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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
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MEETING WITH DEPARTMENT OF ENERGY  
OFFICE OF NUCLEAR ENERGY  
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MONDAY,  
JUNE 20, 2016  
+ + + + +  
ROCKVILLE, MARYLAND  
+ + + + +

The Commission met in the Commissioners' Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Stephen G. Burns, Chairman, presiding.

- COMMISSION MEMBERS:  
STEPHEN G. BURNS, Chairman  
KRISTINE L. SVINICKI, Commissioner  
WILLIAM C. OSTENDORFF, Commissioner  
JEFF BARAN, Commissioner

1 ALSO PRESENT:

2 ANNETTE VIETTI-COOK, Secretary of the Commission

3 MARGARET DOANE, General Counsel

4 NRC STAFF:

5 VICTOR M. MCCREE, Executive Director for Operations

6 BILL DEAN, Director, Office of Nuclear Reactor

7 Regulation

8 RICHARD LEE, Office of Research

9 JANE MARSHALL, NRR

10 MICHAEL MAYFIELD, NRO

11 JENNIFER UHLE, Director, Office of New Reactors

12 MICHAEL WEBER, Director, Office of Nuclear

13 Regulatory Research

14

15 DEPARTMENT OF ENERGY STAFF:

16 JON CARMACK, National Technical Director for DOE

17 Fuel Cycle Research & Development Advanced

18 Fuels Campaign, Idaho National Laboratory

19 RAY FURSTENAU, Associate Principal Deputy Secretary

20 for Nuclear Energy

21 JOHN KELLY, Deputy Assistant Secretary for Nuclear

22 Reactor Technologies

23 JOHN KOTEK, Acting Assistant Secretary for Nuclear

24 Energy, Department of Energy

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

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9:02 a.m.

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CHAIRMAN BURNS: All right, good morning everyone. I want to welcome our panelists from the Department of Energy and, later, we'll also be hearing from the NRC staff and I also welcome other members of the staff and members of the public who are here with us in the audience today or who may be listening in.

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The purpose of today's meeting is to provide information regarding items of mutual interest to the NRC and the Department of Energy's Office of Nuclear Energy and will include discussions on advanced and small modular reactors, continued operation of existing nuclear power plants beyond 60 years, advancements in fuel design, and programs that support students and universities and nuclear research and development.

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And, we'll begin presentations with our panel from the Department of Energy including John Kotek, Acting Assistant Secretary for Nuclear Energy.

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Sir John Kelly, Deputy Assistant Secretary for Nuclear Reactor Technologies.

21

22

Ray Furstenau, Associate Principle Deputy Assistant Secretary for Nuclear Energy.

23

24

And, John Carmack, National Technical Director for the DOE Fuel Cycle Research and Development Advanced Fuels

1 Campaign at the Idaho National Laboratory.

2 And, following the panel, we'll have a panel from the  
3 NRC staff. I think we just have -- I'll take a brief break between the two  
4 panels.

5 And, we look forward to the presentations and ensuing  
6 discussion with Members of the Commission.

7 Before we begin, any opening comments from our  
8 colleagues? No? Well, thank you.

9 And, I think with that, we'll begin with John Kotek to  
10 begin the DOE presentations.

11 MR. KOTEK: Great, thank you very much and thank  
12 you for the opportunity to be here this morning.

13 I'll just give a brief overview and then hand over to my  
14 colleagues to get into more detail in each of the areas we're going to  
15 present on today.

16 Of course, there are a wide range of areas of mutual  
17 interest to the NRC and DOE's Office of Nuclear Energy. Today, we'll  
18 focus on some of the things we're doing in advanced reactor technology  
19 and looking at today's plants.

20 There's a growing interest, I'd say, nationally and  
21 internationally in nuclear energy as we and other countries look to meet  
22 our climate commitments as we try to move forward with what Secretary  
23 Moniz sees as a need to essentially de-carbonize the electricity sector  
24 over the intermediate term.

1                   We, in the Department, have been highlighting nuclear  
2 over the last year or more in a variety of forum, not least of which was  
3 an event on Capitol Hill last month that the Chairman attended where  
4 we looked at some of the economic challenges facing today's nuclear  
5 plants and looked a policy options that might be available to help  
6 address the loss of those plants.

7                   We've also been doing things in DOE trying to chart a  
8 course for the future of nuclear energy. And, as we look at nuclear in  
9 DOE, we tend to think in three general time frames.

10                  The first is today's plants and what do we do to help  
11 ensure the safe, reliable, long-term operation of those plants?

12                  Second, is kind of in the intermediate stage. What  
13 near-term options can we provide to ensure that there are multiple  
14 potential pathways for new nuclear deployment in the U.S. and  
15 internationally? And, that's been concentrated on our support for small  
16 modular reactor development.

17                  Then, of course, over the long-term looking at  
18 advanced reactors non light water reactor technologies that might be  
19 available coming -- starting in the 2030 time frame.

20                  We'll spend some time today talking to you about  
21 programs that we have and initiatives that we have to try to make  
22 progress in each of those areas.

23                  And, I'll start by turning it over to Ray Furstenau who's  
24 going to give you an update. So, Ray?

1 MR. FURSTENAU: Thank you, Commissioners, for  
2 letting us speak to you about our ongoing programs and future  
3 programs.

4 I'll start with the outline page to kind of frame up what  
5 John Kotek referred to with our ongoing programs, what we're focusing  
6 on and then I'll get into a little more detail on the GAIN initiative, the  
7 Gateway for Accelerated Innovation in Nuclear, our Nuclear Energy  
8 University programs, and our Nuclear Science User Facilities.

9 Go to slide three?

10 As John talked about, we're, you know, we have a  
11 focus on sustaining the current fleet, of course, and commissioning the  
12 next generation of that advanced light water reactors. And, John Kelly  
13 will go into a little more detail when I turn it over to him about those  
14 programs.

15 Also, we have programs looking at the utilization of  
16 nuclear and hybrid systems. We need to develop really a fundamental  
17 change in how nuclear technologies are perceived by the public,  
18 develop license and deploy with industry and regulated by a  
19 government in order to really move nuclear forward.

20 And, of course developing solutions for the waste that's  
21 generated.

22 If we go to slide four, really, this is a nominal time line  
23 here. I think also John Kelly will give a time line that shows a different  
24 projection on nuclear.

1                   But, the point, whether it's 200 gigawatt capacity by  
2                   2050 or some other number more or less, the point of this is to show  
3                   that the current fleet, which ever scenario is going to be decreasing in  
4                   its nuclear capacity. If we're going to maintain some nuclear capacity,  
5                   we need to deploy current Gen III+, SMRs and Gen IV.

6                   And, that's really our strategy as we talk here later  
7                   today. We have life extension programs for 60 years and beyond 60.  
8                   John Carmack will talk about accident tolerant fuels, in particular, as  
9                   part of the current research being done.

10                  John Kelly will also talk about the Gen III+ Advanced  
11                  Light Water Reactors that are being built right now as well as Small  
12                  Modular Reactors and a little bit about the Gen IV Advanced Reactors  
13                  that are being developed.

14                  And, I'll go in now in a little bit more detail on to slide  
15                  five about what we're doing to support the U.S. industry in the Gateway  
16                  for Accelerated Innovation in Nuclear.

17                  It's really an organizing principle that we have that how  
18                  can we provide the nuclear community with access to the expertise that  
19                  the laboratories and DOE has in technical, regulatory as well as  
20                  financial support as we move advanced nuclear technologies forward?

21                  And, it's an integrating function, as I mentioned, and a  
22                  facilitating function for advanced reactor and advanced technology  
23                  concepts.

24                  A few things that, in recent -- recently that we have

1 taken on under GAIN, the voucher initiative, it was announced earlier  
2 this year for a \$2 million program, small business vouchers. It kind of  
3 took off of an EERE program on small business vouchers.

4 We just announced those last week, eight small  
5 business vouchers. Some companies, you may recognize, some may  
6 not. But, that was the intent was to have -- give a little boost to some  
7 of the newcomers to help them develop their concepts. So, those were  
8 announced last week.

9 Also, this year, DOE has this Energy Technology  
10 Commercialization Fund. And, that's where it's a 0.9 percent of our  
11 R&D budget in the Office of Nuclear Energy, that amounted to about  
12 \$4.3 million and it's allocated to pursue some high-impact commercial  
13 activities where there is lab involvement as well.

14 Expect those matching fund announcements to be  
15 made later this month, maybe early next month.

16 And, a longer ongoing program, SBIR, STTR and that  
17 -- what those acronyms are, the Small Business Innovative Research  
18 and the Small Business Technology Transfers. And, they'll add about  
19 3.4 percent. The SBIR is around 3 percent and there's usually Phase  
20 I and Phase II activities involved in that.

21 Phase I are usually around \$100,000.00 to  
22 \$150,000.00 range and then some of those Phase I activities with small  
23 business then to into a Phase II activity which are in the million, million  
24 and a half range.

1                   We go to slide six, a little bit more on GAIN. The  
2 challenges column there is -- a lot of that is well known to most folks, I  
3 think. And we sponsored a series of workshops. Actually,  
4 geographically, they were far disbursed, but we brought them all  
5 together in March of 2015 that really looked at how can we help bring  
6 technologies to market? What are the challenges?

7                   And, the results of those workshops from the spring of  
8 2015 really then helped us frame the development of GAIN, the  
9 Gateway for Accelerated Innovation of Nuclear. And, the DOE  
10 response to that is in that center column.

11                   And, we're really looking to how can we, as the  
12 Government, and DOE really provide access? That was a big issue  
13 that innovators have, that National Labs, the DOE sites, have a -- really  
14 have a -- it's a vast resource of people, expertise, facilities, real estate  
15 that may be of use to nuclear innovators as well as expanding our  
16 cooperation with the NRC here to assist developers through the  
17 regulatory process.

18                   And then, so GAIN was kicked off during the nuclear  
19 summit sponsored by the White House in November of 2015 and really  
20 been taking off and developing ever since.

21                   The three main labs associated with that right now are  
22 Idaho National Lab, Argonne National Lab, and Oak Ridge National  
23 Lab.

24                   But, the capabilities of all the national labs can really

1 be accessed through that framework.

2 On page seven, really, the GAIN innovation test bed  
3 really has built on our successful nuclear science user facility model  
4 which really is a subset of GAIN.

