, and accelerate demonstration.

18 So, we have some activity areas here that
19 include some research into microreactor transportation
20 and decommissioning regulations, just kind of
21 compiling what are the various regulations that exist,
22 where are there gaps, and how are we going to manage
23 transporting microreactors.

24 We coordinate with NRC and we're working
25 to be able to coordinate with them on demonstration

NEAL R. GROSS

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

1 projects. The pictures on the right-hand side, the
2 one on the bottom right is an addendum to the
3 memorandum of understanding between the DOE and the
4 NRC for advanced reactor demonstrations, and this
5 addendum specifically pertains to NRIC and how NRIC is
6 going to help with this coordination.

7 We envision potentially having some shared
8 resources for staff, so maybe having some staff
9 rotations where we could get some NRC expertise,
10 perhaps helping us with the development of work on the
11 test beds that I described earlier or having a
12 learning opportunity for NRC staff in advanced reactor
13 safety analysis for some of those demonstrations.

14 And some of those might be DOE authorized,
15 but we want a pathway for them to get, you know,
16 familiar with the NRC and vice versa so they can move
17 to a commercial license once they've moved to their
18 commercial product.

19 We also see opportunities for engaging
20 with NRC on some of the advanced technologies like
21 digital engineering or advanced construction
22 technology, and then, let's see, I got off my list
23 here.

24 We have several demonstration projects
25 that will use the DOE authorization process, and so

NEAL R. GROSS

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

1 we're developing some guidance on that because while
2 many folks think, well, maybe it's more flexible and
3 it can be more agile, it isn't as well documented as
4 the NRC processes, and so there's a lot of
5 misunderstanding or just opacity around the process,
6 so we've been working on some guidance for that.

7 We're working to identify issues that
8 could come up when you try to site an NRC-licensed
9 reactor near DOE authorized facilities, and those
10 issues are numerous and complicated but should be
11 resolvable, so we are working with DOE and NRC and
12 some private sector companies to resolve those things
13 and make sure we get clarity on how we manage those.

14 VICE CHAIRMAN REMPE: So, Ashley, I was
15 interested in this bullet about the DOE authorization
16 process guidance.

17 Many years ago, there was an effort that
18 DOE had investigated about some of the folks who ran
19 the facilities at DOE laboratories wanted to switch to
20 the NRC because they found the authorization process
21 so fuzzy, they'd rather have a regulator who had
22 everything written out and they weren't subject to
23 another DOE monitor coming in and interpreting it
24 differently. In your efforts for this guidance, are
25 you -- is that an issue you've identified and you're

NEAL R. GROSS

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

1 trying to resolve?

2 DR. FINAN: Yeah, well, actually, I mean,
3 DOE helped identify that, so they must have learned
4 from that experience, and what they asked us to do was
5 to work to develop a standard review plan for the DOE
6 authorization process for an advanced reactor
7 demonstration.

8 I don't know that it will be particularly
9 applicable to other DOE facilities, but for an
10 advanced reactor demonstration, it really tries to
11 take the -- it looks at the NRC processes and tries to
12 make the DOE process more well documented and
13 transparent as those NRC processes are, so I would say
14 it's probably responsive to exactly what you were
15 hearing.

16 VICE CHAIRMAN REMPE: It will be
17 interesting to see what they have for this standard
18 review plan because a lot of them tend to get
19 technology specific.

20 I mean, we did design-specific review
21 standards for some of the advanced light water
22 reactors, so coming up with something that will work
23 for a molten salt, and a gas reactor, and whatever
24 other type at the same time might be hard.

25 MEMBER BALLINGER: And with respect to NRC

NEAL R. GROSS

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

1 versus DOE, there are a number of projects, not
2 necessarily good ones, but out in Hanford where they
3 said they were going to adhere to what they called NRC
4 equivalents. I never really knew what that meant, but
5 it may be that somebody does.

6 VICE CHAIRMAN REMPE: Well, I think a lot
7 of the DOE standards are actually the same as what you
8 see within the NRC, but the problem was that they
9 didn't have all of the guidance and specific things
10 that have been developed in the NRC, you know, over
11 the years that got rid of some of the subjectivity.

12 MEMBER BALLINGER: Well, it may be that
13 somebody did some project or something that identified
14 these issues.

15 VICE CHAIRMAN REMPE: I remember there was
16 -- there were two facilities that had actually gone to
17 NRC regulation. Now, this was something that I was
18 involved with like 15 years ago. It was a while back.

19 MEMBER BALLINGER: Yeah, the spent fuel --

20 VICE CHAIRMAN REMPE: But it just is
21 something I've been seeing this come up again. It's
22 interesting to me.

23 MEMBER BALLINGER: Yeah, the end reactor
24 spent fuel dry storage facility was one of them and I
25 don't remember the second one. I would say that it's

NEAL R. GROSS

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

1 ongoing, but I would be mistaken because that one's
2 been ongoing for a generation.

3 VICE CHAIRMAN REMPE: Well, this was a
4 Lawrence Berkeley facility was one of the two.

5 MEMBER BALLINGER: Oh.

6 VICE CHAIRMAN REMPE: I can look that up
7 because I was involved in a document that cited the
8 two, so it's just my memory has forgotten the names of
9 the facilities, but I'll look it up and send you an
10 email. Anyway, go ahead, Ashley, sorry.

11 DR. FINAN: No, no problem, it's
12 interesting to hear the conversation and the history,
13 and I did just look it up and it is the generator
14 review plan that's specific to microreactors, so that
15 does narrow it down somewhat, though it doesn't give
16 you a specific fuel, but I can dig up that document.

17 It was finished last, the end of our
18 calendar year, so I'll dig that up and see if I can
19 share that, and maybe it would be of interest.

20 Then we have, let's see, so I described
21 our NEPA approach, which is to develop this plant
22 parameter envelope which we developed with PNNL as the
23 lead authors on that, and that's on our website in the
24 resources section.

25 That was released a couple of weeks ago

NEAL R. GROSS

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

1 and I'm excited about that, not just for INL where we
2 are looking at whether we can get some NEPA coverage
3 for potential reactors, but also elsewhere.

4 And it's designed to be ultimately, we
5 hope, very compatible with the NRC's advanced reactor
6 generic EIS because we have been coordinated with them
7 on that. We've been meeting on a weekly basis with
8 the NRC's environmental team on the plant parameter
9 envelope effort, so --

10 MEMBER KIRCHNER: Ashley?

11 DR. FINAN: -- we're going to be
12 coordinated there. Yes?

13 MEMBER KIRCHNER: This is Walt Kirchner,
14 nice to hear your voice again. I would commend to you
15 to look at the Oak Ridge early site permit that was
16 issued recently, well, recently now being, I think,
17 2019, but for the Clinch River site there. They did
18 use the plant parameter envelope approach.

19 DR. FINAN: Yes.

20 MEMBER KIRCHNER: So, it's been, how
21 should I say? It's been christened, or it's been
22 exercised, or it's been used, so there is something to
23 build on there.

24 DR. FINAN: Absolutely, and that has been
25 a really important precedent for us because we've had

NEAL R. GROSS

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

1 some, I guess, raised eyebrows about the approach, but
2 it's been proved, so that's fantastic.

3 And that was an important precedent and
4 something that the PNNL team has good expertise on,
5 and we were able to take that, and that was, of
6 course, more focused on light water small modular
7 reactors. Our plant parameter envelope is not light
8 water focused.

9 It's advanced reactor, and we did a survey
10 and received a good deal of information from the
11 potential demonstrators on their reactors and worked
12 to envelope those, so Clinch River was an important
13 model for it.

14 And then so finally, the advanced
15 construction technology and digital engineering are
16 two important areas of technology that I think will be
17 important for scalability in the future.

18 And one of the things that we're doing is
19 working on a public/private partnership for
20 demonstrating some advanced construction technologies,
21 and we're working closely with innovators to use and
22 demonstrate digital engineering approaches for
23 advanced reactors as well.

24 And these are, all of the things we're
25 doing here are widely used in other industries, but

NEAL R. GROSS

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

1 haven't really been applied successfully or
2 pervasively in the nuclear industry, at least in the
3 western nuclear industry.

4 Digital engineering is used to great
5 effect in Korea and perhaps elsewhere, but not here,
6 so we're trying to utilize that extensively in our
7 work and open source some of the tools we're
8 developing to make them available to innovators.

9 On the advanced construction side, we have
10 some, a project that we're working to execute or to
11 initiate, I guess. We're looking to make an award
12 from an RFP where we would demonstrate some different
13 advanced construction technologies.

14 I'm not going to get into more detail
15 right now, but it includes some things that would help
16 on the civil construction side of things to reduce
17 excavation costs, reduce engineered fill, and reduce
18 the costs of the steel and the concrete, which we know
19 drives, overruns, and costs in general, but these are
20 technologies that have been used elsewhere.

21 We need to make sure that they can be used
22 in the nuclear sphere successfully, which means
23 including the NRC in their demonstrations, figuring
24 out how is the NRC going to inspect these things and
25 ensure that they're up to their standards.

NEAL R. GROSS

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

1 And that's what we want to do through some
2 of the projects that we're initiating, and we've had
3 great enthusiasm from the NRC on cooperating on these
4 things. So, next slide, please?

5 So, next I want to talk a little bit about
6 how we're looking to deliver successful outcomes and
7 I'm almost done, so next slide, please?

8 We're working to coordinate and
9 collaborate with all of the key parties who need to
10 work together to make these successful, so that
11 includes, of course, the DOE and the NRC, the advanced
12 reactor demonstration program companies, and there are
13 other elements of the advanced reactor demonstration
14 program that we're working with that are focused on
15 licensing, on safeguards and security, and on other
16 elements of these projects.

17 We're working with GAIN and many of the
18 laboratories, and we're developing a cross-functional
19 core team at NRIC. We have a diversity of
20 backgrounds.

21 We're drawing from, you know, folks who
22 have built complex energy and complex aerospace
23 projects, so not all nuclear backgrounds, but more --
24 you know, some nuclear backgrounds certainly, but
25 there's a lot of that expertise in the lab.

NEAL R. GROSS

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

1 What we need to bring in are people who
2 know how to demonstrate complex technologies, who know
3 how to work with the government and the private
4 sector, who know how to do digital engineering and
5 systems engineering, and can help us supercharge this
6 effort and make it not just research, but in fact,
7 demonstration towards scalable deployment in the end.

8 And then other things here, I've talked
9 about digital engineering. I've talked about advanced
10 construction technology. I think those are really
11 important for scalable, affordable technology that
12 really moves the ball forward on climate change.

13 And then construction project management
14 is another area where I'm developing a program. We
15 don't have activities there yet, but I think it's very
16 important, so I'm in conversations with some potential
17 partners on how do we take care of that major issue
18 that we've seen in nuclear projects.

19 And then we're coordinated very closely
20 with the integrated energy systems project at DOE led
21 by Shannon Bragg-Sitton.

22 One of our mandates is to further the
23 demonstration of non-electric applications of nuclear,
24 and so we're working to develop a conceptual design of
25 some demonstrations of either integrated energy

NEAL R. GROSS

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

1 systems or non-electric applications, and I don't have
2 a lot of detail on that yet.

3 We've been working hard on that this
4 fiscal year and we're going to be doing a request for
5 expressions of interest to get some input from
6 industry partners on what they would like to see and
7 what they would like to be involved in there, so we
8 hope to really demonstrate some interesting things
9 with advanced reactors in that space. Next slide?

10 And then finally, NRIC is a national
11 program, so I want to remind folks of that, and we're
12 an essential integrator for partners and
13 collaborators. And these aren't all of our partners
14 and collaborators, but I could only fit so many on our
15 logo. I did the best I could.

16 There are a lot of really important
17 stakeholders in this and a lot of folks who need to
18 work together to make these demonstrations successful,
19 and our goal is to help everyone work together more
20 efficiently and move this forward.

21 So, my next slide is just a thank you very
22 much for the opportunity to talk to you, and thank you
23 for your questions so far. I have a few to follow up
24 on, and if there are any more questions, I'm happy to
25 try to answer them.

NEAL R. GROSS

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

1 MEMBER PETTI: Ashley, I have a question
2 that might not be fair, but I'll ask it anyways. You
3 know, this is a really broad mandate that NRIC has,
4 and there's so much coordination and collaboration
5 that has to happen. I mean, if you just look at the
6 DOE sphere and the way the programs are organized,
7 they're not organized the way industry would look at
8 it probably.

9 Is there any movement in DOE to kind of
10 align what it's doing and how it does it to focus, to
11 help your mission get fulfilled because that's a big
12 stumbling block, one of the many, you know, big
13 challenges you have?