5 Our user facility concept in the Office of Nuclear Energy  
6 really developed in the 2007 time frame with the Advanced Test Reactor  
7 which is a reactor in Idaho that's sponsored by the Office of Nuclear  
8 Energy. And, it was made a user facility in 2007.

9 And, it was really done to expand beyond the traditional  
10 naval reactor's role with the Advanced Test Reactor and really allow  
11 access to many more users, university and industry, isotope production.

12 And, I know I've been involved in ATR for 25 years and  
13 it has really made a difference. I've seen with -- it's far exceeded what  
14 I thought it would with regard to having access the radiation space and  
15 the ATR, it is really been more utilized than I've seen it in my years  
16 involved with the ATR.

17 And then, it really took off from there because we also  
18 expanded the user facility concept in NE to the Post-Radiation  
19 Examination facilities.

20 At Idaho, we also brought in partner facilities, we call  
21 them, like MIT Reactor is a partner facility, Oak Ridge facilities, other  
22 university facilities. And, I'll get into that a little bit more later in the  
23 discussion.

24 But, again, part of that is to use our existing capabilities

1 from multiple institution. And, again, GAIN is that organizing function  
2 to do that.

3 It also includes high-performance computing  
4 capabilities that we have within the labs as well as a knowledge and  
5 validation center to basically take advantage of work, experimental  
6 work, research that's been done in the past and allow access to that  
7 historical data as well as the historical knowledge of the people that  
8 work at the labs.

9 One other question or topic area that was on our  
10 agenda was the initial steps towards internationalizing GAIN. And, I'll  
11 go to slide eight with that.

12 We've had -- CRADA work for others arrangement with  
13 SCK-CEN in Belgium, the BR-2 Reactor, in particular to irradiate  
14 material. We also have done work -- and NSA has done work with the  
15 BR-2 Reactor for the reduced enriched research and test reactor  
16 program to develop LEU fuel.

17 And, we're in the process right now of developing an  
18 MOU with SCK-CEN and the BR-2 Reactor to allow R&D access to  
19 those facilities. And, we're doing some work right now, like I  
20 mentioned, on a CRADA basis with ATR.

21 But we see, as we look at the research capabilities  
22 across a complex and the universities, there are international  
23 components of this that we can -- we think can be beneficial to DOE as  
24 well as the cooperating nations and BR-2 could be one of those having

1 high-flux neutrons available for capacity that we may not have in the  
2 DOE complex in the U.S.

3 Also, John Kotek just this week asked the NEAC, our  
4 Nuclear Energy Advisory Committee, to initiate a review of the  
5 availability of R&D capabilities internationally.

6 The charter letter is not quite out yet, I think, John, but  
7 we're in the middle of developing that.

8 Okay, on to NE's University programs on slide nine.

9 Off to the right there it kind of shows you a map of  
10 where the NE University programs have touched across the nation.  
11 And, as you can see, almost every state is seeing some benefit to that.

12 This orange block, since FY '09, it's really, we just  
13 announced a week ago the FY '16 awards. And so, the number there,  
14 we've really awarded over \$460 million to 113 schools across the  
15 nation. So, it's been quite successful.

16 We designate up to 20 percent of our R&D funding to  
17 that program and then we do a competitive bid along with the integrated  
18 use of university program and the research reactor infrastructure  
19 program.

20 That's one giant announcement, if you will, every year  
21 where there's a request for proposals to -- for those grants. And, it's  
22 really been quite successful.

23 The Integrated University Program, the fellowships are  
24 \$50,000.00 a year. Then in addition to that, there's like \$5,000.00 for

1 summer work at a laboratory or elsewhere in addition to the \$50,000.00.

2 And then, for the undergraduates scholarships, it's  
3 \$7,500.00 a year.

4 And then, the research reactor infrastructure is to  
5 provide funding to universities with research reactors to modernize their  
6 infrastructure, instrumentation, for example, a number of things and as  
7 well as a traineeship program.

8 Going to slide ten, I spoke about this a little bit early on,  
9 Nuclear Science User Facilities, again, a very, very successful program.  
10 And, we're really looking at expanding that.

11 This lists the reactor facilities that are in the NSUF  
12 family. Right now, I also have beam lines and post-radiation  
13 examination facilities at the laboratories. And Westinghouse is also a  
14 member, a commercial entity.

15 So, in summary, I think a recognition of the importance  
16 we see of nuclear in today and in the future to reach carbon reduction  
17 and our climate goals.

18 Of course, in the near-term, there is concern on the  
19 financial viability. Some currently operating plants, but there's a huge  
20 carbon reduction benefits in keeping them, so we have that dilemma  
21 that the nation is dealing with.

22 We've seen increased interest in nuclear on some  
23 domestic and international markets, Gen III+ Reactors, John will talk  
24 about that, some of our technologies here in a little bit in more detail.

1                   And, we'll also looking at Gen IV technologies. Earlier  
2 this year, we had a funding opportunity announcement on two activities,  
3 one headed by Southern and one headed by X-Energy to pursue  
4 Advanced Reactor concepts as well.

5                   And, with that, I'd like to turn it over to John Kelly. He'll  
6 go into a little bit more detail on a few of the programs I mentioned.

7                   John?

8                   DR. KELLY: Thank you, Ray.

9                   So, the slides loaded? Great.

10                  So, to give an update on the nuclear energy -- our  
11 nuclear reactor R&D program.

12                  So, if -- next slide, please?

13                  So, I think over the last year, we've seen tremendous  
14 enthusiasm about new reactors. This is being driven by a couple of  
15 factors.

16                  One is certainly the interest in reducing carbon  
17 emissions and the agreements that were reached in Paris back in  
18 December.

19                  But, if you extrapolate what that actually means and the  
20 Secretary has come out and talked about this, is that we actually need  
21 to decarbonize electricity production by about 2050.

22                  Now, next slide, please?

23                  So, what does this mean? Well, in terms of  
24 decarbonizing the electricity production, we have to think about the

1 current fleet and then what the next generation is.

2 So, you know, we currently are operating under the fact  
3 that most of the plants are going to go from 40 years to 60 years, some  
4 will close early. But then, we're looking now at 60 to 80 years.

5 But in 2050, we're looking at about a doubling of the  
6 nuclear capacity. And, this is in, if you look at the numbers, we need  
7 a tenfold increase in renewables, you know, carbon with sequestration  
8 needs to basically come to the point that we currently have all of our  
9 natural gas.

10 And so, the doubling of nuclear is certainly within, I  
11 think, a reasonable grasp.

12 The key, though, is what is the outlook for nuclear?

13 Well, we think that our large Light Water Reactors will  
14 certainly have a key role in the 2050 time frame and beyond.

15 SMRs, which we're currently developing will come to  
16 the market in the 2025 range.

17 And, the key question is really for in terms of our R&D  
18 program is what will the role of Generation IV reactors be in that 2050  
19 time frame?

20 Next slide?

21 So, the strategy we have is really this three-prong  
22 effort.

23 The first is looking at continuing the safe and reliable  
24 operation of the current fleet with the focus on aging management,

1 advanced instrumentation and controls, looking at the margins, safety  
2 margins as the plants age, looking at emerging issues as they arrive  
3 and then reactor safety technologies which is really an effort that we  
4 launched after the Fukushima accident.

5 We're coordinated very well with the NRC and EPRI.  
6 And I think this continued coordination will be important for the success  
7 of the program.

8 And, you know, we've recently heard of two plants that  
9 are going to see subsequent license renewal going from 60 to 80 years.

10 Next slide?

11 I think, though, if you look at the previous chart, you'll  
12 see that, eventually, the current fleet will eventually retire. And so, we  
13 need to be looking at new reactor technologies.

14 DOE invested in the Gen III+, the Westinghouse AP-  
15 1000 and then the ESBWR. But, we need to be looking forward.

16 And so, one thing that we've been very interested in is  
17 the small modular reactors.

18 This was a program that we started in 2012. So, it's  
19 kind of amazing it was just four years ago that we actually started this.  
20 And, we're now at the point where the -- we have actual submittals to  
21 the NRC in terms of early site permit, design certification later this year.  
22 So, we're very excited about the opportunity here.

23 But, what we're trying to do is accelerate the  
24 deployment. We thought that the, left on its own, the industry would

1 eventually come to this, but by having the government invest in this, we  
2 could significantly accelerate the deployment of this technology.

3 So, NuScale is our primary partner right now in terms  
4 of reactor design. They're working on the design certification.

5 TVA has been -- just submitted their early site permit  
6 last month.

7 And then, the organization called UAMPS which is a  
8 group of utilities out in the west is also looking at the NuScale reactor  
9 as a potential source for power in that part of the country.

10 We've also been working with industry and trying to  
11 solve some of the generic issues associated with user requirements,  
12 licensing, economic and market studies and siting.

13 Next slide, please?

14 So, as I mentioned, that NuScale was making great  
15 progress. They just froze their design at the end of May with the  
16 intention of submitting their design certification by the end of this year.

17 TVA submitted their early site permit earlier this last  
18 month. And, they will be looking at technology specific selection in the  
19 fall of this year followed by a COLA development.

20 So, the early site permit that they submitted will be  
21 bounding in the sense that they will basically be able to cover any of the  
22 SMR vendors in the U.S.

23 In terms of the NuScale and UAMPS, I think what was  
24 really interesting for our perspective was putting together a Site User

1 Agreement earlier this year where we've given them the opportunity to  
2 use a parcel of land on the Idaho National Lab Reservation.

3 There were four candidate sites that were screened in  
4 that process and they are going to get to the point of selecting one of  
5 those in the next month or so.

6 And then, the decision to proceed will be coming next  
7 after they pick their site.

8 Next slide, please?

9 But, we feel like we're not done yet. We've been  
10 working the licensing regulatory issues associated with SMR designs  
11 and the sites, but we think more will be needed.

12 And so, this week, later this week, we are conducting  
13 workshops out here in the Rockville area to look -- to get input from our  
14 stakeholders as to what are the next steps needed for  
15 commercialization of SMRs?

16 Some of the things that have come to our minds is that  
17 with the -- there is more work needed on design finalization. We  
18 actually need more sites, so additional COLAs are probably in order.

19 We need to be looking at advanced manufacturing  
20 technologies. How do we actually make these SMRs?

21 And, looking at alternative uses for SMRs, in particular,  
22 looking at the integration of nuclear with renewables in the long term.

23 We've been working closely with the Nuclear Energy  
24 Institute and our industry partners to understand the dynamics. And,

1 as I said, the workshop will be held just across the street next week.