14 DR. FINAN: Yeah, I think that's a great
15 question, Dave, and there's a natural intention here
16 that is important. So, I think the answer is yes,
17 well, there's an intent, and there's a recognition
18 that we have this big goal and we want to demonstrate
19 these advanced reactors, and we need to align.

20 We have funding pressure. We just have to
21 align these programs towards that goal, and I think
22 that that's very positive and I think that as we, you
23 know, as we look to the future, I'd expect that we'll
24 see that as DOE continues to develop changes in that
25 area.

NEAL R. GROSS

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

1 So, the intent and the recognition, I
2 think, are there. Of course, there's a transition
3 right now, so I don't know exactly what, you know,
4 that will look like, and there's not a lot of change
5 happening right now in the structure of DOE, but they
6 recognize it, Dave.

7 But the other intention is that, yes, we
8 want to demonstrate these reactors, but we can't
9 forget that there's a long game and we need to have
10 basic research and development, and we can't, you
11 know, we can't let that all go.

12 So, there's this intention in the funding
13 to try to make sure we don't lose the potential for
14 game-changing innovations because we strip R&V, so
15 that's my thought on that one. I don't have the best
16 answer.

17 CHAIRMAN BLEY: Ashley, thank you very
18 much. I know you've gotten most of your questions
19 from those of us who have spent a lot of time with
20 DOE. For the rest of us, it's been very informative
21 and it's getting extensive where some of the, how some
22 of the gaps that we've been worrying about might get
23 filled in the future.

24 I'll go back to the members. Are there
25 any members with any further questions for Ashley?

NEAL R. GROSS

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

1 MEMBER RICCARDELLA: Yeah, this is Pete
2 Riccardella. I just have a more general question
3 actually to both speakers, and that is, you know, the
4 programs you're talking about and the outreach efforts
5 that I heard in the earlier presentation, they were
6 all focused on five percent or ten percent of the U.S.
7 public.

8 Who's concerned about outreach to the
9 other 90 percent? That's really why we have -- our
10 industry is in the problems that it's in. It's by and
11 large very unpopular.

12 DR. FINAN: Lori, I'll let you take the
13 first answer to that one if you want to.

14 MS. BRAASE: That last goal of ours on the
15 GAIN presentation is focused on that. It's reaching
16 out to folks who don't include nuclear as part of the
17 renewable definition.

18 We're trying to reach out to states, and
19 local entities, and to these groups, and to the public
20 in general. That's what we've been focused on the
21 last several months, and it's a little bit harder to
22 do from webinars, but our social media and our efforts
23 are trying to do that.

24 We have different connections with groups
25 like Envoy Public Labs and with a few other groups on

NEAL R. GROSS

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

1 public outreach so that we're trying to touch that
2 audience.

3 MEMBER RICCARDELLA: I hope we can do it.

4 MS. BRAASE: Yeah.

5 MEMBER RICCARDELLA: It's a good story to
6 tell, but unfortunately, it's a very complicated one,
7 and I think most of the public doesn't have the
8 appetite to listen to this kind of complexity.

9 MS. BRAASE: You're seeing Bill Gates, and
10 Microsoft, and Google, and all of these folks coming
11 up with their goals and their 100 percent renewables,
12 and --

13 MEMBER RICCARDELLA: Yeah.

14 MS. BRAASE: -- carbon neutral, carbon
15 negative goals, and I don't think that that's possible
16 without nuclear, and so Bill Gates certainly includes
17 it in his portfolio. So, I think the conversations
18 are there. We just need to push to have them. I
19 mean, I think we're right on the verge.

20 MEMBER RICCARDELLA: I hope so.

21 DR. FINAN: And Pete, I did want to add --
22 (Simultaneous speaking.)

23 DR. FINAN: That's okay. I just was going
24 to add that, you know, I think that, as Lori said,
25 GAIN is working to reach broader audiences. I think

NEAL R. GROSS

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

1 with advanced reactors, we have an opportunity to
2 communicate better, but also to actually do better
3 with how we --

4 MEMBER RICCARDELLA: Yeah.

5 DR. FINAN: -- interface with society, and
6 so one of the things that we're looking at is how do
7 we innovate in our sociotechnical systems, not just
8 our technology?

9 And we're working with Argon, Oak Ridge,
10 and the University of Michigan's Fastest Path to Zero
11 to develop some citing tools that allow us to look at
12 socioeconomic and sociopolitical aspects of sites.

13 And we're working with some graduate
14 student researchers and things to look at
15 environmental justice aspects of citing and how we can
16 incorporate environmental justice into how we cite
17 advanced reactors and really do a better job, and then
18 also, I think, demonstrating what nuclear can do.

19 Really getting to demonstration and
20 showing what it offers is going to be critical to
21 communicating with that other 95 percent who doesn't
22 really care about, and rightfully doesn't care about
23 the details of this technology. They want to know
24 what it's going to do for them.

25 MEMBER RICCARDELLA: Okay, well, thank

NEAL R. GROSS

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

1 you, and thank you for some very interesting
2 presentations today.

3 CHAIRMAN BLEY: Was that you trying to get
4 in?

5 MEMBER KIRCHNER: Yes, I don't know how to
6 phrase this, Dennis, but --

7 CHAIRMAN BLEY: Oh, go ahead.

8 MEMBER KIRCHNER: -- just an observation
9 that there are additional concepts, whether you call
10 them advanced reactors or not, that might be in the
11 mix in the near term and perhaps even be deployable
12 faster than the time scale that we were discussing
13 today, and just an observation.

14 I'm not -- so that's not a criticism. I'm
15 just thinking how the efforts of both GAIN and NRIC
16 might support those other advanced reactor concepts.

17 DR. FINAN: You know, I'm really interested
18 to talk more about that. Perhaps maybe I could reach
19 out to you and you could give me a little more detail.

20 I know of a few interesting concepts that
21 are moving quicker and maybe those are the same ones,
22 but they might not be, so maybe we could connect on
23 that.

24 VICE CHAIRMAN REMPE: Well, are you
25 precluded from funding advanced light water, small

NEAL R. GROSS

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

1 modular light water reactors, Ashley?

2 DR. FINAN: No, we're not precluded.
3 We've had discussions with Holtec, for example, about
4 how we can support them. We don't directly fund
5 demonstration projects, so that's funded via DOE.
6 We're helping provide support, but not that kind of
7 demonstration cost share at this point.

8 CHAIRMAN BLEY: Okay, good, well, thank
9 you. Thomas, can we get the public line open?

10 PARTICIPANT: The public line is open for
11 comments.

12 CHAIRMAN BLEY: Thank you. If there is
13 anyone on the public line who would like to make a
14 comment, please state your name and give us your
15 comments.

16 PARTICIPANT: Hi my name is Li Chao
17 (phonetic) from the DOE Loan Program Office, and I
18 want to make a comment.

19 DOE does the funding through NE and
20 through GAIN for the advanced reactors, but our loan
21 programs also support the advanced reactors. For
22 example, we have the loan to the Vogtle project. So,
23 it will be a more mature project now, the R&D project,
24 so I just wanted to add that comment here.

25 CHAIRMAN BLEY: Thank you. Anyone else?

NEAL R. GROSS

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

1 Thomas, I think we can close the public line. Lori
2 and Ashley, I want to thank you again for spending the
3 time with us. We really appreciate it. Any last
4 comments from any members? Then at this time, Mr.
5 Chairman, I turn it back to you well within the two-
6 hour time allotted.

7 CHAIRMAN SUNSERI: Thank you. Thank you,
8 Dennis, and I'll add my compliments to the presenters
9 today. Both of the presentations were fantastically
10 interesting and delivered in an equally captivating
11 way, so thank you for that, and thank you for the
12 interactions with the members. It was very good.

13 Let me bounce this off the members. We
14 have some time left today. I would like to get into
15 the letter that Charlie has prepared in response to
16 the reconciliation from the last meeting that we had.

17 I propose that we'll take a 15-minute
18 break here to allow the transition. We'll bring the
19 letter up and Charlie can read it in, and we can get
20 main comments in, but I do want to end around 6:00, so
21 as close to 6:00 as possible because, you know, this
22 is a long day for everybody. Is that acceptable to the
23 committee? Sandra is ready to go. She's in standby.

24 (Whereupon, the above-entitled matter went
25 off the record at 5:08 p.m.)

NEI 12-16, Rev. 4 - Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants

ACRS Meeting

Ben Holtzman (NEI)

March 3rd, 2021



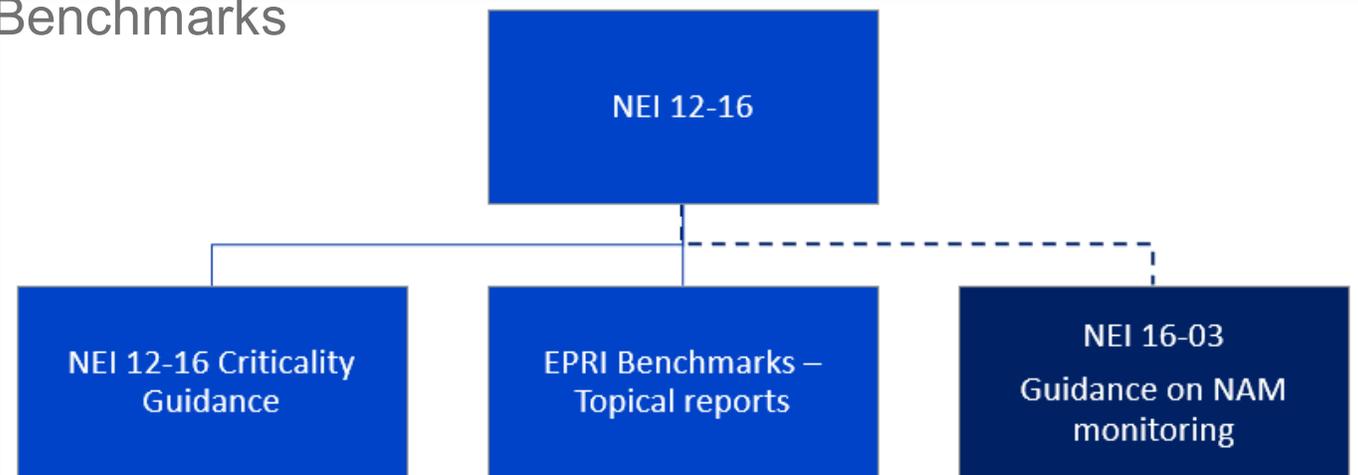
NEI 12-16 Background

Goal: Provide durable guidance for consistent criticality analyses for applicants and reviewers

- Historically, Spent Fuel Pool (SFP) Criticality Safety Analyses (CSA) were simple but over time they became more complex
- Increased application complexity with no comprehensive guidelines for application preparation, expectations, and the review process
 - More NRC Requests for Additional Information (RAIs)
- NEI 12-16 project inventoried, categorized, evaluated, and reached agreement on numerous issues
- EPRI Benchmarks were developed to quantify depletion uncertainty and determine if the 5% (Kopp Memo) is conservative

NEI 12-16 History

- NRC, Industry and EPRI spent significant efforts in the development of NEI 12-16
 - Numerous RAIs and Public Meetings
 - Full week audit
- Four Revisions of NEI 12-16
 - Additional approvals of EPRI Benchmarks and NEI 16-03





ELECTRIC POWER
RESEARCH INSTITUTE

NEI 12-16, Revision 4 - Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants

Presenters:

Hatice Akkurt, EPRI

Bob Hall, EPRI



NUCLEAR



www.epri.com

© 2021 Electric Power Research Institute, Inc. All rights reserved.