2 Next slide, please?

3 So, that sort of is the Light Water Technology, but  
4 what's the vision for the future? And, I think, really, it has to come down  
5 to what's the role of Generation IV reactors in this 2050 time frame and  
6 beyond?

7 We've just recently posted our vision and strategy for  
8 the development and deployment of these reactors, Advanced  
9 Reactors. This has been put out on our website.

10 And, I think the key thing, though, is that by 2050, we  
11 have to have Advanced Reactors become part of the actual mix. And,  
12 in order to have them be part of the mix, we have to actually have to do  
13 the development and deployment of the concepts, but in the 2030s.

14 That means the next 15 years are going to be a very  
15 important time for us to get Gen IV ready for market.

16 Now, why is Gen IV going to be important, well, I think  
17 because of the higher temperature that the reactors can operate, they'll  
18 be more efficient. This could be led to better economics. It also leads  
19 to improved safety. So, there's many good reasons to consider  
20 Generation IV.

21 Next slide, please?

22 You asked us to talk about our Advanced Test and  
23 Demonstration Reactor Study, so we have a report that we've published  
24 -- released, actually, very recently on this. And, it look at two

1 categories of reactors.

2 The first as a Test Reactor which was in principle to  
3 provide irradiation services. It would be primarily used for R&D. It  
4 would provide the appropriate environment, that is the coolant for the  
5 Advanced Reactors and it must support the development of Advanced  
6 Reactors.

7 So, there's a variety of concepts that are available to  
8 do this. So, basically, we come down to the idea of having a fast  
9 neutron spectrum with cooling channels that will allow us to test either  
10 in gas or sodium or lead or molten salt.

11 We're also looking at the ability to have demonstration  
12 reactors. And this would be to do technology and validation.

13 So, while we've built in the past sodium fast reactors,  
14 gas cooled reactors, there are certain reactors that have only been  
15 demonstrated at the experimental level.

16 And so, we're -- and with a number of vendors that we  
17 see today, we're looking at how do we combine our resources to make  
18 the most effective use. And, this gets back to the GAIN initiative to  
19 how do we use our capabilities to demonstrate new reactor  
20 technologies?

21 In this effort, we would be looking at doing technology  
22 integration, demonstrating transient performance, be able to flexibly  
23 swap out components and provide feedback and designs.

24 Next slide, please?

1                   So, fundamentally, though, our objectives are to create  
2 the environment that will allow our industry to come in and demonstrate  
3 their capabilities.

4                   So, we're basically seeing three main missions right  
5 now. One is on high temperature process heat applications which can  
6 not only generate electricity but generate a high temperature process  
7 heat for a variety of industrial purposes.

8                   Actinide management which we expect to be important  
9 in the latter half of this century which will allow us to increase the use of  
10 uranium to -- and reduce our nuclear waste in the future.

11                  And then, we also are looking at the ability to, you  
12 know, demonstrate at smaller scale reactors of less mature  
13 technologies. So, for instance, molten salt type of reactors.

14                  And, as I mentioned, the reactor -- the irradiation test  
15 reactor would be to develop irradiation capability to test fuels and  
16 structural materials for the reactors.

17                  Next slide, please?

18                  So, the study is out. It basically looked at these four  
19 different options where the conclusion was that if we wanted process  
20 heat, then the high temperature gas reactor would probably be the  
21 preferred option.

22                  If we demonstrate waste management, then it would  
23 be a Sodium Fast Reactor. If we wanted to demonstrate a less mature  
24 technology, it'd be the fluoride-salt high temperature reactor or a lead

1 fast reactor and for testing purposes, we're kind of heading toward a  
2 Sodium Cooled Fast Reactor.

3 So, in summary, I think in order to meet our clean  
4 energy goals of the future, we need to have nuclear remain as a key  
5 and significant part of our electricity production.

6 It starts with making sure that we have safe and reliable  
7 operation of the current fleet and extend that as long as possible.

8 Begin to deploy the SMRs in the mid-2020s and then  
9 develop the Advanced Generation IV Reactors for deployment  
10 beginning in the 2030s.

11 So, thank you.

12 MR. CARMACK: So, I'll start on slide two.

13 I'm not sure where, if you have had a previous  
14 presentation on accident-tolerant fuels for Light Water Reactors, but I  
15 will give you some of the history of where this program started and how  
16 we are to where we are today and then move forward pretty quickly into  
17 where we are right now and how we see going forward over the next  
18 few years.

19 We had actually started working on sort of  
20 revolutionary innovative fuel, research and development activities and  
21 concepts in the spring of 2010. And, the program, based on some  
22 input and feedback that we have gotten from our industry advisory  
23 committees and such.

24 We'd then primarily focused those on looking at higher

1 burn up fuels or fuels that could possibly go to higher powers and things  
2 like this.

3 But, shortly after Fukushima, we were reviewing those  
4 concepts with some of our industry advisory committees and it was  
5 suggested that we add something on off-normal performance of fuels.

6 And then, shortly after that, in the fall of 2011, in our  
7 Consolidated Appropriations Act of 2012, we received specific guidance  
8 to do a program like this specifically on -- and it was termed Meltdown  
9 Resistant Fuel.

10 We did not like the term Meltdown Resistant Fuel, so  
11 we worked pretty hard on page three across the domestic as well as  
12 international community to define a consistent set of metrics about how  
13 we define and characterize what we mean by enhanced accident  
14 tolerant fuels.

15 And so, that's the term that we've come up with to really  
16 sort of communicate what we mean in enhancing the accident tolerance  
17 and providing grace time and coping time to utility and operator to  
18 respond to off-normal conditions in the plants.

19 We think we've come up with a fairly concise set of  
20 attributes and metrics that sort of clearly define what we mean by  
21 enhanced by enhanced accident tolerant fuel performance. But, you'll  
22 notice that it doesn't specifically include the economics of the situation.

23 So, we did not want to prejudge possible research and  
24 development concepts based on the potential economics of the future,

1 which are very hard to predict at this early phase of research and  
2 development.

3 But, we do have that as well as back end performance,  
4 fuel cycle considerations as attributes and metrics that have to be  
5 looked at in terms of looking at how to put these types of fuels into the  
6 fleet in the future some time.

7 So, we also were required to and directed to provide a  
8 report to Congress which we delivered in 2015. It's available  
9 publically, I can give you the reference to that, it's not listed on the slide,  
10 but it is available of the Department website.

11 And, it outlined a ten-year goal. Because, as you  
12 noticed in the 2012 language, it directed us to demonstrate these fuels  
13 in an operating commercial plant by 2020, which we felt was a really  
14 aggressive goal.

15 So we worked pretty hard also to extend that time line  
16 to at least ten years to give us time to identify candidate research and  
17 development technical options and then put them through the  
18 development phase to the point that we felt that we could demonstrate  
19 them at a commercial scale.

20 So, we have been focused over the last four to five  
21 years since 2012 in doing the preliminary feasibility studies on some of  
22 these concepts.

23 We have a range of concepts that have been proposed  
24 by a number of entities.

1                   And, at the end of Phase II, or at the end of Phase I,  
2                   we have defined a specific fuel selection and I'll talk about that a little  
3                   bit later.

4                   But, one of the things we realized on slide five is that,  
5                   to really do this as quickly as we've challenged to do it by Congress that  
6                   we needed to quickly engage the entire nuclear community in the United  
7                   States as well as internationally.

8                   And so, the Department established three competitive  
9                   projects, one led by AREVA, one led by GE and one led by  
10                  Westinghouse to define specific technologies that, they as institutions  
11                  felt that they could provide on this ten-year time frame and successfully  
12                  demonstrate in a ten-year time frame.

13                  And so, these teams have been working together  
14                  individually over the past four years to develop specific and research --  
15                  perform research and development on specific technologies that are  
16                  now under the procurement phase for Phase II.

17                  So, these teams will complete Phase I in September of  
18                  this year and then in October, they will change into what we refer to as  
19                  Phase II, which I would characterize as really taking the technology,  
20                  bringing the fabrication processes to a scale that demonstrate  
21                  commercial viability as well as increasing the prototypicality of the  
22                  irradiation testing and assessment of the concepts.

23                  We are moving from a sort of drop-in capsule  
24                  irradiation test series that we've been performing over the last four or

1 five years to some initial assessment of these concepts to specific PWR  
2 prototypic loop irradiation in both the Advanced Test Reactor at the  
3 Idaho National Laboratory as well as the Halden Test Reactor in  
4 Norway.

5 In addition to that, the Department is invested heavily  
6 in the transient testing capabilities in the United States by deciding to  
7 refurbish and restart the TREAT Reactor at the Idaho National  
8 Laboratory and we anticipate that it will be available for testing purposes  
9 beginning in the 2018 time frame.

10 We have some recent interest and engagement with  
11 the utility representatives. They've been asking for the possibilities of  
12 enhanced accident tolerant performance that can provide an impactful  
13 coping time for the current fleet.

14 They believe that this can help them economically in  
15 the current situation in the United States. And, one of the statements  
16 that's made is to make the Gen II Reactors that we have today on par  
17 with the Gen III+ designs of 72 hours of coping time.

18 So, we'll see as the technologies go forward as to their  
19 capabilities in that regime.

20 But, I will note that, in closing, that to take full  
21 advantage of some of these accident tolerant fuel technologies, we  
22 need to consider all of the core and reactor components that will be  
23 affected.

24 MR. KOTEK: I thought I might just wrap up and then

1 I'll to go to questions.

2 CHAIRMAN BURNS: Okay, that's fine.

3 MR. KOTEK: A few things I want to highlight out of  
4 that.

5 So, what we've tried to lay out for you today is things  
6 that we're doing, looking at today's reactors, things that we're looking at  
7 to create a frame -- or a set of nuclear choices for the relatively near-  
8 term and then choices for nuclear over the long-term.

9 There are a few other things going on that will help  
10 inform our strategy going forward.

11 As John Kelly mentioned, we've put out this draft vision  
12 strategy document, that's out. We're receiving input from a variety of  
13 sources on them including our Nuclear Energy Advisory Committee.

14 There's also a Secretary of Energy Advisory Board  
15 Task Force that's looking at this question and looking at the future of  
16 nuclear power and what it takes to get to having Advanced Reactors  
17 available in the 2030 to 2050 time frame. They're expected to report  
18 out this fall in response to a charge from the Secretary, Dr. John Deutch  
19 from MIT is leading that effort.