Spent Fuel Pool (SFP) Criticality and Depletion Uncertainty and Bias

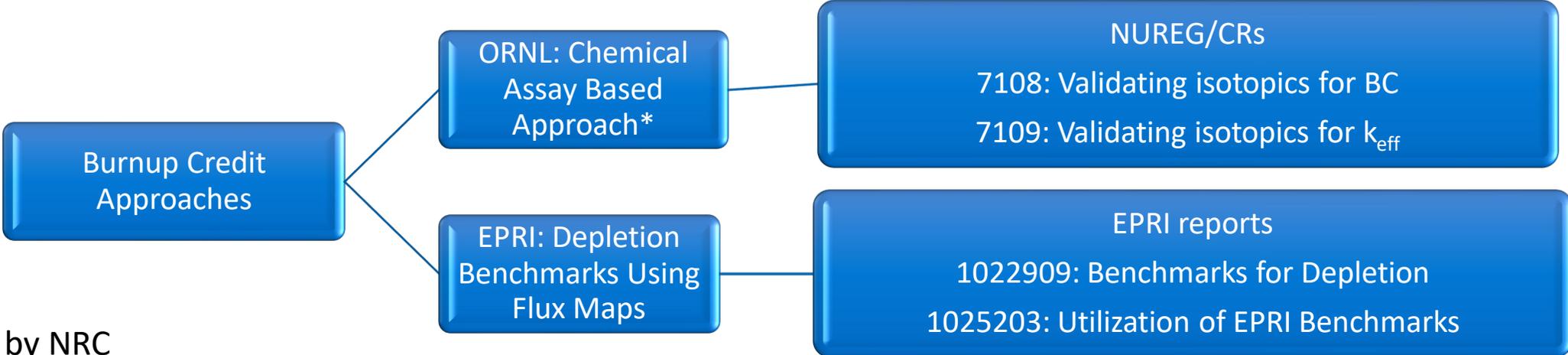
- No critical experiments using spent fuel
- Critical experiments are very expensive
- Using fresh fuel assumption for spent fuel causes loss of SFP storage space
- How to account for uncertainty and bias for spent fuel?

1998 Kopp Memo:

“In the absence of any other determination of the depletion uncertainty, an uncertainty equal to 5 percent of the reactivity decrement to the burnup of interest is an acceptable assumption.”

1998-2009
Easy to use, implement, justify; subsequently, used by many utilities

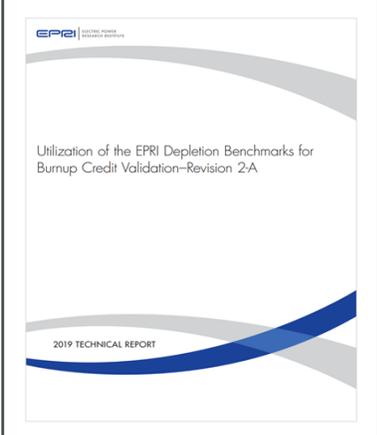
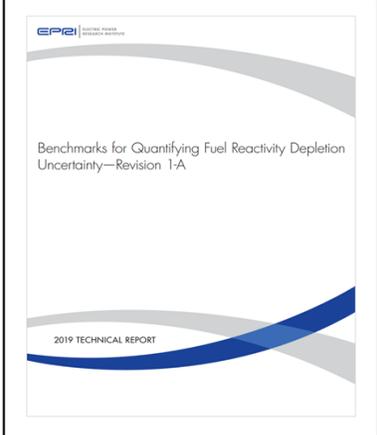
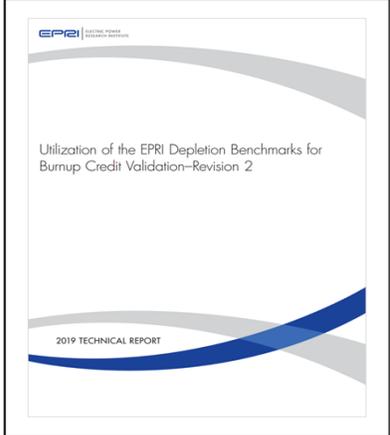
NRC: What is the technical justification or where is the documentation for 5% decrement?



*Funded by NRC

EPRI Benchmarks

Received final SER on July 26, 2019

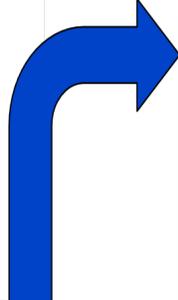
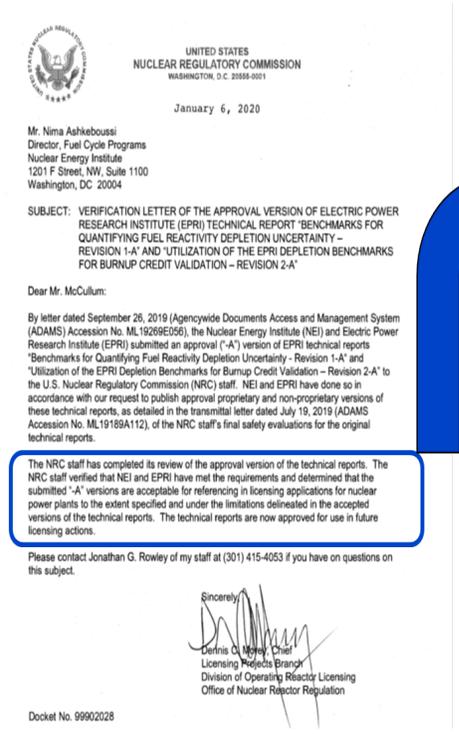


3002016888, Utilization of the EPRI Depletion Benchmarks for Burnup Credit Validation - Revision 2, published August 29, 2019

3002016035, Benchmarks for Quantifying Fuel Reactivity Depletion Uncertainty- Revision 1-A, published September 18, 2019

3002017254, Utilization of the EPRI Depletion Benchmarks for Burnup Credit Validation - Revision 2-A, published September 18, 2019

Burnup (GWd/MTU)	EPRI Uncertainty (%)	Additional NRC Bias (%)
10	3.05	0.0
20	2.66	0.0
30	2.33	0.0
40	2.12	0.15
50	1.95	0.35
60	1.81	0.54



The NRC staff has completed its review of the approval version of the technical reports. The NRC staff verified that NEI and EPRI have met the requirements and determined that the submitted "-A" versions are acceptable for referencing in licensing applications for nuclear power plants to the extent specified and under the limitations delineated in the accepted versions of the technical reports.

The technical reports are now approved for use in future licensing actions.

Received final approval letter on January 6, 2020

EPRI benchmarks showed that Kopp memo (5%) is conservative and provided technical justification for additional margins

NEI 12-16: Depletion Uncertainty Resolution

Option 1: 5% for PWR & BWR, no additional work

Option 2: For PWRs, use EPRI benchmarks for additional margin provided EPRI benchmarks are modeled

For BWRs, applicants may use alternate methods like peak reactivity

Applicants may use alternate approaches when technical basis is provided

Impacts on K_{eff}

- *Significance is determined based upon the overall effect on the total uncertainty, and on the margin to the regulatory limit. Because the total uncertainty term is typically dominated by a few large uncertainties, an individual uncertainty that is less than 10% of the total uncertainty may be considered insignificant.*
- **Safety significance vs. effort for applicant and reviewer**
- **Uncertainty items with low reactivity effect can be considered insignificant given typical total uncertainty**

$$k_{max} = k_{eff} + \sum_{i=0}^m Bias_i + \sqrt{\sum_{j=0}^n Uncertainty_j^2}$$

Uncertainties:

- Depletion Code Uncertainty
- Criticality Code Validation Uncertainty
- Fuel Manufacturing Tolerances
- Rack Manufacturing Tolerances
- Burnup Uncertainty (BU)
- Facility Structural and Material Uncertainties
- Uncertainties for Validation Gaps
- Monte Carlo Computational Uncertainty

Biases:

- Depletion Code Bias (Applicant Depletion Code Bias)
- Criticality Code Validation Bias
- Moderator Temperature Bias
- Design Basis Fuel Assembly Bias
- Eccentric Positioning Bias

NEI 12-16 - Criticality Analysis Checklist

- Inventory of the list of items that may need to be included
 - Intended to reduce the number of RAIs
- Useful for pre-application meetings
 - Discussion of proposed application can be methodical and directed
 - Highlights presence or absence of typical content
- Useful for applicant
 - Applicant confirms content is complete
- Useful for reviewer(s)
 - Reviewer can quickly confirm key items are addressed
 - Applicant can use notes area to identify report section numbers for each item or add short explanations to streamline review

Subject	Included	Notes / Explanation
1.0 Introduction and Overview		
Purpose of submittal	YES/NO	
Changes requested	YES/NO	
Summary of physical changes	YES/NO	
Summary of Tech Spec changes	YES/NO	
Summary of analytical scope	YES/NO	
2.0 Acceptance Criteria and Regulatory Guidance		
Summary of requirements and guidance	YES/NO	
Requirements documents referenced	YES/NO	
Guidance documents referenced	YES/NO	
Acceptance criteria described	YES/NO	
3.0 Reactor and Fuel Design Description		
Describe reactor operating parameters	YES/NO	
Describe all fuel in pool	YES/NO	
Geometric dimensions (Nominal and Tolerances)	YES/NO	
Schematic of guide tube patterns	YES/NO	
Material compositions	YES/NO	
Describe future fuel to be covered	YES/NO	
Geometric dimensions (Nominal and Tolerances)	YES/NO	
Schematic of guide tube patterns	YES/NO	
Material compositions	YES/NO	
Describe all fuel inserts	YES/NO	
Geometric Dimensions (Nominal and Tolerances)	YES/NO	
Schematic (axial/cross-section)	YES/NO	
Material compositions	YES/NO	
Describe non-standard fuel	YES/NO	
Geometric dimensions		
Describe non-fuel items in fuel cells	YES/NO	

Checklist is 6 pages long and finalized with the NRC staff during 1 week-long audit

Checklist aimed toward bringing consistency for applicant and reviewer

Regulatory Guide 1.240

- NEI 12-16 is endorsed in Reg Guide 1.240 along with the already approved EPRI benchmarks and will provide the basis for a stable regulatory framework.
- Additional clarification is needed for exception A
 - The example lacks the clarity needed in a guidance document
 - Uncertainty regarding NRC expectation for “controls or documents”

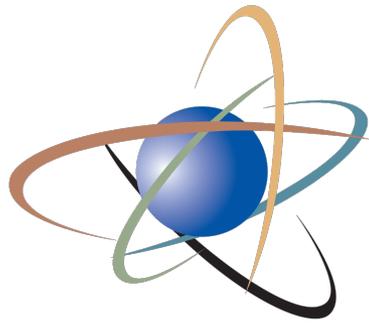
Lessons Learned

- Separating issues into stand-alone documents was a successful strategy that improved regulatory stability and predictability, but extended the overall duration by reducing urgency on NRC
- NUREG/CRs without quality assurance (QA) appeared to be given more weight than industry reports of similar pedigree
- NRC management oversight of long running issues is essential to bring them to a timely closure

Questions?

Questions





U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Regulatory Guide 1.240 Fresh and Spent Fuel Pool Analysis

Kent Wood

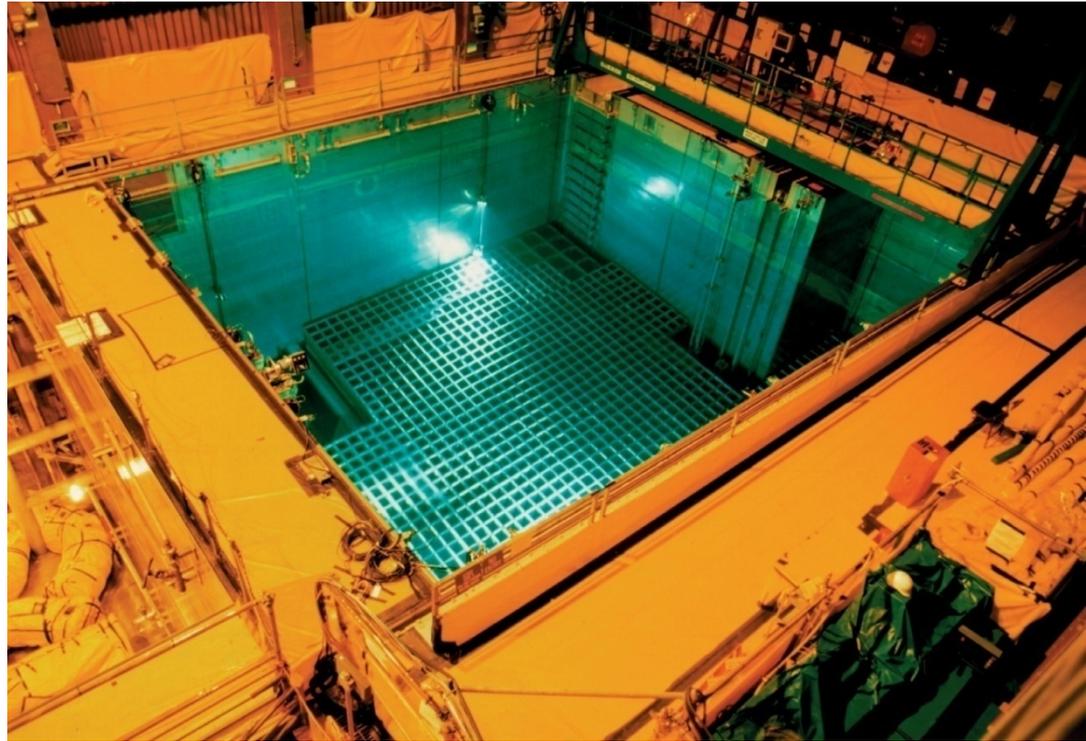
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

Advisory Committee on Reactor Safeguards

March 3, 2021

Overview

- Background
- NEI 12-16 Clarifications
- Going Forward



- Initial Design/Construction
 - 10CFR70.24/GDC 62
- 1st Re-Rack Wave
 - No reprocessing
 - GL 78-11
- 2nd Re-Rack/Re-Analysis Wave
 - Boraflex Degradation
 - 10CFR50.68
- 3rd Re-Rack/Re-Analysis Wave

Reg Guide 1.240

- NRC Staff worked with NEI, EPRI, and other industry representatives to develop NEI 12-16
- Intent is to achieve regulatory certainty
- NEI 12-16 R4 already being used by the industry
- Endorse NEI 12-16 with 17 clarifications
 - Includes three exceptions
 - Public comments on three of the clarifications

Exceptions

- C.1.i: Eccentric position
- C.1.m: BWR cold critical measurements as benchmarks
- C.1.n: Code to Code comparison as validation for criticality code

Clarification C.1.a

- Clarification: Double Contingency Principle
 - Based on an actual LAR
- Comment takes exception using a miss installed SFP neutron absorbing panel as the example because licensees have controls to ensure a miss installed SFP neutron absorbing panel does not go undetected
- Clarification states that if there are controls to prevent it, it doesn't have to be considered part of the normal condition

Clarification C.1.a

- As with all safety related modifications, NRC expects licensee QA and Maintenance procedures to provide the controls necessary to preclude consideration of an incorrect modification or installation of SFP storage racks during the design and licensing phase
- Should those controls identify an issue during installation, the licensee's chosen remedy will determine the next course of action

Clarification C.1.b

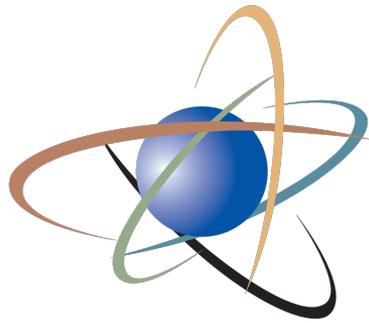
- Graded approach/Margin control
 - Graded approach is essentially incorporating ‘risk’ considerations into the review
- Comment implies all margin is the purview of the licensee
 - Licensee is responsible for margin control
- The clarification is a caution that when large margin is the basis for a graded approach, not all of that margin is available for future changes

Clarification C.1.k

- Soluble Boron for the Rx depletion modeling.
- Based on an actual LAR
- Industry standard practice is it is a ‘cycle average’ soluble boron
- Commenter wants to use a different method to determine the ‘average’
- Clarification that the guidance is ‘cycle average’
- Other ‘averages’ will be an exception to the guidance

Going Forward

- NEI 12-16/Reg Guide 1.240 will increase regulatory certainty with regard to Fresh and Spent Fuel criticality analyzes
 - NEI 12-16 already being used
- ATF, increased enrichment, and higher burnup levels will need to be evaluated to determine if any changes to NEI 12-16/Reg Guide are necessary
 - Clarification C.1.o



U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Regulatory Guide 1.240 Fresh and Spent Fuel Pool Analysis

Kent Wood

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

Advisory Committee on Reactor Safeguards

March 3, 2021



NRIC

National
Reactor
Innovation
Center

Advanced Reactor Demonstrations & NRIC

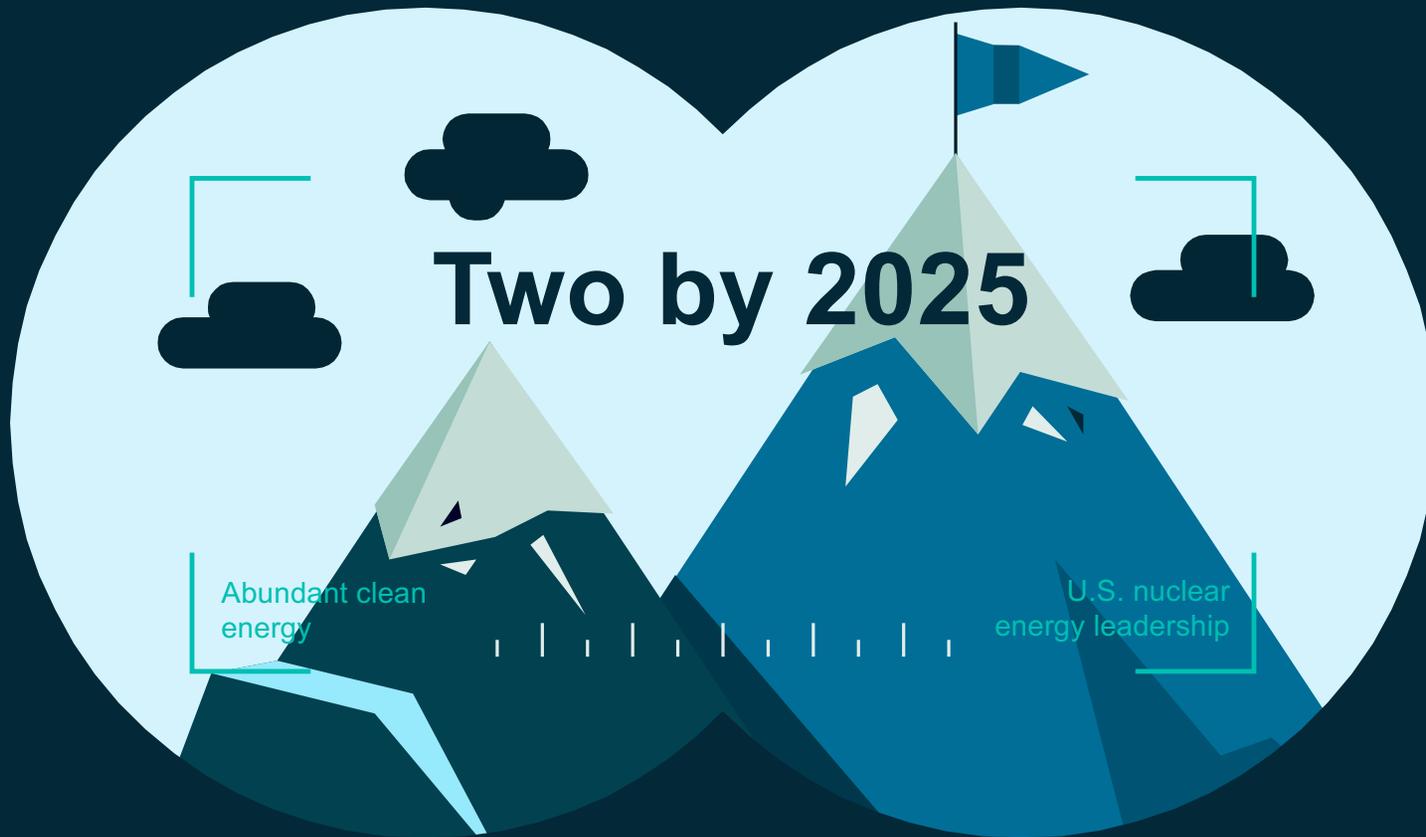
March 3, 2021

Ashley E. Finan, Ph.D., NRIC director

ashley.finan@inl.gov



NRIC Vision



Commercial Advanced Nuclear by 2030

5-Year Program Objectives

Enable demonstration of at least 2 advanced reactors

- Make available infrastructure, sites, materials, expertise
- Provide regulatory support
- Best practices in public engagement

Prepare DOE/labs for continuing innovation and demonstration

- Develop best practices for planning/construction/demonstration of nuclear projects
- Develop enduring infrastructure and expertise
- Establish methods for efficient coordination among laboratories

inspire

empower



mission

deliver



NRIC

NRIC Stakeholders

Public

- Local citizenry
- Local governments

Industry

- AR developers
- Supply chain
- Users

Government

- DOE
- NRC
- Congress
- Others (DOD, NASA)

Researchers

- Laboratories
- Universities



Historical Context

- **Reactor Demonstration Programs**

- Atomic Energy Commission
- National Reactor Testing Station
- Production Reactors
- Cooperative Power Reactor Demonstration Program
- International Development
- NGNP

- **Recent Policy Actions**

- Nuclear Energy Innovation Capabilities Act
- Nuclear Energy Innovation Modernization Act
- Advanced Reactor Demonstration Program
- Energy Act of 2020



U.S. Advanced Reactors

- Dozens of companies
 - Sizes range from ~1MWe to ~1000MWe
 - Variety of coolants (gas, sodium, salt, lead, water, etc.)
 - Private investment
- Motivation
 - Clean, reliable, increased efficiency
 - Potential for improved nuclear resource utilization and reduced nuclear waste
 - Diverse markets



Image courtesy of GAIN and Third Way, inspired by the *Nuclear Energy Reimagined* concept led by INL. Learn more about these and other energy park concepts at thirdway.org/blog/nuclear-reimagined



© Oklo, Inc.

Advanced Reactor Demonstration Program

- Objectives:
 - Develop, construct, and demonstrate several advanced reactors with beneficial capabilities
 - Support diversity of advanced designs
 - Stimulate private sector companies/supply chains
- Funding pathways aligned with varied maturity levels:
 - Advanced Reactor Demonstration (Demos) awards
 - Risk Reduction for Future Demonstration (Risk Reduction) awards
 - Advanced Reactor Concepts-20 (ARC-20) awards

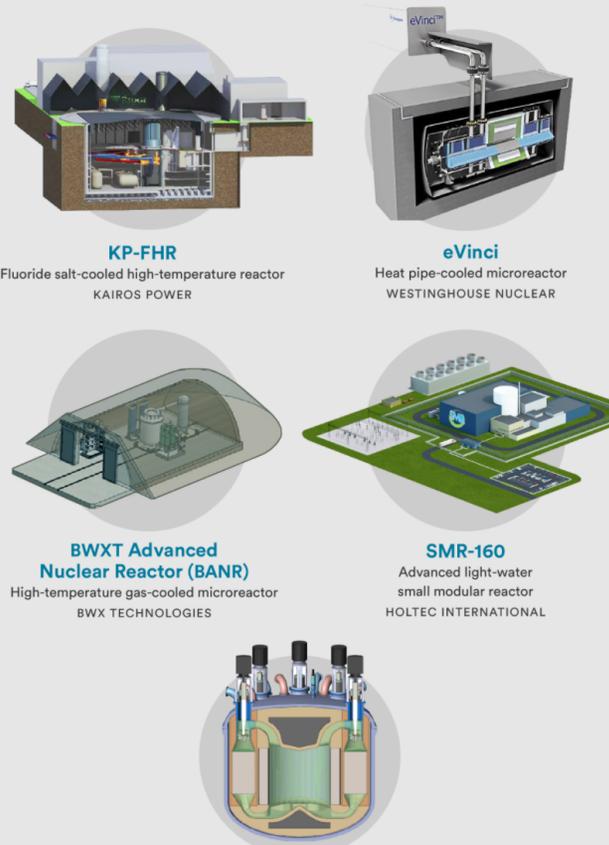
Demonstration



Natrium Reactor
Sodium-cooled fast reactor + molten salt energy storage system
TERRAPOWER

Xe-100
High-temperature gas reactor
X-ENERGY

Risk Reduction



KP-FHR
Fluoride salt-cooled high-temperature reactor
KAIROS POWER

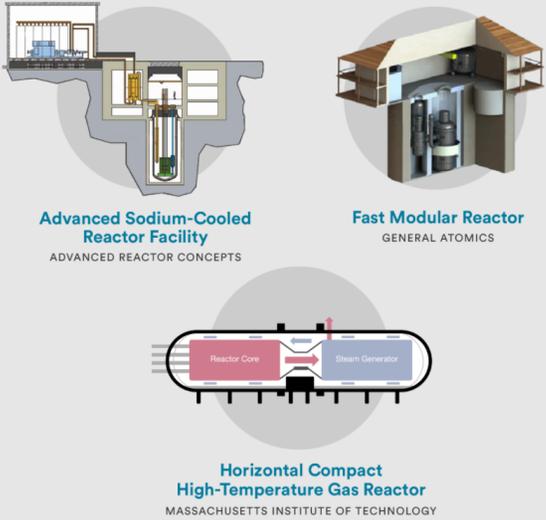
eVinci
Heat pipe-cooled microreactor
WESTINGHOUSE NUCLEAR