20 Looking more near-term, the challenges facing today's  
21 reactors, we talked about a little bit earlier and, again, thanks to the  
22 Chairman for joining us at the event last month.

23 There are other things going on in the Department and  
24 other things that we're trying to do to provide greater clarity on the

1 importance of today's nuclear and of the challenges facing today's  
2 nuclear plants.

3 For example, the Quadrennial Energy Review 1.2 is  
4 underway right now. They are evaluations looking at the question  
5 evaluation going on.

6 We, in DOE, are also planning on preparing a report  
7 from the summit that we had last month that, again, will we hope serve  
8 as a resource for policy makers.

9 On the question of the test and demo reactor that John  
10 Kelly described, the study done by NEAC helped us understand what  
11 our options are for going forward. It didn't say you should go do one  
12 or the other, it said, if you want to do X then here's the things that's kind  
13 of best positioned to serve that need in the near-term.

14 What we've done is we've asked our Nuclear Energy  
15 Advisory Committee -- or we've told them we're going to ask them, we  
16 haven't chartered them yet -- to help us look at taking the next step on  
17 the test reactor side.

18 You know, as you could hear from the discussion  
19 today, one of the things we're trying to do is figure out how to make our  
20 capabilities and make our programs more impactful in helping the  
21 industry get technologies into the marketplace.

22 A test reactor has been identified by several entrants  
23 in the -- participants in the nuclear innovation community as something  
24 that would be very helpful to them.

1                   We haven't made a decision to go down that road yet,  
2                   but we want to look at what is the potential need? What's the user  
3                   community that's out there, both domestically and internationally, and  
4                   help us define what that might look like and see whether it might be  
5                   worth going down that road. And also to help informed design choices.

6                   So, we're going to ask our Nuclear Energy Advisory  
7                   Committee to help us take a hard look at that.

8                   And then, of course, there are, you know, things we  
9                   didn't talk about today, and particularly the waste program that we're  
10                  restarting in DOE right now. We're in the midst of a series of eight  
11                  public meetings to get input on the design of a consent-based siting  
12                  process.

13                  In fact, I'll be headed out to Arizona this week for the  
14                  next of those meetings. So, that's underway and we can talk about  
15                  that detail another time, if you'd like.

16                  And then, I just wanted to close by thanking you all for  
17                  the opportunity to be here. I want to thank the staff as well. Of course,  
18                  John Kelly and his team have been working extensively with your folks  
19                  over a number of years looking at some of the licensing issues facing  
20                  tomorrow's reactors.

21                  And, I think we have certainly found that partnership to  
22                  be very constructive and hope to continue that over the long-term.

23                  And, again, thank you for their efforts, thank you for  
24                  your efforts and for the opportunity to be here.

1                   CHAIRMAN BURNS: Well, thanks, John, and thanks  
2 to all of you today for the presentations. I think very informative,  
3 particularly as at one point, we were all part of the same agency, a long  
4 time ago, in 1974.

5                   But, it does, I think, from my standpoint, the  
6 presentations from you and I'm sure what we're going to hear from the  
7 staff in this intersection between development of technology, continued  
8 research and then, you know, our role as regulators is very important.

9                   And, it is important for my perspective that we are, you  
10 know, talking with one another to understand where we're coming from,  
11 where is, you know, John put up the chart about the potential in terms  
12 of employment of new technologies and all, that we have an  
13 understanding on this side of the table and our staff of where things are  
14 going.

15                   I'll start off, and you need to, I think, start my -- yes --  
16 the button here, the magic timer here.

17                   I'll start off.

18                   One of the questions, and this may be just a sort of a  
19 clarifying question because, I get this sometimes, sometimes in  
20 international fora or other places about the distinction.

21                   We're often, even, I think, sometimes in our  
22 discussions with the Congress, and I'll try to be very careful about when  
23 we talk about SMRs and then Gen IV Advanced Technology.

24                   Is there -- when we speak of SMR or when you talk

1 about SMRs or Gen IV, is there -- can you elaborate on any of the  
2 distinctions you might be making there in that kind of discussion?

3 Anyone? John?

4 MR. KOTEK: Well, I'll start and ask John Kelly or  
5 others if they want to add on to it.

6 I mean, when I think about Gen IV, of course, I was  
7 involved heavily in the Generation IV road mapping effort, right, so when  
8 I think of Generation IV technologies, we were looking at sodium and  
9 gas and lead and super critical water and molten salt back then.

10 So, that's kind of the frame work I think about. I've  
11 always thought of SMRs as it's something beyond what we have in  
12 commercial use today. So, certainly, there may be different, you know,  
13 different licensing considerations.

14 I know there are things that you all have been taking  
15 on and in that space, as have we. And so, there are all things that kind  
16 of aren't here today, so they all might require, you know, efforts in  
17 different directions to help them get to commercialization.

18 But, at least I've thought of them as kind of when I say  
19 Generation IV, I'm generally not talking about SMRs.

20 John, what's --

21 DR. KELLY: So, I think a couple of things about  
22 SMRs, the first is that the designs that are out there right now have  
23 basically, through the design, eliminated large pipe break scenarios.

24 And so, eliminating that whole class of accident

1 scenarios is really important and innovative type -- innovative idea.

2 But also, because of the design of the systems, they  
3 can actually cool the reactor core after shutdown and with loss of power  
4 for weeks, perhaps a month or more.

5 And so, the coping time, which has become evidently  
6 important since Fukushima, is really long for them. So, their improved  
7 safety, eliminate a whole class of accidents.

8 But, the designs are also such that they could be  
9 manufactured in the U.S. in factories and shipped to the site. So, we  
10 no longer would have to rely on factories in Korea or Japan or China to  
11 make the reactor pressure vessels because of the size of these -- the  
12 pressure vessels are something within the range of the capabilities  
13 within the U.S.

14 And, because of the reduced or improved safety and  
15 the reduction in potential accidents and the reduction in the source term,  
16 these plants can be sited closer to population zones than the large  
17 plants.

18 And this opens up a whole new market for nuclear, in  
19 particular, we expect many of our coal plants to be retired in the 2030  
20 and beyond time frame and so having a clean energy technology such  
21 as nuclear SMRs, the SMRs can fit nicely into the footprint that the  
22 existing coal plants.

23 So, this is why, from an SMR perspective, we're so  
24 interested.

1                   Now, Generation IV is sort of a continuity of this. And,  
2                   it's really can we, you know, what's the economics going to look like in  
3                   the 2050 time frame?

4                   We expect natural gas in this country to be still an  
5                   important player, but it will probably have to have sequestration. And  
6                   so, the question is, is there a nuclear technology that can be competitive  
7                   with fossil fuel and sequestration?

8                   We think because of the higher temperature, the better  
9                   our safety, et cetera. This is why we're interested in investing in Gen  
10                  IV.

11                  How it plays out? There's 30+ companies out there  
12                  right now. We don't know who's -- what the down select is going to  
13                  look like. But, we think that there's enough good ideas out there that  
14                  we're interested in investing in the technology today for the future.

15                  CHAIRMAN BURNS: Okay, thanks, that was a good  
16                  -- great explanation there.

17                  I think I might ask, yes, to Ray, in terms of talking about  
18                  the voucher initiative under GAIN, it's a \$2 million voucher or coupon.  
19                  What does that do for the person who receives it? What do they do  
20                  with that? How does that help them?

21                  MR. KOTEK: Well, how that helps them, it provides  
22                  them that access to the lab. They have some contributory to that.

23                  CHAIRMAN BURNS: Okay.

24                  MR. KOTEK: But, it basically gives -- it pays for the

1 laboratory people's time to help them with their concepts. So, it's the  
2 access and the laboratory expenses during -- for that access is what it  
3 does.

4 CHAIRMAN BURNS: So, to help them carry out  
5 demonstration or certain research aspects of what they're --

6 MR. KOTEK: Correct.

7 CHAIRMAN BURNS: -- finding?

8 MR. KOTEK: I mean, it's small to begin with.

9 CHAIRMAN BURNS: Yes.

10 MR. KOTEK: But, it gives them the ability where they  
11 maybe have not had the experience of dealing with this daunting task  
12 of how do you do work a national lab or how do you do work with DOE  
13 to help?

14 And, that's where GAIN helps with that, as well, is to  
15 get that initiating input into the DOE system and help them with that, to  
16 take advantage of that expertise.

17 CHAIRMAN BURNS: Okay. I mean, I wanted to --  
18 and I think, one of the Johns mentioned this, in terms of -- I think what  
19 we're seeing with this notion that we have 25 or 30 organizations or  
20 groups or small startups, ever who or have some sort of interest in this  
21 advanced technology would -- it strikes me.

22 But I probably went back and looked in the history of  
23 the 1950s, that's not so much what I had. I probably had, you know,  
24 the Westinghouse, General Electric, and actually, I know from looking

1 back at some of liability -- my old -- looking at some of the liability issues  
2 and the, you know, the development of liability conventions in terms of  
3 why they developed in terms of the vendors and interests like that.

4 What -- coming back to the model we have today, how  
5 do you all -- how do you sort of cope with that from the standpoint of  
6 looking at what's real, what, you know, making decisions without stifling  
7 innovation, obviously, but how do you make decisions about what  
8 merits going forward or merits, in effect, the voucher or what's real,  
9 what's just a PowerPoint dream, if you will?

10 MR. KOTEK: Well, I'll start and ask the rest of the  
11 folks to comment on this.

12 But, you know, we do have to sometimes make  
13 decisions when it comes to, you know, putting out some sort of funding  
14 opportunity announcement and we've got to establish criteria that  
15 they've got to try to meet and in their application.

16 And, you know, just because somebody, you know,  
17 doesn't win one of our funding opportunities doesn't mean that they  
18 don't have a good concept, it might mean they just didn't have the right,  
19 you know, the best proposal at that time or maybe, you know, maybe  
20 there were half a dozen great ideas in there, but we only have enough  
21 funding for two of them. And so, you know, we have make those  
22 decisions sometimes.

23 But, of course, you know, part of what we're seeing as  
24 well with this is, you know, the marketplace is now getting involved.

1 And then latest number I heard at our NEAC meeting last week was  
2 we're now approaching \$2 billion in private capital that's gone into  
3 financing these several dozen, what I call, you know, nuclear innovators  
4 or aspiring nuclear vendors.