BWXT Advanced Nuclear Reactor (BANR)
High-temperature gas-cooled microreactor
BWXT TECHNOLOGIES

SMR-160
Advanced light-water small modular reactor
HOLTEC INTERNATIONAL

Molten Chloride Fast Reactor
SOUTHERN COMPANY

Concept Development



Advanced Sodium-Cooled Reactor Facility
ADVANCED REACTOR CONCEPTS

Fast Modular Reactor
GENERAL ATOMICS

Horizontal Compact High-Temperature Gas Reactor
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

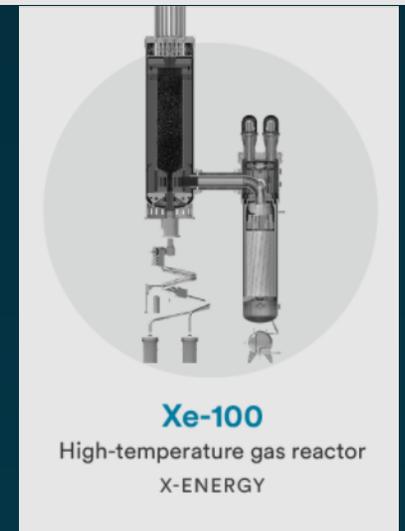
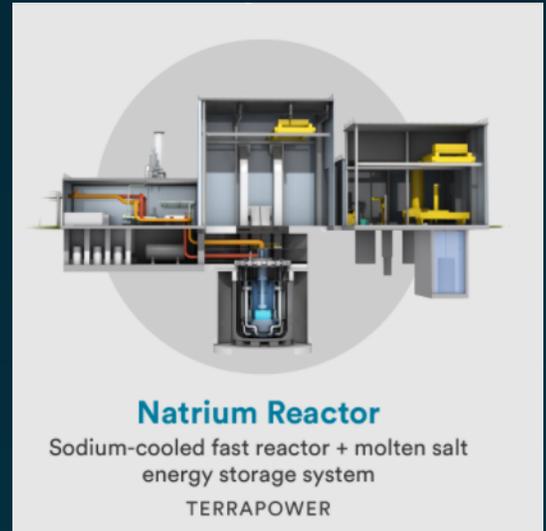
Demonstration Pathway Selected Technologies

- TerraPower LLC – Sodium Reactor

- SFR that leverages decades of fast reactor and metallic fuel development
- High temperature reactor coupled with thermal energy storage for flexible electricity output
- New metal fuel fabrication facility
- Visit: <https://natriumpower.com/>

- X-energy – Xe-100 reactor

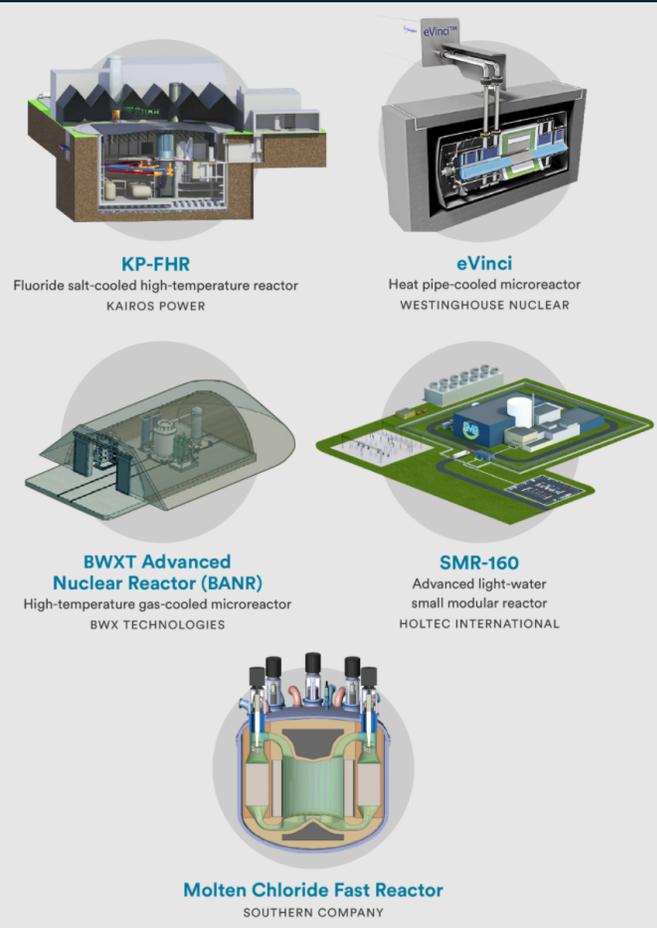
- HTGR that leverages decades of reactor and robust TRISO fuel form development
- Provides flexible electricity output and process heat for a wide range of industrial heat applications
- Commercial scale TRISO fuel fabrication facility
- Visit: <https://x-energy.com/>



Slide content courtesy of U.S. DOE-NE

Risk Reduction Pathway Selected Technologies

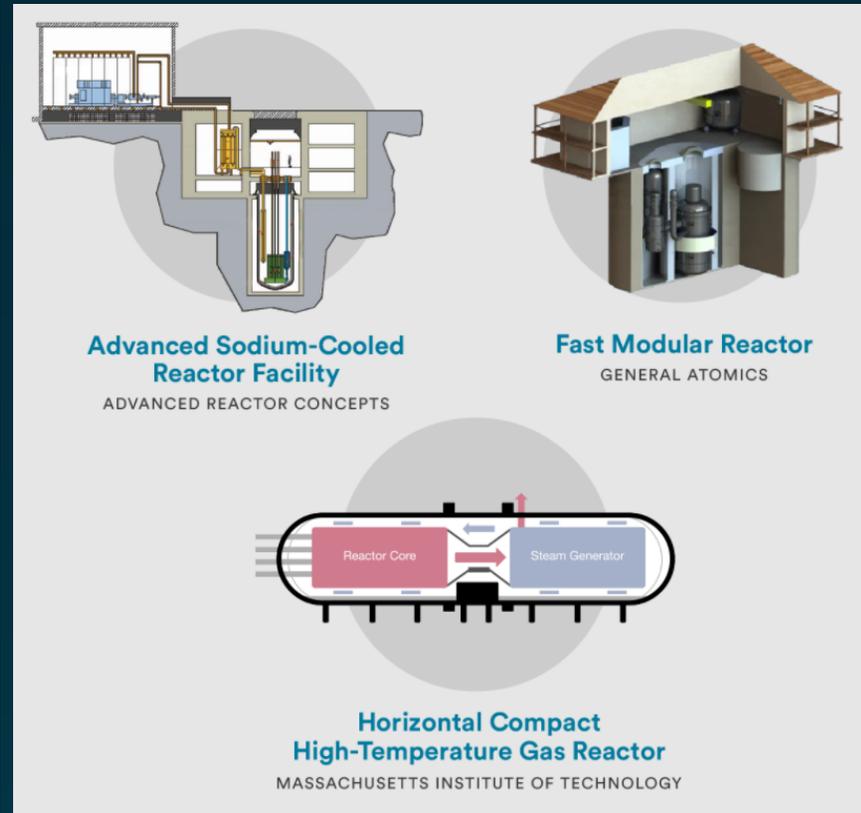
Prime Recipient	Commercial Target Reactor Type and Fuel	Risk Reduction Project Key Deliverables
Kairos Power, LLC	KP-FHR - 140 Mwe thermal spectrum fluoride salt-cooled MSR, TRISO annular pebble fuel	Design, construction and operation of Hermes reduced-scale test reactor (precursor to commercial-scale KP-FHR)
Westinghouse	eVinci - 4.5 MWe heat pipe-cooled microreactor, TRISO UCO compact HALEU fuel	Technical risk reduction for moderator design, wick manufacturing, refueling and licensing.
BWXT	BANR - 50 MWt transportable microreactor HTGR with UN TRISO	Maturation of technology, including the development of UN TRISO fuel, to improve the commercial viability of BANR
Holtec	SMR-160 - 160 MWe LW-cooled natural circulation PWR	Early stage design, engineering, and licensing activities for the SMR-160.
Southern Company	Molten Chloride Fast Reactor – 180 MWt pool-type MSR fast reactor with liquid salt fuel	Design, construction and operation of Molten Chloride Reactor Experiment (MCRE)



Slide content courtesy of U.S. DOE-NE

ARC-20 Selected Technologies

Prime Applicant	Commercial Target Reactor Type	ARC-20 Project Key Deliverables
Advanced Reactor Concepts	ARC-100 100 MWe pool type sodium-cooled fast reactor	Conceptual and preliminary design of a seismically isolated advanced sodium-cooled reactor facility
General Atomics	GA-EMS 50 MWe gas-cooled fast modular reactor	Conceptual design of the GA-EMS 50 MWe FMR, increase TRL on systems and components, develop prelim. cost estimates
MIT	Modular Integrated Gas-cooled High Temperature Reactor (MIGHTR)	Conceptual design for MIGHTR and support for future commercialization as a safe and cost-competitive HTGR concept





empower



NRIC

Stage 1
Research

Stage 2
Development

Stage 3
Demonstration

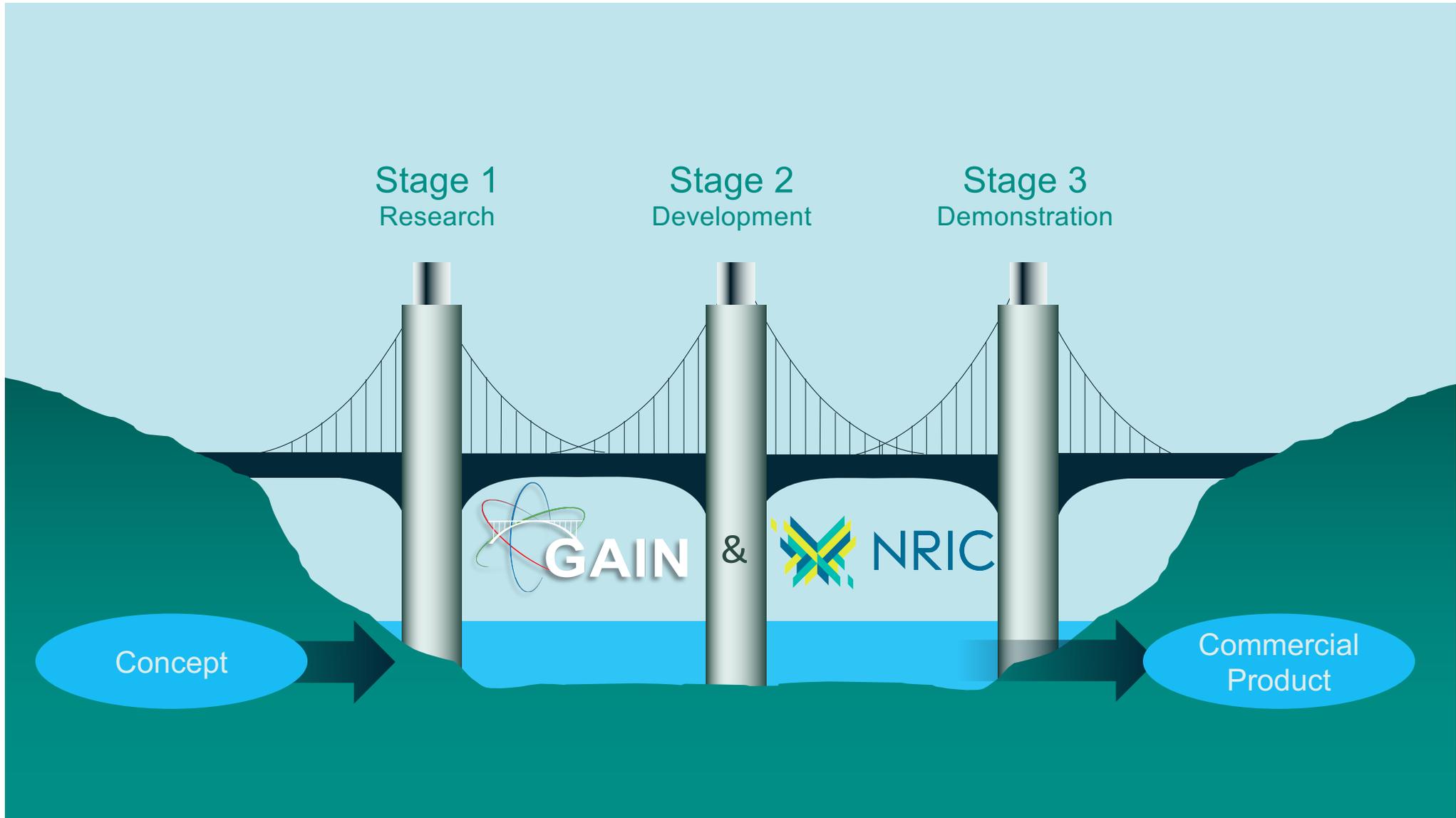


&

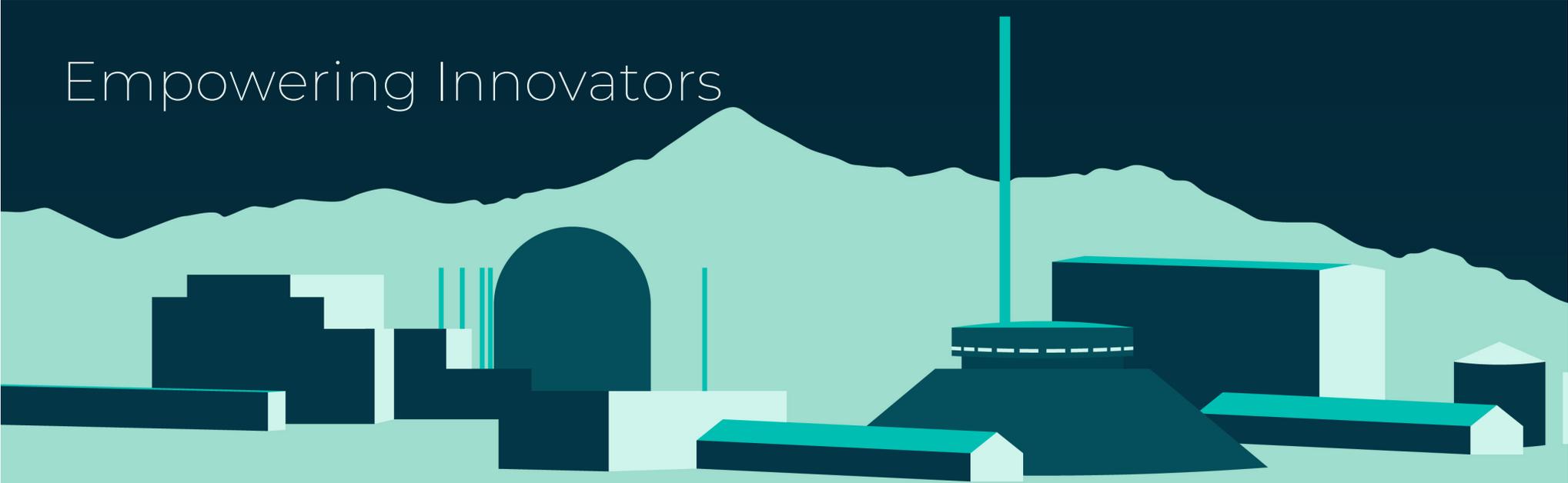


Concept

Commercial
Product



Empowering Innovators

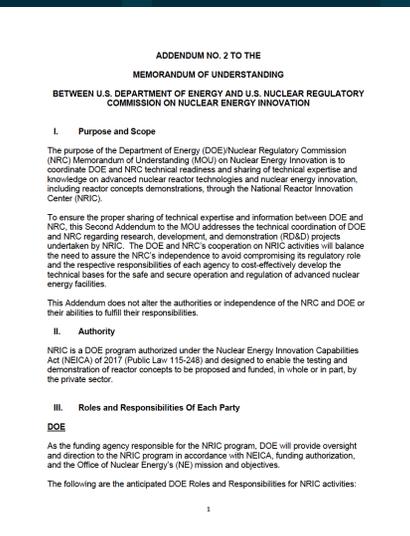
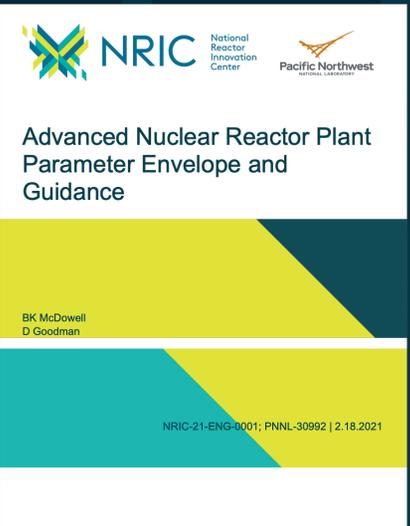
- 
- Demonstration Resource Network
 - Test beds & Demonstration Sites
 - Experimental & Fuel Facilities
 - Irradiation & Characterization
 - Component testing (sodium, helium, molten salt, lead, etc.)
 - Regulatory Risk Reduction
 - Virtual Test Bed
 - NRIC Resource Team

Regulatory Risk Reduction

Objective: Anticipate required regulatory preparations common to NRIC stakeholders & take actions to increase certainty, reduce risk, and accelerate demonstration.

Activity areas:

- Microreactor transportation and decommissioning
- Coordination with NRC on demonstration projects
- DOE authorization process guidance
- INL site safety authorization or licensing issue identification and resolution
- NEPA (INL and general)
- Advanced construction technology and digital engineering regulatory engagement



deliver



NRIC

Delivering Successful Outcomes

- Coordination & Collaboration
 - DOE/NRC
 - ARDP
 - GAIN, Labs
 - Cross-functional core team
- Digital Engineering
- Advanced Construction Technology
- Construction Project Management
- Integrated Energy Systems

NRIC is a
National
Program and
Central
Integrator for
Partners and
Collaborators



Thank you!

Questions?



GAIN Overview

Advisory Committee on Reactor Safeguards (ACRS)

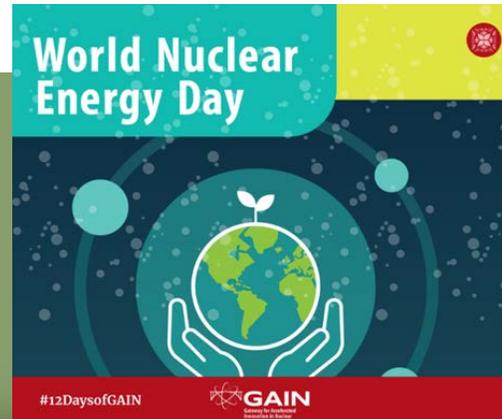
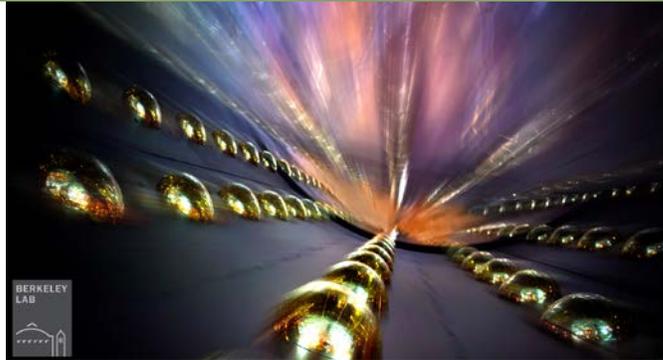
**Christine King, Director
Lori Braase, Program Manager**

March 3, 2021

Mission and Vision

Vision (2030)

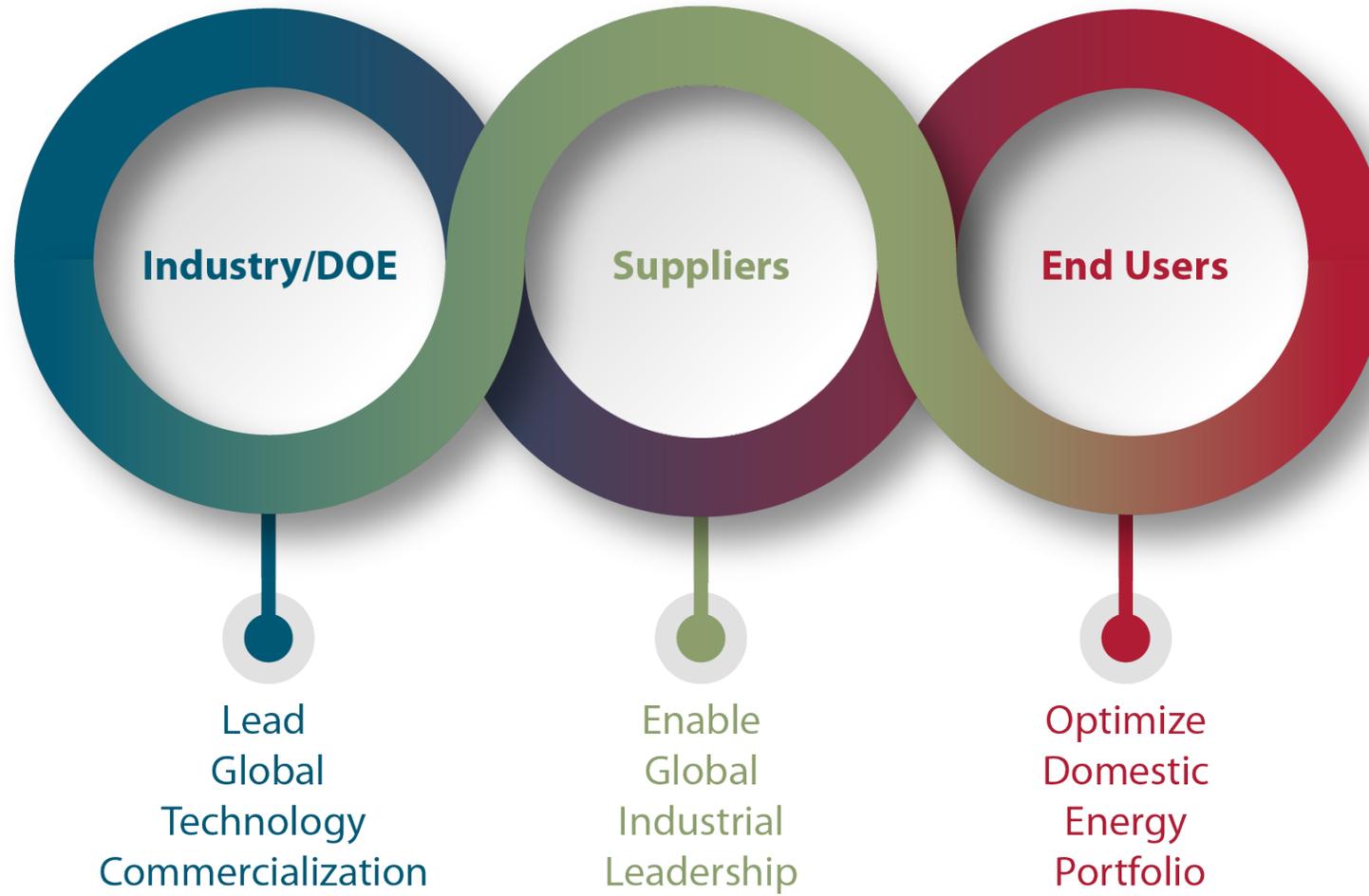
The U.S. nuclear industry is equipped to lead the world in deployment of innovative nuclear technologies to supply urgently needed abundant clean energy, both domestically and globally.



Mission

Provide the nuclear energy industry with access to cutting-edge R&D, along with the technical, regulatory, and financial support necessary to move innovative nuclear energy technologies toward *commercialization* in an accelerated and cost-effective fashion.

NUCLEAR ENERGY STRATEGIC GOALS



NRIC and GAIN are Complementary and Coordinated Efforts to Support the Nuclear Energy Industry



- Established in November 2015 as a resource for accelerated development of nuclear innovations with lab partners
 - Enables comprehensive resource to entire nuclear innovation ecosystem at all development stages
 - Provides streamlined access to testing, experimental facilities, lab expertise, and legacy data
 - Provides regulatory expertise (e.g., NRC advanced reactor licensing strategy support)
 - Manages NE Vouchers



- Equipped for building and demonstrating reactor concepts
- Provides focused program to enable innovators nearing demonstration stage
- Enables access to sites, required upgrades, site services, fuel material/fabrication facilities, and demonstration process support
- Provides regulatory assistance related to demonstration
- Facilitates NRC observation/learning



GAIN Goals for FY 2020-2025:

Goal #1. Provide nuclear industry entities access to financial support opportunities and national laboratory capabilities (facilities, expertise, and tools) to accelerate commercialization of innovations through research, development, demonstration, and deployment.

Goal #2. Work with industry to identify gaps, gather needs, and develop viable paths forward to inform DOE research programs and remove barriers for industry.