5 And, I think, you know, part of the reason they're, of  
6 course, interested in working with us and with you all on maybe building  
7 more feedback loops into the regulatory process, for example, is they  
8 want to be able to show potential investors that they're making  
9 progress, right, and there's some there there, it's not just a PowerPoint,  
10 but there's some hope that they'll get through, you know, through the  
11 development stages and into the regulatory process and into the  
12 marketplace.

13 And so, you know, we, of course, as, you know, as we  
14 have funds available to provide, we put together expert teams that, as  
15 you'd expect, you know, that review proposals and decide who's got the  
16 most meritorious applications and we award funds that way.

17 But, you know, to the extent that they've got resources  
18 that they want to bring to the laboratories, for example, to get access to  
19 capabilities, that's, you know, to the extent that they can pass through  
20 the laboratory reviews for work for others or for a cooperative research  
21 and development agreement, they can access capabilities that way  
22 whether there are DOE funds involved or not.

23 So, there's a lot of ways for them to get in to the system.  
24 There are times where we have to make a call as to who's got the most

1 meritorious proposal just because that's -- because of the limitations  
2 we've got, but we're trying to make our capabilities broadly available,  
3 whether somebody's using federal funds or not.

4 And, in fact, we do have at least one large company I  
5 can think of off the top of my head that, you know, hasn't really been  
6 applying for DOE funds, but they bring in funds to the laboratory and  
7 paying for quite a bit of work there. So, it can work a variety of ways.

8 And, I'll ask John to kind of build on that.

9 DR. KELLY: Yes, so a couple observations.

10 First is that if you look at the history of innovation in the  
11 last couple decades, it's been driven by small business that can do  
12 things quickly, you know, they can have success or failure and then they  
13 just keep moving and moving.

14 So, one of the emphasis through GAIN is to support  
15 small business innovation. And, it's -- the voucher program is one way  
16 to do that.

17 I think the other thing that we're -- as part of GAIN  
18 coming to grips with is that, you know, the Generation IV roadmap, the  
19 things that we did 15 years ago, is still valid, but we need to sort of corral  
20 the different design together.

21 And so, what we're beginning next month is to conduct  
22 technology centric working groups -- workshops and then hopefully that  
23 will evolve into working groups.

24 Well, everyone interested in the technology such as

1 Sodium Fast Reactors, would get together and help identify the key  
2 R&D needs that they need from both a technology risk and a regulatory  
3 risk perspective and then we can work to get collectively to reduce those  
4 risks.

5 And so, we will be convening these meetings beginning  
6 next month and really try to shepherd the technologies so that we get a  
7 consistent story and then we can make investments, I think, much more  
8 effectively and with the private sector and the government funding, you  
9 know, this should lead to a very successful path forward.

10 CHAIRMAN BURNS: All right, thanks again for your  
11 presentations.

12 Commissioner Svinicki?

13 COMMISSIONER SVINICKI: Well, good morning and  
14 thank you all for being here.

15 The Chairman noted that our agencies have their  
16 origins together and, although he might not mention it, Commissioner  
17 Ostendorff wore his atom tie today in your honor because you are our  
18 guests and he wanted to honor nuclear sciences by wearing that tie.

19 I have some specific questions, but I want to begin with  
20 some observations and I was having a hard time realizing kind of what  
21 were the constructive things to say? I sometimes think in terms of  
22 Hollywood movies and I think, if it was a movie, you were panning this  
23 side of the table or your side of the table and like what were people  
24 thinking, you know, while they're listening to the presentations?

1                   Some of what I was thinking is how long have I known  
2                   some of these folks that we've been talking about some of these same  
3                   issues? But, the truth of the matter is that, for nuclear science and  
4                   technology, those of us working in the public policy space are a pretty  
5                   small community of people.

6                   So, as administrations come and go, the chances that  
7                   you're going to walk into a room and know a lot of the people is pretty  
8                   high. There just aren't that many of us toiling away on these types of  
9                   energy policy issues.

10                  So, I sit here in this moment and I've got this huge  
11                  diametrically opposed set of observations about nuclear. I'm serving  
12                  my ninth year on this Commission and when I joined this Commission,  
13                  there was a lot of talk of the nuclear renaissance based on incentives  
14                  provided in the Energy Policy Act of '05.

15                  At our peak, I think we had applications for 28 new  
16                  nuclear units and there was a lot of excitement about SMRs.

17                  I will say that every year that I've served on this  
18                  Commission, we have projected that we are going to receive a design  
19                  certification application for an SMR next year.

20                  So, if we get one this year, we'll finally break that nine  
21                  year streak of it's going to be next year.

22                  And, I think, again, based on the maturity of some of  
23                  the work that's done in the vendor community, I'm feeling a lot more  
24                  confident about that actually happening according to schedule later this

1 year.

2 But, we do have a lot of forces at work that aren't  
3 controlled by people at this table. I know that DOE had a workshop  
4 that Mr. Kotek referred to on the economic challenges to the current  
5 fleet.

6 So, it's interesting to sit in year nine thinking that we  
7 have had a number of currently operating reactors either shutdown or  
8 announce their premature cessation of operations.

9 The industry itself at the DOE workshop, and I think  
10 that they're not probably in the business of creating or predicting the  
11 most bleak picture. They talked about the possibility for 15 to 20 more  
12 shutdowns.

13 So, the Federal Energy Regulatory Commission is an  
14 also independent regulator as we are. We meet jointly with them. I  
15 know that they are looking at some of the market structure. Some of  
16 this, I think, falls squarely for state legislatures and state regulators.

17 So, you know, taken that it isn't solvable by the people  
18 at this table, I wondered if DOE was doing any work related to an  
19 entirely new thought process about the plants that face a noneconomic  
20 circumstance in the moment of potentially being put into lay up for  
21 extended periods as is done with fossil units?

22 It would require a fundamental paradigm shift by  
23 operators and for NRC to have a new regulatory paradigm. But, you  
24 haven't mentioned it, but is that anything even in a conceptual stage of

1 looking at what that might look like?

2 Again, the option would be that the asset itself, as an  
3 asset for the nation's clean energy, is not permanently moving towards  
4 a shutdown which, again, is the way things are structured right now.

5 So, I know -- I would note there's some conferring at  
6 the table.

7 MR. KOTEK: I mean, certainly that's an approach  
8 we've taken in DOE before. So, for example, the TREAT Reactor is  
9 going to restart now after being in lay up for more than 20 years. And,  
10 well, even with FFTF, I think that was in a kind of a standby state for a  
11 number of years before the decision was taken to finally shut it down.

12 I've heard the idea raised just in the last couple of  
13 weeks, we haven't started anything.

14 COMMISSIONER SVINICKI: Do you think it's more a  
15 regulatory issue than a technical issue?

16 MR. KOTEK: I honestly haven't looked at it hard  
17 enough yet to know. I don't know whether John has looked at it any  
18 closer than I have.

19 COMMISSIONER SVINICKI: I just, you know, from  
20 my own standpoint, it would seem to me that even the preliminary or  
21 fundamental viability of it would reside so heavily in terms of what  
22 regulatory measures would need to be maintained, that it seems like  
23 there would at least be some fundamental questions that you would  
24 then need to engage in regulatory space before you could really look at

1 it as kind of technical systems and what needs to be done to have  
2 something in extended lay-up.

3 MR. KOTEK: I'll certainly raise that idea. You know,  
4 as we talked to the folks involved in the industry who are confronting  
5 these challenges, I'll certainly ask the question and see if there's any,  
6 you know, anything going on in their space and where they think you  
7 might start.

8 But, we just haven't looked at it close enough to have  
9 a good answer for you.

10 COMMISSIONER SVINICKI: I have heard some  
11 mumblings out of EPRI, that might be a place to start. I don't know if  
12 they have an internal group looking at it and I certainly can't speak for  
13 them.

14 But, it was not the first place I heard of this. I heard of  
15 it in hallway talk at a conference. But, I just wondered if DOE had taken  
16 anything on. It sounds like not formally. Okay.

17 And, I said I had a diametrically opposed set of  
18 observations. The other perhaps more forward looking set of  
19 observations is that I think in my 25-year career in nuclear, I think that  
20 advanced nuclear has the broadest public policy support, I think, right  
21 now of any time in the last 25 years. So, that's an interesting set of  
22 circumstances to try to square.

23 I also think that there are opportunities for innovation.  
24 I think the availability of venture capital, just a resurgence of

1 nonconventional operators in the nuclear space who are interested with  
2 the development of nuclear technology. That's out there.

3 But, again, we see strange outcomes such as very  
4 successful innovators in the U.S. tech industry who have decided that  
5 going outside of our country to demonstrate these reactors is more  
6 promising than doing it here.

7 And I think I visited a university in China that is a  
8 potential location where I think U.S. tech innovators interesting in  
9 making some prototypes and demonstration reactors. And, it gives me  
10 a lot of pause to think that a U.S. -- a successful U.S. business innovator  
11 has decided that engaging with the Communist Government of China  
12 is less bureaucratic than working with DOE and NRC.

13 I think that for everyone around this table, this should  
14 give us some pause to step back and wonder why that is.

15 And, in that light, I really appreciate that DOE is looking  
16 at, you know, national user facilities and the access to the national labs,  
17 which were such cradles of innovation at their origin. That was the  
18 whole purpose that they were made.

19 So, I know that you're looking at what barriers exist  
20 there.

21 A lot of think tanks and groups that are looking at  
22 barriers to advanced technology, though, seem to circle back to the  
23 regulatory framework as a strong impediment or obstacle.

24 It's hard, I think we've done some honest soul-

1 searching here at NRC. We feel that through the use of our current  
2 frame work, coupled with selected and justified exemptions, that we  
3 could regulate technologies that look a lot different than we have today.

4 I struggle a little bit, and maybe I'm too linear in my  
5 thinking about this, but at the end of the day, the certification of a  
6 technology or the issuance of a license is a legal action. And, I say  
7 this as the only person on my Commission without a law degree.

8 But it, you know, it arises, the authority comes from the  
9 Atomic Energy Act and it's a group of five people or maybe four or three  
10 or however many are serving at the time. It's their determination that,  
11 based on tens of thousands of staff hours of review that we probe and  
12 scrutinize that issuance of that license or certification of that nuclear  
13 reactor design technology is not going to have an adverse effect on the  
14 common defense and security and it's going to protect public health and  
15 safety.

16 And so, all of these calls for phased and staged  
17 licensing are different. It's hard for me to wrap my mind around, I think,  
18 you know, what people are asking the regulator to do is engage  
19 intermittently and say, looks good so far, looks good so far.

20 And, at the end of the day, they want all of that to roll  
21 up into this decision about the common defense and security and public  
22 health as safety.

23 So, somehow we have to find a way to bring that  
24 together. I realize that without greater confidence in the licensing

1 process as it moves forward in some sort of phased or staged way over  
2 time, that innovators simply are not going to want to take that risk here  
3 in the U.S.

4 But, it is, I think, there are some paradigm shifts and  
5 new ways of thinking that we will have to have. I'll explore this with the  
6 NRC staff and I know that they are already thinking about it.

7 Accident tolerant fuels, I think, is very tantalizingly  
8 within our grasp. That's the kind of innovation that I think, in terms of  
9 mission space, both NRC and DOE could share -- have a mutual goal  
10 there since it's accident tolerant or resistant fuels.

11 And, I hope that NRC is engaging with DOE with the  
12 requisite, I think, urgency over that. Or, I know the Congressional  
13 direction came to DOE, but I think also it's an expression of Congress's  
14 desire that these types of innovations maybe not take until 2022, which  
15 I think is your aggressive time frame for having deployment of that.

16 So, I, again, I assess that it's good to have this  
17 engagement with DOE today. We obviously have a lot of things that  
18 we're working on mutually. And, I think, from all I hear, both from  
19 meeting with the NRC staff and hearing from you today, it's a very  
20 cooperative movement forward on all of these topics.

21 I would say on subsequent license renewal, just to  
22 close, that the one thing that appears clear, given that we are all made  
23 humble about projecting the energy future, given how much it changed  
24 in my nine years serving on this Commission, it appears that for some

1 fraction or percentage of the fleet of currently operating reactors  
2 subsequent license renewal and the successful execution of that by  
3 NRC and the industry is really important to the energy planning of this  
4 country because these are these are huge projects that, if we were not  
5 to be successful on that and suddenly have a need to replace  
6 substantial capacity, that is not something that the integrated resource  
7 planning of states, regions and the industry can support in short time  
8 frame.

9 So, that will have to be something that we have a good  
10 sense of our confidence on being able to carry forward with subsequent  
11 license renewal reviews without technical challenges or surprise.

12 We almost need to know that yesterday because the  
13 kind of planning that needs to be done for energy infrastructures is  
14 decadal and not something that and not something that we can do on a  
15 short period of time.

16 So, I think I just appreciate the opportunity to hear the  
17 presentations and I'll close with that.

18 Thank you.

19 CHAIRMAN BURNS: Okay, thank you,  
20 Commissioner.

21 Commissioner Ostendorff?

22 COMMISSIONER OSTENDORFF: Thank you,  
23 Chairman. Thank you all for being here today.

24 The partnership between the part of Energy and

1 Nuclear Regulatory Commission is very important. I've noted that, in  
2 my time on the Commission with various leaders in NRO and our side  
3 of the house with Mike Johnson, Glenn Tracy and now Jennifer Uhle,  
4 that they've all reported on their close working relationship with you and  
5 your predecessors and in many respects, and it's been a very good  
6 news story as far as governancing and government.

7 I have to, I can't let this moment go by without  
8 commenting on Commissioner Svinicki's remark about her time and  
9 seeing some of the same faces here, I note in the audience John Kotek,  
10 you're a strong very personal friend of mine. Craig Welling, who, in  
11 January of 1977 when I was as an ensign reporting at the prototype,  
12 Craig was my lead engineer on the watch of SG3 up in Ballston Spa,  
13 New York. And, I give Craig full credit for getting my Navy nuclear  
14 career off to a good start. So, Craig, thank you for your leadership and  
15 mentor of this young ensign many, many years ago.

16 MR. WELLING: Thank you for your kind remarks.

17 COMMISSIONER OSTENDORFF: I've got a few  
18 questions and maybe I'll start out, because I'm not sure where to start,  
19 but I'm going to start with John Kelly, so we'll go there.

20 When we were looking at your slide three, and the  
21 graph that says Nuclear Power Capacity Needed to Meet Clean Power  
22 Goals, I think that was your slide.

23 DR. KELLY: Yes.

24 COMMISSIONER OSTENDORFF: So, I realize there

1 are things that are under our control as a safety regulator and a lot of  
2 things are not under our control. I realize with your responsibilities in  
3 the Office of Nuclear Energy, you have things under your control and  
4 things not under control.

5 And, there's broader U.S. Government, White House,  
6 Environmental Protection Agency, Congressional actions and policies  
7 FERC, I guess Commissioner Svinicki mentioned, regional power of  
8 authorities and so forth.

9 I guess I'm struck by the little small piece there that  
10 says double U.S. nuclear capacity required to meet clean power goals.  
11 And, you have the line there for Generation IV reactors.

12 Is that an assessment by your office that the only way  
13 to make clean power goals under certain economic assumptions is to  
14 build more nuclear?

15 DR. KELLY: Well, let's see --

16 COMMISSIONER OSTENDORFF: I want to better  
17 understand the foundation for that.

18 DR. KELLY: Yes, so, there are several ways to look  
19 at this.

20 In order to basically decarbonize electricity production,  
21 we have to take all the fossil fuel driven electricity out of the market.  
22 That's about 50 percent of our current generation.

23 So, we looked at what would that mean in terms of, you  
24 know, you get to the specifics, but it means about a tenfold increase in

1 renewables. So, what it is today, ten times.

2 Completely taking all the carbon -- all the natural gas  
3 generation and putting that on sequestration.

4 And then, the gap is this is nuclear, which basically  
5 leads you to a doubling, doubling of nuclear.

6 Now, if you look at that curve, you'll see it's about 4  
7 gigawatts per year that we would add, which has historically been  
8 something that we've accomplished in the past. So, this is not out of  
9 our realm of engineering.

10 We have a group at DOE called EPSA that is doing  
11 systems analysis. They also are projecting -- they're predicting a  
12 range, but it's somewhere between 180 and 250 gigawatts of nuclear  
13 being needed to meet the clean power goals in the 2050 time frame and  
14 beyond.

15 So, there is -- it's -- you can sort of do a thumb or you  
16 can do more detailed analysis.

17 The OECD has done a study that showed that  
18 worldwide, the amount of nuclear needs to double in this time frame.

19 So, there's lots of evidence that shows that this is about  
20 the right order of magnitude.

21 I think from our perspective that the question is, what  
22 is that mix? And, what's the baseload mix going to be in the 2050 time  
23 frame?

24 Certainly Light Water Reactors, which we've invested

1 in heavily in the NP-2010 program, will be a significant contributor, as  
2 will the SMRs that we're developing now.

3 The question is, is there a Generation IV technology  
4 that's even better? And, that's what our quest is now is investing in the  
5 potential for even better technology that will be available in 2030 and  
6 beyond.

7 MR. KOTEK: Yes, and, you know, from an  
8 administration standpoint, of course, you know, we're not in the  
9 business setting targets for particular types of generation. But, you  
10 know, building on what the Secretary has said about the need to  
11 essentially decarbonize the electric sector, you know, as he looks at this  
12 and as he said publically many times.

13 It's hard to see how you get there without a significant  
14 contribution from nuclear. Right? And so, that's what we're -- what  
15 our program is all about is and is, you know, is developing multiple  
16 potential pathways so that you could achieve the types of growth that  
17 we've, you know, that we've laid out here and in what's admittedly not  
18 a, you know, it's not a goal or anything, it's just a picture of what might  
19 the future look like if you're going to get to a decarbonized electric  
20 sector?

21 And, to John's point, you know, some of the  
22 technologies we're looking at, get nuclear beyond just electricity. And,  
23 I know it's been used for district heat or desalination in some  
24 applications.

1                   But, broadly speaking, you know, if you could get  
2 nuclear to be a supplier of industrial process heat or desalination  
3 services or hydrogen production or, you know, I mean any number of  
4 other things, now, you know, now you now you can obviously start  
5 penetrating other energy products and services which seem to be  
6 where at least some of today's utility companies are going.

7                   I mean, when we engage with some of the large utility  
8 companies, they are thinking 20 years down the road, do we still want  
9 to be an electric utility or do we want to be a provider of energy projects  
10 and services?

11                  More broadly speaking, we're trying to provide nuclear  
12 options that get them there.

13                  COMMISSIONER OSTENDORFF: Okay. I'm going  
14 to stay with John, if I can, for the next question.

15                  And, I know that a lot of us have seen each other at the  
16 Department of Energy, NRC, Advanced Non-Light Water Reactor  
17 Workshops, various industry laboratory type conferences and you're  
18 aware of what we've done with respect to the FY '17 budget request to  
19 the Congress on requesting \$5 million off of our fee base to help us  
20 prepare on the regulatory development side of the house for non-LWR  
21 technologies.

22                  Recognizing the constraints that we have within some  
23 resource issues, are the things that you think we ought to be doing that  
24 we're not currently doing or planning to do?

1 MR. KOTEK: Well, I'll start and I'm going to ask John  
2 to get into this in more detail because he's been closer to it.

3 First of all, I can tell you that just the mere fact that you  
4 asked for the \$5 million that was a really important signal to folks on the  
5 outside and the innovator community that you all are taking this  
6 seriously. Right?

7 And, you guys started -- when I got here, it was Glenn  
8 and Glenn was working with us very closely on things like the workshop  
9 and then, of course, Jennifer's picked up and now you've got the vision  
10 strategy document. I forget exactly what you've called it, but looking at  
11 Advanced Reactor licensing.

12 From what I've seen, at least, you all are sending very  
13 important signals to the innovator community that you do take this  
14 seriously, you want to find ways to help them, you know, to help develop  
15 a process that better suits kind of what they see as their development  
16 trajectory.

17 When I talk to them, I liken it to the experience I had --  
18 I actually worked with some mining companies back in a past life when  
19 I got out of nuclear and I came back and I see the same people.

20 But, you know, they will go through a process of, you  
21 know, identifying a potential resource, proving up that resource, going  
22 through getting -- a lot of these are on federal land, so they've go to get  
23 approval to do an exploratory drilling program, maybe do a larger drilling  
24 program.

1                   Then they put out a mine plan and then they get, you  
2 know, the federal -- the agencies review that through, usually an EIS  
3 or EIEE process.