Goal #3. Work with industry stakeholders and NRC as means of communicating and resolving common (industry-wide) issues through regulatory interactions.

Goal #4. Facilitate the advanced nuclear industry's access to information to support their technology commercialization efforts.

Goal #5. Contribute tailored, factual information to key stakeholders to motivate the integration of clean nuclear energy for long-term success.

How to do Business with GAIN

- Provides *Contract Mechanisms* on one side and *Funding Opportunities* on the other
- Information applies to all DOE national labs in their contracting discussions with industry

How to do Business through GAIN

			
Funding Opportunities			
Funding Opportunities	Description	Timeframe	Funding*
Advanced Nuclear Technology Development (IFDA)	Provides funding to support innovative, domestic, nuclear industry-driven designs and technologies that have high potential to improve the overall economic outlook for nuclear power in the U.S. The iFOA is comprised of three tiers focused on first-of-a-kind demonstration, advanced reactor development, and regulatory support. gain.inl.gov	Continuously open Award: Quarterly Duration: up to 3 years	Tier 1: \$10-40M Tier 2: \$0.5-10M Tier 3: \$50K-0.5M (Tiered cost share)
Consolidated Innovative Nuclear Research (CINR)	Provides competitively awarded access to the Nuclear Science User Facilities (NSUF) by industry for non-proprietary nuclear materials and fuels research. CINR is the primary means to award irradiation and post-irradiation examination (PIE) access. It also supports DOE-NE mission and program directed work scopes primarily led by universities or national labs with the possibility of industry participation. gain.inl.gov	Call: August Award: July Duration: up to 3 years for R&D; up to 7 years for PIE and testing	Up to \$500K for R&D Up to \$4M for irradiation and PIE (NSUF) (0% cost share)
GAIN Nuclear Energy (NE) Vouchers	Provides competitively awarded access to DOE national labs for U.S. businesses to tap into the intellectual and technical resources needed to overcome critical technology challenges for their advanced energy products and gain a global competitive advantage. Awarded funds are sent directly to a national laboratory to perform work on behalf of an awardee. gain.inl.gov	Continuously open Award: Quarterly Duration: 12 months	\$50-500k (20% cost share)
NSUF Rapid Turnaround Experiments (RTE)	Offers an avenue for researchers to perform irradiation effects studies of limited scope on nuclear fuels and materials of interest utilizing NSUF facilities. R&D funding is not provided, and work is to be completed within 9 months. nsuf.inl.gov/Page/rte	3 times per year Duration: 9 months	Up to \$50K (0% cost share)
Small Business Innovation Research (SBIR)	Offers competitively awarded funding to small businesses to encourage development and commercialization of their technologies. SBIR targets the entrepreneurial sector and seeks to offset the risk and expense of necessary R&D. SBIR is comprised of three phases, each contingent on building from the results of the previous phase. science.energy.gov/sbir/funding-opportunities/	Phase 1: 6 months Phase 2: 2 years Phase 3: Refer to website	Phase 1: up to \$150K Phase 2: up to \$1M Phase 3: \$0 SBIR Funds (Refer to website)
Technology Commercialization Fund (TCF)	Seeks commercialization of laboratory technology with industry partners. Leverages R&D funding in applied energy programs to mature promising energy technologies that are originally conceived at national laboratories with the potential for high impact. gain.inl.gov	Call: February Award: July Duration: 1-2 years	Topic 1: \$100 - 150K Topic 2: \$250 - 750K (Refer to website)

*Contingent upon Congressional appropriations. Note: DOE National Laboratory (lab)

How to do Business through GAIN

		
Contract Mechanisms		
Agreement	Description	Highlights
DOE Cooperative Agreement	A contract that is signed by DOE and an industry awardee to perform work at the Awardee's facilities and/or national lab. This is the mechanism used by DOE to fund awards made through the iFOA.	• Allows DOE to fund competitively awarded research directly.
Cooperative Research and Development Agreement (CRADA)	DOE lab partnering with one or more non-federal entities (including industry) that facilitates private sector research utilizing, for example, lab technologies, facilities, R&D capabilities, or expertise. The CRADA participant must contribute in-kind resources (personnel, equipment, facilities, etc.), and/or cash. A funding source for the lab work must be identified before work can start; this may be either participant funds, federal funds, or a combination. Commonly used for GAIN NE Voucher awardees who are large businesses or foreign influenced. Terms and conditions are non-negotiable.	• Up to 5 years of data protection. • Both parties may take title to their own inventions. • May negotiate exclusive license to inventions. • Advance payment required if participant is contributing funds to lab.
GAIN Small Business Voucher CRADA	Used exclusively for a GAIN NE Voucher awarded to a small business/non-profit voucher requester with NO foreign ownership/control/influence. Terms and conditions foster commercialization and are non-negotiable. This CRADA is intended to speed up the process of signing an agreement to complete awarded GAIN NE Voucher work.	• In addition to standard CRADA terms, provides the participant a nonexclusive license, at a minimum, to inventions conceived or first reduced to practice under the CRADA.
Nondisclosure Agreement (NDA)	Establishes the obligations regarding the exchange of proprietary or confidential business information between a DOE lab and an industry entity in order to allow them to progress toward a specific objective, commonly a contract under which work may be performed.	• Enables business relationships to develop work scope for joint projects.
Strategic Partnership Project (SPP) (Work for Others)	This is a fee-for-service contract that enables industry, non-profit institutions, and other non-federal entities to pay labs to perform a defined scope of work or tasks. Work must draw upon the unique facilities, equipment, or personnel intrinsic to the lab. The rights to the inventions and data (subject inventions) may vest in the sponsor if the sponsor is a U.S. entity and pays for the work with private funds; however, if the sponsor is providing federal funds to the lab to support the work (typically received through a competitive process) or if the sponsor is a non-U.S. entity or has foreign influence, then the rights of subject inventions will vest with the lab performing the work with no rights for protection of generated data.	• Generated data may be designated as proprietary. • Sponsor typically retains right to elect title to subject inventions. • Advance payment required.
User Facility Agreement	A User Facility Agreement provides access to facilities to conduct research. It may be possible to perform proprietary or non-proprietary (e.g., NSUF) research at the designated user facilities. In certain circumstances, access to facilities is available to U.S. companies on a full cost recovery basis. Access generally begins with an invitation from an employee or through submission and approval of a peer-reviewed proposal.	• IP belongs to inventor/company. • No charge for users who are performing non-proprietary research. • Non-proprietary users are expected to publish results.

GAIN NE Voucher Awards for Round 1, FY2021

- TerraPower is the first voucher awarded for work at LANL and involves characterization of plutonium chloride salt properties using neutron beam imaging in the LANSCE facility.
- The two ORNL vouchers involve the use of modeling and simulation capability in support of innovations in additive manufacturing.
- NE Vouchers Round 2 closed on February 1, 2021.
- iFOA Round 1 closes April 30, 2021.

GAIN 2021 1st Round NE Voucher Recipient	Awarded Proposal	Partner Facility
Exelon Generation Kennett Square, PA	<u>Advanced Nuclear Fuel Pellet Designs</u>	Oak Ridge National Laboratory
TerraPower, LLC Bellevue, WA	<u>Density Measurements of Plutonium Bearing Salts via Neutron Beam Dilatometry</u>	Los Alamos National Laboratory
Westinghouse Electric Company, LLC Columbia, SC	<u>Multiphysics Design Optimization and Additive Manufacturing of Nuclear Components</u>	Oak Ridge National Laboratory

GAIN FY2020 Voucher Awards

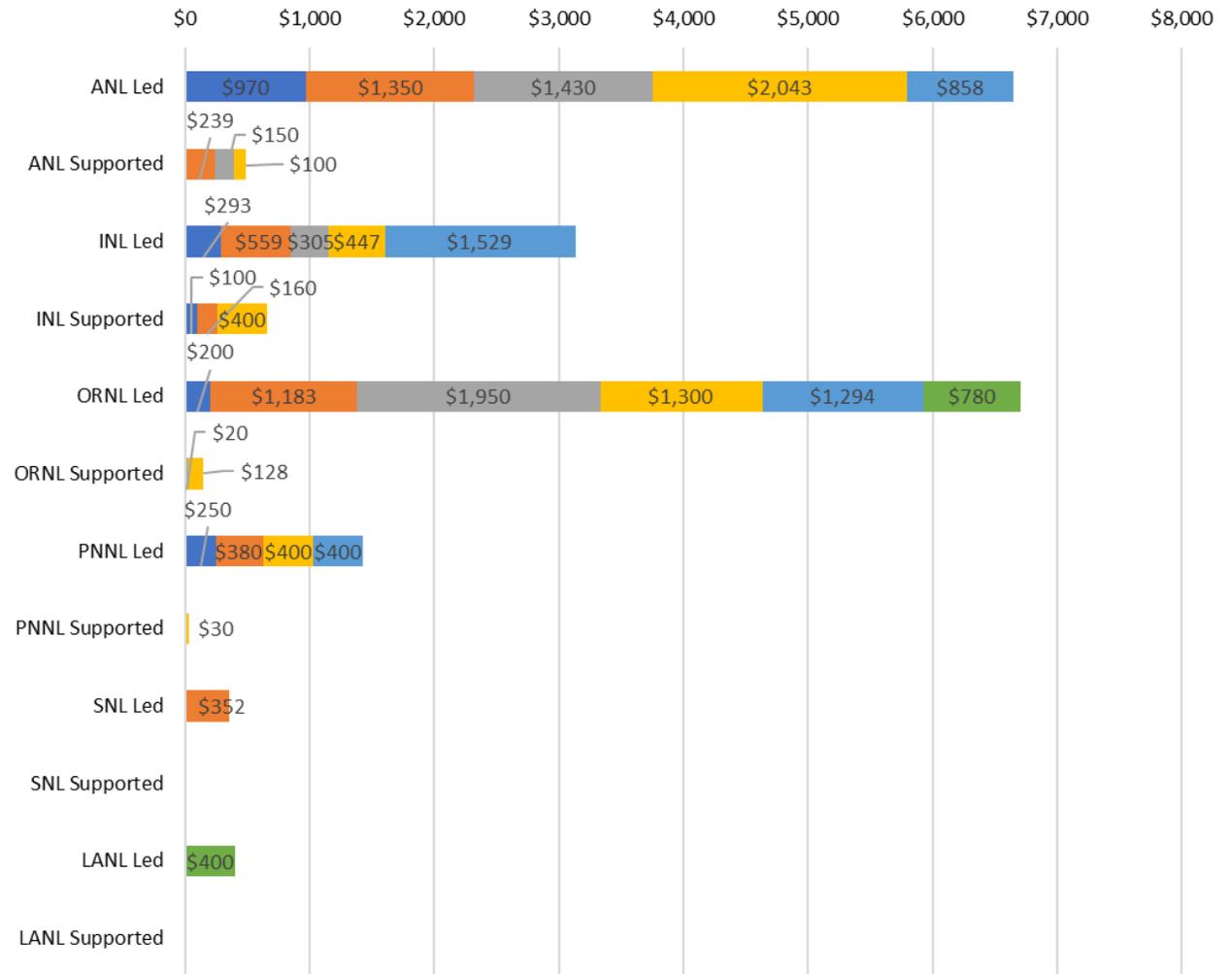
FY 2020	Voucher Recipient	Proposal	Lab
Round 1	Hydromine, Inc.	On-Line Lead/Water Heat Exchanger Sensor/System Feasibility	PNNL
Round 1	Lightbridge Cor	Advanced Test Reactor experiment design for measurement of Lightbridge Fuel™ thermophysical properties	INL
Round 2	Neutroelectric	Combined effects testing of high-temperature and neutron fluence to support qualification of NE-300, a high-temp Neutron shielding Material	ORNL
Round 2	Oklo, Inc.	Address gaps in legacy data on fuel steel interactions	INL
Round 3	SMR, LLC	Coupled neutronic and thermal hydraulic analysis of a natural circulation based small modular reactor using VERA-CS	ORNL
Round 3	Ultra Safe Nuclear Corp	Graphite finite element model verification	ORNL
Round 4	Kairos Power	Pebble Bed Large Eddy Simulations for Lower Order Methods Benchmarking and Uncertainty Quantification Development	ANL
Round 4	Natura Resources, LLC	RELAP5-3D Development and Assessment for Liquid-fuels Molten Salt Reactor Licensure	INL
Round 4	TerraPower, LLC	Thermophysical Properties Measurements of NaCl-PuCl ₃	ANL

GAIN Voucher Impact 2021 Round 1

Voucher Summary

- 57 Awarded
- 28 Completed
- \$20 M to National Labs
- Total Project Costs \$25.3 M

Total Funds Directed to National Laboratories (Supported/Led)



GAIN Assistance on Process Improvement

NE Advance Class Patent Waiver

- DOE forgoes taking title to patentable inventions conceived using DOE funding
- Advance: Available when contract negotiations begin
- Class: large domestic businesses interested in DOE-NE related funding opportunities. (Note: small business can use the Bayh-Doyle legislation)
- This waiver will accelerate negotiations for iFOA and ARD awards and reduce uncertainty in negotiations

More information is available at
gain.inl.gov

GAIN Access CRADA (in process)

- Enable an industry partner to sign an agreement with a single lab that grants them simultaneous access to other labs in the complex
- Conceptually:
 - Industry partner has work scope that crosses multiple labs
 - A “lead lab” is identified and the CRADA is negotiated
 - Partner Labs review and accept the CRADA
- Allows single agreements across DOE Offices of NE, Science, and NNSA

Legacy Documents / Industry Access

Initial **Fast Reactor (FR) Technology List** provides access to 4250 openly published FR documents available from OSTI (December 2018)

Initial **Molten Salt Reactor (MSR) Technology List** provides access to 210 cataloged MSR documents available on OSTI (February 2017)

OSTI Spreadsheet of 12,000 Applied Technology (AT) Documents with abstracts provided to GAIN. List released with abstracts on February 28, 2019. Provided to TWG Chairs on March 8, 2019.