4                   So, there's a whole bunch of stages along the way to  
5 getting to an actual functioning mine.

6                   And, every time they get through one of those gates,  
7 they go back to the investor community and they say, see, we're further  
8 along and they get the next tranche of funding.

9                   And, I think -- so I think they're looking for something  
10 like that and I think they see that you all are trying to work with them to  
11 find ways of kind of fitting with, again, what they see as their  
12 development time line.

13                   On the specifics, John, anything you want to add in  
14 terms of kind of what we're doing, need to be doing question?

15                   DR. KELLY: Well, just reflecting on the last couple of  
16 years, I think we've made -- together have made tremendous progress.  
17 Things are slow, I mean, they tend to be slow. But, we're heading in  
18 the right direction.

19                   So, we've got our strategy and visions aligned. We're  
20 working the key issues, you know, the fact that we need to involve the  
21 public in this leads to some time delays, but I think in general, we're all  
22 rolling on the same -- in the same direction right now.

23                   COMMISSIONER OSTENDORFF: Okay.

24                   DR. KELLY: And, I just would encourage the

1 Commissioners to continue to push on that because this is one of the  
2 key areas that will -- needs to be -- come to a conclusion in order for  
3 the investment of the private sector to come to fruition.

4 COMMISSIONER OSTENDORFF: Okay. Thank  
5 you.

6 I've got just to make two very quick remarks, my time  
7 is almost up.

8 Ray, I want to just echo your comments. I think the  
9 Advanced Test Reactors is a national asset. And, I had a chance to  
10 visit when I was an official at NSA eight years ago. I'm a big believer  
11 and it's a great program.

12 So, I just want to thank you for your stewardship out  
13 there and for the Idaho National Laboratory stewardship of that  
14 resource.

15 And, John, on the fuel piece, I will just throw my voice  
16 in with others. I think it's really important what you're doing there.

17 Even if it results in not necessarily deploying  
18 widespread new fuels, the learnings that will occur through the process,  
19 that, by itself, will be extremely valuable. So, thank you for your work  
20 in that area.

21 MR. KOTEK: Thank you.

22 COMMISSIONER OSTENDORFF: Thank you all for  
23 being here.

24 Thank you, Chairman.

1 CHAIRMAN BURNS: Thank you, Commissioner.

2 Commissioner Baran?

3 COMMISSIONER BARAN: Thanks.

4 Well, I want to add my thanks to all of you for being  
5 here. It's very helpful to hear directly from you about what DOE is  
6 working on and where you think the technologies are heading.

7 I want to follow up on some of the Advanced Reactor  
8 questions for a minute. We'll hear on the next panel that NRC is  
9 looking at updating our regulatory frame work to be able to more  
10 efficiently license Advanced Reactors.

11 And, part of that is thinking through the time frames  
12 involved and when we need to have an updated regulatory frame work  
13 ready to go.

14 So, I'll just ask you to predict the future a little bit. I  
15 mean, what is your sense, what's your assessment of what are the  
16 technologies, the one or two technologies we're likely to see come in  
17 for a design certification first and when do you think that'll be?

18 MR. KOTEK: Well, I'd certainly hesitate to try to put  
19 too fine a point on that. There are, of course, a couple of technologies  
20 that are pretty far down, call the TRL line.

21 And as John Kelly mentioned, we talked about the test  
22 and demo reactor study. You know, that concluded that gas cooled  
23 reactors and sodium cooled reactors were the ones that had the, you  
24 know, the --or the furthest state of development.

1                   You know, there are folks, of course, you know,  
2                   TerraPower is one we talk about that are looking at a sodium cooled  
3                   reactor technology that, you know, they have invested, what, from what  
4                   we've seen in public reports, a few hundred million dollars in that. So,  
5                   that would seem to be pretty well down the pathway of, you know,  
6                   having a design in place.

7                   And then, there was a lot of work that was done by the  
8                   NGNP on gas reactor technology that, you know, that a couple of these  
9                   companies are looking at.

10                  John, I don't know if you have -- if you've heard  
11                  anything publically from any of these companies about when the  
12                  Commission might see something in the way of an application. I've not  
13                  seen anything specifically from anyone on that.

14                  DR. KELLY: Yes, but I agree with John, that the  
15                  sodium cooled reactor technology and the high temperature gas are at  
16                  the highest level of technical maturity. We've built them before, we've  
17                  got the experience base.

18                  What is interesting, though, is that utilities are now  
19                  getting involved. So, two years ago, no utility was saying anything  
20                  about advanced reactors. Now, we have NEI had a working group on  
21                  advanced reactors.

22                  The CEO from Southern Company is the Chair --  
23                  Chairs that group. They're trying to bring in that.

24                  So, this is moving from a completely technology push

1 to technology pull. And, I think that's going to be critical for the, you  
2 know, the next steps in this.

3 And so, we see NEI having this activity. The EPRI has  
4 a working group now on, you know, getting utility investment into  
5 advanced reactors.

6 So, things are coming together. When is still a good  
7 question, but I think if we open up our doors like we've been trying to  
8 do, I think this will really accelerate the innovation and push forward.

9 COMMISSIONER BARAN: Just for our planning  
10 purposes and maybe it's just too hard to say at this point, I mean, do  
11 you think, for example, we're likely to see a design cert application in  
12 the next five years or is it going to be longer than that?

13 MR. KOTEK: I don't have a great answer for you  
14 because I haven't asked that specific question of the developers and to  
15 get a sense of their time lines. Why don't you let us do a little  
16 canvassing and get back to you with a -- if we learn something, we'll get  
17 a letter over or something like that.

18 COMMISSIONER BARAN: That'd be helpful, thank  
19 you.

20 MR. KOTEK: Yes, okay.

21 COMMISSIONER BARAN: Let me ask about the  
22 work you're doing on the subsequent license renewal issues, the aging  
23 issues and the outstanding technical issues there.

24 Can you walk us through, briefly, just the time line for

1 when you think that work will be completed and those outstanding  
2 technical questions resolved and what are you finding so far? Are  
3 there issues that you're concerned about or that you see as potential  
4 show stoppers for operating plants beyond 60 years?

5 DR. KELLY: So, I think, you know, our coordination  
6 with the NRC to try and identify the aging management issues has been  
7 very important.

8 This allows us then to maximize the data collection and  
9 have that data available.

10 You know, we're looking at applications in the 2018  
11 time frame. And, we suspect that, based on the previous license  
12 extension process, this may be a, you know, a five to ten year kind of  
13 process.

14 So, we see that the data will be collected, will then be  
15 processed through the SLR. And, I guess we're not seeing any major  
16 hiccups. I think we're -- we think we have the -- not only the data, but  
17 the material science, background, that we're not expecting any  
18 surprises, but it's really a question of follow through and delivery.

19 COMMISSIONER BARAN: Okay. And, John Kotek,  
20 you briefly mentioned -- you kind of referred to high-level waste and it's  
21 not something we really talked about today, so I just wanted to ask you  
22 about that a little bit.

23 Can you give us an update on the status of DOE's plan  
24 to move forward with a defense only high-level waste repository or

1 disposal facility?

2 MR. KOTEK: Yes, so we're in very early stages right  
3 now of developing the design of the consent based siting process. So,  
4 we're out getting the input from states, Tribes, local governments, other  
5 interested parties on what they think a process ought to look like. What  
6 factors should be considered in the design of a process.

7 We've made it clear that what we're ultimately looking  
8 for is to develop an integrated waste management system that includes  
9 both storage and disposal facilities. And, disposal facilities that could  
10 include a separate repository for defense waste.

11 The President, of course, issued a finding last year that  
12 allows us to move forward with that consideration of a separate  
13 repository. It doesn't require it, but allows us to look at it.

14 We have not yet gotten to the stage where we're out  
15 looking for sites or even, you know, engaging in conversations with  
16 states and communities or potentially Tribes that might be interested.

17 We see that as something that comes after we have  
18 both issued a design of a process and then after we've also start --  
19 begin providing resources, particularly in the form of grants to, again,  
20 states, Tribes, local governments, potentially others so that they can  
21 study whether they might be interested in serving as ultimately a willing  
22 and informed host of such a facility.

23 So, we're still several years away from actually getting  
24 to the point of, you know, looking at specific sites. But, you know, we

1 will go through a process of explaining, you know, laying out the  
2 process, establishing guidelines, considerations for siting. Then,  
3 engaging in conversations and then starting to identify specific sites.  
4 So, it'll take us a few years to get there.

5 COMMISSIONER BARAN: Okay. So, it's -- this is  
6 something that, it's a little ways down the road --

7 MR. KOTEK: Yes.

8 COMMISSIONER BARAN: -- before we would be  
9 expecting --

10 MR. KOTEK: Certainly on defense repository side.  
11 Yes, obviously, we've seen interest from commercial entities and from  
12 states --

13 COMMISSIONER BARAN: Right.

14 MR. KOTEK: -- and communities interested in the  
15 consolidated storage piece. So that could certainly move faster, we  
16 think.

17 COMMISSIONER BARAN: Okay. And, then, one  
18 other question I had was on the test and demo -- going back to test  
19 reactors for a second, on the potential test and demonstration reactor  
20 for a less mature advanced reactor technology, is this something that  
21 you would anticipate NRC licensing or no? Do you have a sense at  
22 this point?

23 MR. KOTEK: Yes, and of course, the test versus  
24 demo question, you know, if you're talking about the demonstration of

1 what will ultimately be a commercial design, then, of course, well, one,  
2 you have a commercial partner, they're going to have a say in that.

3 But, you know, you would think that -- I mean, certainly,  
4 there's going to need to be some sort of a regulatory review at the point  
5 that -- so they can get it into the marketplace.

6 For, you know, DOE test reactors, of course, we  
7 haven't built on in a long time. I think the FFTF was probably the last  
8 test reactor that we built. Is that -- I'm looking at Ray. Yes, okay.

9 At the time, I think we had the -- it wasn't an NRC  
10 licensed facility, but there was NRC review done of the design and  
11 those, you know, the results of that review were factored into the, you  
12 know, the ultimate plans for the facility.

13 So, you know, we're far away from having made a  
14 decision as to what the relationship would be there, but there's certainly  
15 a history in DOE of involving the NRC even though we've, you know,  
16 we do regulate our own test reactor operations.