Clinch River Breeder Reactor (CRBR) Project documents. Contract initiated in Feb 2020. Scanning on hold (COVID-19). Iron Mountain will proceed as soon as possible (235 boxes + 75 reels of microfilm).

LOFT and other LWR Experiments. Fauske and Associates developed a pilot knowledge preservation activity in March 2019. Phase II contract will proceed in FY2021.

New Production Reactor (NPR) documents at INL Storage (125 boxes-Idaho Falls). Working with Red Ink to scan and organize files for Export/Classification Reviews. Effort is underway.

Loft Experiment Data for code validation (Box of data –INL – to be scanned & reviewed.
PBF Documents (3 boxes at INL) will be scanned and reviewed.

Databases of Experimental Information

Database	Lab	Status (25Jan21)
TREXR TREAT Experiment Relational Database	ANL	https://www.trexp.anl.gov/ External access available by application
NaSCoRD Sodium System & Component Reliability Database	SNL	https://www.sandia.gov/nascord/ Phase II Complete – FY20.
ETTD EBR-II Transient Testing Database	ANL	https://ettd.ne.anl.gov/ External access available by application
FIPD EBR-II Metallic Fuel Irradiation Database	ANL	https://fipd.ne.anl.gov/ External access available by application. Data for U-Zr fuel type employed in commercial designs being qualified in accordance with NRC approved QAPP.
FFTF Passive Safety Testing & Metal Fuel Irradiation Database	PNNL	Available FY21. External Access Plan Complete
OPTD Out of Pile Transient Testing Database	ANL	https://optd.ne.anl.gov/ External access available by application
EBR-II and FFTF Metal Fuel Experiment PIE Data	INL/ANL	Organized effort to supplement the FIPD and FFTF Databases. Complete in 2021.
MSRE Molten Salt Reactor Component Reliability Database	ORNL/EPRI	Available FY-21– Currently being populated with operations, maintenance, and experimental data.

All databases will have links available at gain.inl.gov

What's New? GAIN Workshops and Webinars - 2021

GAIN Webinar Series Focused on Multi-Industry Stakeholders



THE REGULATORY ROUTE TO COMMERCIAL NUCLEAR DEPLOYMENT

A webinar series to understand the road that was taken to arrive at the current regulatory framework to navigate future paths to successful deployment.

Find us online: GAIN.INL.GOV | [f](https://www.facebook.com/GAINnuclear) [t](https://twitter.com/GAINnuclear) @GAINnuclear



Workshops Focused on Advanced Nuclear Needs and Feedback

- April 13-15, 2021: GAIN-EPRI-NEI Advanced Reactors Safeguards & Security Virtual Workshop
- May 12-13, 2021: GAIN-EPRI-NEI Microreactor Virtual Workshop
- August 24-26, 2021: GAIN-EPRI-NEI Advanced Methods for Manufacturing Qualification Workshop



GAIN WEBINAR SERIES

Shaping our CARBON-FREE FUTURE




SAVE THE DATE

GAIN-EPRI-NEI
Advanced Methods for Manufacturing QUALIFICATION WORKSHOP

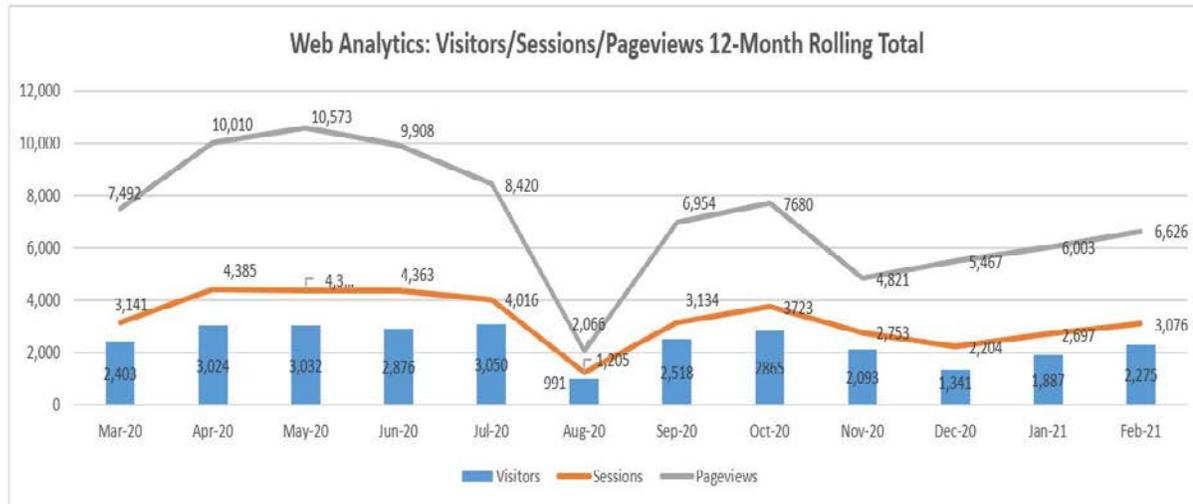
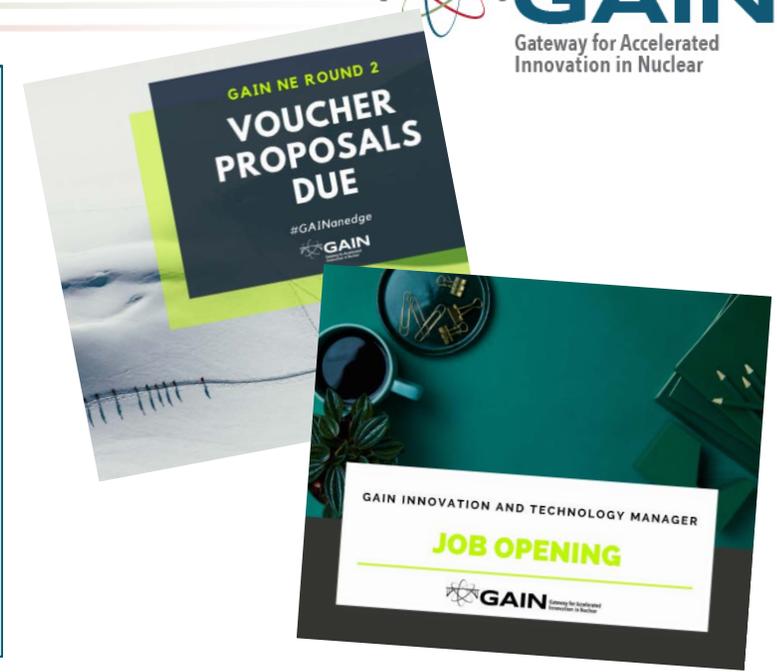
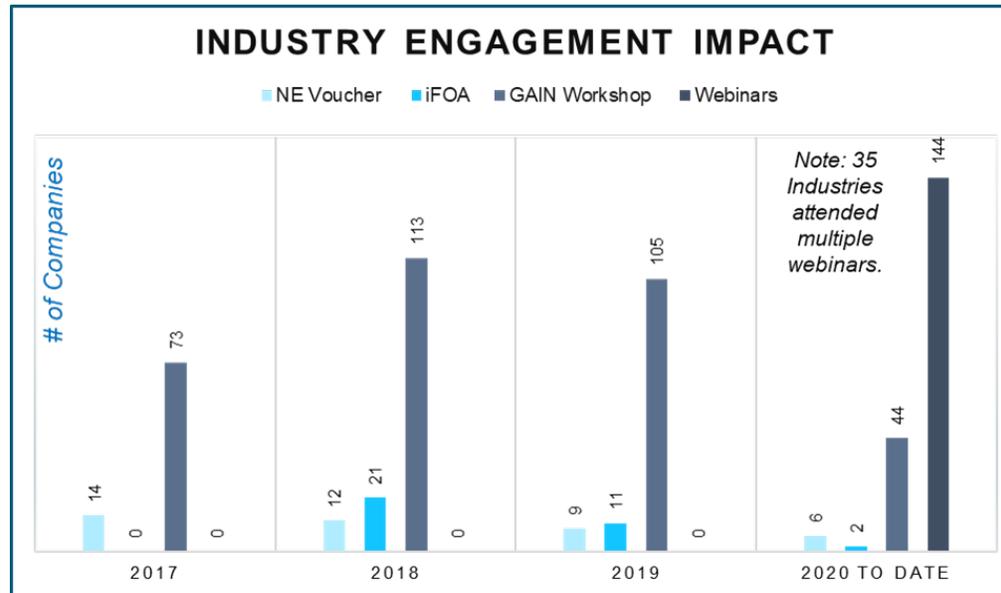
AUGUST 24-26, 2021
INL Meeting Center, 775 MK Simpson Blvd, Idaho Falls, ID 83401



GAIN Outreach

Nuclear-focused Collaborators

- Nuclear Energy Institute
- Electric Power Research Institute
- Envoy Public Labs
- Third Way
- Clearpath
- Titans of Nuclear
- Generation Atomic
- American Nuclear Society
- Nuclear Innovation Alliance



	1,208	Facebook Followers	1,388	Facebook Reach
	2,546	Twitter Followers	26.8K	Twitter Impressions
	836	Instagram Followers		
	212	LinkedIn Followers		

GAIN Social Media – February 2021

Titans of Nuclear GAIN-NRIC Miniseries: Realizing the Nuclear Future

Titans of Nuclear produces podcasts featuring interviews with experts across technology, industry, economics, policy and more.

“Connect with what excites you about nuclear today and imagine nuclear tomorrow.”



Ep. 287, GAIN-NRIC Miniseries: Christine King

Dec 7, 2020

- 1) Christine King reflects on her time at EPRI where she focused on solving inherited material problems related to the use of Alloy 600 in steam generators
- 2) Christine shares her personal journey to find purpose and how it impacted her career path in the nuclear sector
- 3) The role of GAIN in the nuclear sector and the many ways it supports developers, investors, end users, and government programs
- 4) A look at how new technology demonstrations ...

[Listen, Watch, View Shownotes & More...](#)



Ep. 288, GAIN-NRIC Miniseries: John Jackson

Dec 14, 2020

- 1) John Jackson shares his experience growing up living off-the-grid and how he got involved in mechanical engineering and fracture mechanics
- 2) How John reconnected with the Idaho National Lab and got involved with the Gateway for Accelerated Innovation in Nuclear
- 3) How the GAIN vouchers connect nuclear technology developers and the resources available at the National Labs
- 4) Why the nuclear industry must unite to work towards demonstrations o...

[Listen, Watch, View Shownotes & More...](#)



Ep. 289, GAIN-NRIC Miniseries: Nicholas Smith

Dec 21, 2020

- 1) How Nick Smith's early professional career on the football field led him to the energy industry in an unconventional way
- 2) Nick reflects on his personal discovery of nuclear power and how it led to a major career shift to advanced nuclear R&D
- 3) An overview of the current projects underway at the National Reactor Innovation Center (NRIC) to enable advanced reactor demonstrations
- 4) The role of the Zero Power Physics Reactor (ZPPR) and the Exp...

[Listen, Watch, View Shownotes & More...](#)

<https://www.titansofnuclear.com/>

GAIN Organization