17 COMMISSIONER BARAN: Okay.

18 Thank you very much.

19 CHAIRMAN BURNS: Commissioner Svinicki?

20 COMMISSIONER SVINICKI: I would be remiss,  
21 having remarked upon Commissioner Ostendorff's tie if I didn't mention  
22 the fact that Dr. Kelly is representing in fine form that, on his wristwatch,  
23 that proud mammal, the Michigan Wolverine.

24 Thank you.

1 DR. KELLY: Thank you.

2 CHAIRMAN BURNS: Thank you.

3 I think it's time for a break.

4 No, thank you all for the presentations. We'll take  
5 about a five or six minute break and then hear from the NRC staff.

6 (Whereupon, the above-entitled matter went off the  
7 record at 10:30 a.m. and resumed at 10:40 a.m.)

8 CHAIRMAN BURNS: Well, I'll start the second half of  
9 our meeting with the NRC staff. And Vic, I'll let you lead off and we will  
10 go to our other speakers and presenters.

11 MR. MCCREE: Thank you, Mr. Chairman. Good  
12 morning. It is good to see you.

13 As the earlier panel also emphasized, I would to  
14 highlight the value of the continued strong relationship that NRC enjoys  
15 with our DOE colleagues. The DOE and NRC collaboration has deep  
16 historical roots, as you heard this morning and it remains strong today,  
17 through such activities as joint workshops like the workshop we  
18 conducted two weeks ago, working group participation and some  
19 annual senior management meetings to name a few. The DOE's  
20 contribution will have a critical role in future NRC activities as well.

21 As we look at the agenda for this morning on slide 2,  
22 the presentation that you are about to hear from us will provide some  
23 specific examples of NRC activities, which have benefited from the  
24 ongoing collaboration with the DOE, including the deployment of

1 advanced reactor technologies, accident tolerant fuel, and the grants  
2 program, to name a few.

3 Dr. Jennifer Uhle, of the Director of the Office of New  
4 Reactors will discuss developments associated with non-light water  
5 reactor designs. This is a key focus area for us and I am pleased to  
6 report that we have made significant progress.

7 Most recently, the NRC published a draft of our  
8 advanced reactor design criteria and our vision and strategy documents  
9 for advanced reactors. These documents were discussed at the June  
10 DOE/NRC workshop two weeks ago in advanced reactors and our  
11 major milestones in our ongoing efforts to be ready to license these  
12 designs.

13 Jennifer will also present to you the NRC  
14 accomplishments in preparing for the review of small modular reactor  
15 applications.

16 Bill Dean, to my far left, the Director Office of Nuclear  
17 Reactor Regulation, will provide an overview of our preparation for  
18 subsequent license renewal, that is licensing plants beyond sixty years.

19 Also in this area, we recently published draft guidance  
20 for comment and look forward to continued engagement with the DOE  
21 and other stakeholders as we move forward.

22 Of particular note, the Peach Bottom plant recently  
23 sent us its formal letter of intent to provide its application for subsequent  
24 license renewal in 2018, the first application of this sort that NRC

1 expects to receive.

2 Bill will also speak to ongoing activities in the area of  
3 accident tolerant fuel.

4 Additionally, Mike Weber, Director Office of Nuclear  
5 Regulatory Research will speak to our collaboration with the DOE to  
6 resolve various challenging technical issues, such as our efforts to  
7 enhance our severe accident codes, using lessons learned from the  
8 Fukushima-Daiichi accident.

9 Finally, we will conclude our presentation with an  
10 update on NRC's Integrated University Program, a vital important  
11 initiative to support the development of students entering the nuclear  
12 workforce and foster the talent of future generations to design,  
13 construct, operate, and regulate nuclear facilities.

14 So, now I will turn the presentation over to Jennifer  
15 Uhle to discuss non-light water reactors and small modular reactors.  
16 Jennifer.

17 MS. UHLE: Thanks, Vic. Good morning Chairman,  
18 Commissioners. I will be describing for you the activities we have  
19 underway, as well as our future plans to prepare us to review non-LWR  
20 designs and I will also be covering our readiness to review small  
21 modular reactors.

22 Slide 4, please. So, let me start by describing our  
23 activities covering the review of non-LWR applications. First, our  
24 regulatory framework could support the review of non-LWRs today;

1           however, we are making a lot of progress on enhancing our framework  
2           to support the efficient and effective review of these designs. There is  
3           tremendous interest in advanced reactor technology, as demonstrated  
4           by the 30 or so different designs that are being discussed within the  
5           industry.

6                           We are developing a comprehensive plan to ensure we  
7           will be ready to conduct efficient and effective reviews of these designs  
8           when they are submitted. We recently made a draft version of our  
9           vision and strategy document available to the public. It summarizes  
10          our plan for achieving what we call mission readiness.

11                          This chart illustrates the construct of our approach. In  
12          the first phase of our work, we started with the NRC's mission and vision  
13          and then developed strategic goals for non-LWRs. Specifically, the  
14          goals are to assure NRC readiness for an efficient and effective review  
15          of non-LWRs. We have verified that our vision and strategy is aligned  
16          with that of DOE.

17                          We then developed strategic objectives and strategies  
18          to achieve the goal. In the second phase of our work, we will work with  
19          our partner offices within NRC to develop specific implementation  
20          action plans that will support task execution, the action plans, our  
21          description of the actual work that must be completed in order to  
22          achieve our goal.

23                          I should note that we have very active engagement  
24          with DOE on the non-LWR activities and I will touch on this more during

1 my presentation. We feel the work with the DOE, the open sharing of  
2 information, and our cooperative activities have contributed appreciably  
3 to our progress in this area.

4 So, next slide, please. As I noted, NRC and DOE do  
5 have complementary goals. DOE is supporting the deployment of two  
6 different non-LWR designs by 2030. So, this means that the NRC  
7 must be ready to review these designs efficiently by about 2025.

8 So, what do we mean by being ready? Ready means  
9 that the elements needed to conduct our reviews are in place and ready  
10 to go. So, we must ensure that the designs are safe but we also must  
11 ensure that we are not imposing any unnecessary regulatory burden.

12 So, slide 6, please. So, we will achieve our readiness  
13 goal by using a three-pronged approach. First, as you can see in the  
14 slide, enhancing technical readiness, optimizing regulatory readiness,  
15 and optimizing communication.

16 Technical readiness means that the NRC has the  
17 specific technical knowledge, skills, and tools in place to efficiently and  
18 effectively review a non-LWR application.

19 Regulatory readiness means that the NRC has  
20 appropriate guidance available to both the applicant, as well as to our  
21 reviewers internal to NRC. It also can mean that in the longer term we  
22 have completed rulemaking that we may find useful to support a number  
23 of reviews of these non-LWR designs.

24 So, optimizing communication means that when we are

1 communicating to the public and our external stakeholders we are  
2 disseminating clear expectations and requirements for the review of  
3 non-LWRs, using multiple channels of communication that are  
4 appropriate for the different stakeholders. We have binned the work  
5 into three different timeframes. Some activities under each of the  
6 prongs need to be completed in the near-term, which is zero to five  
7 years; mid-term, which five to ten years; and then some activities may  
8 take longer such that they are beyond the ten-year horizon.

9 It is important that we continue to engage with our  
10 external stakeholders so that we know the work we are doing is the right  
11 work at the right time. Continued interaction with DOE, the industry,  
12 and the public will help ensure this alignment.

13 Next slide, please. As I stated earlier, the second  
14 phase of our work is developing specific implementation action plans  
15 for each of the strategies. The action plans will address the detailed  
16 tasks, the estimated costs of performing these tasks, and the duration  
17 of the task. It also identify what groups inside NRC will be performing  
18 the work. We have a number of partner offices, including our partners  
19 in the Office of Nuclear Regulatory Research, Nuclear Reactor  
20 Regulation, Nuclear Material Safety, and Safeguards as well as Nuclear  
21 Security and Incident Response. They will all be key players in  
22 developing and executing the action plans.

23 The plans for the near-term will be completed in  
24 September and the mid-term and longer term plans will be completed

1 more like February of 2017.

2 So, I would like to provide an example of an activity that  
3 we are planning to support the objective of regulatory readiness.  
4 Operating nuclear plants now, are operated temperatures are well  
5 below 700 degrees Fahrenheit. In contrast, most advanced reactor  
6 designs operate at temperatures well above this point.

7 This introduces significant additional material property  
8 considerations that must be addressed in order for the plants to operate  
9 safely. So, the NRC and DOE have been working the American  
10 Society of Mechanical Engineers, Boiler and Pressure Vessel Code  
11 Committees to support the development of code rules, as well as  
12 qualification of appropriate materials for high temperature applications.  
13 DOE supports the development of the technical information that  
14 underpins the ASME Code rules; whereas, the NRC is preparing to  
15 review the ASME Code requirements with the objective of endorsing  
16 them as acceptable rules for advanced reactor design and construction,  
17 if appropriate.

18 Slide 8, please. So, I would like to emphasize the very  
19 successful collaboration we continue to have with DOE Office of  
20 Nuclear Energy. You heard about some of our activities on the  
21 previous panel.

22 During the development of our vision and strategy  
23 document, we took the opportunity to compare our goals to those put  
24 forward by DOE and we found that they are complementary. Beyond

1 just comparing the goals, we shared with DOE and DOE shared with us  
2 the actual vision and strategy documents and we commented on each  
3 other's documents.

4 While our roles of regulator and promoter are clearly  
5 distinct, we should not work in isolation, certainly, and we should, in  
6 fact, collaborate in technical activities to defray costs and also so as not  
7 to duplicate effort. We will ensure NRC's independence is maintained.

8 We have collaborated on a number of activities,  
9 including the development of non-LWR design criteria and we have  
10 exchanged ideas and pertinent information that has helped NRC  
11 resolve key policy issues.

12 One recent example of successful collaboration  
13 between NRC and DOE has been the co-sponsored advanced reactor  
14 workshops. These workshops are intended to allow key stakeholders  
15 to share perspectives, reach a common understanding on issues,  
16 identify potential challenges, and explore opportunities to resolve them.

17 We held the first workshop in the fall of 2015 and the  
18 second workshop just a few weeks ago and both workshops received a  
19 great deal of feedback on the desire to have an agile regulatory process  
20 for non-LWR reviews. We provided an overview of our proposals to  
21 support step-wise licensing review and also for reviewing a preliminary  
22 design in terms of a conceptual design assessment process. They  
23 were both very well received.

24 We are in the early planning stages for the next

1 workshop and expect to provide more details on these regulatory  
2 proposals at that point.

3 The workshops have been attended by well over 300  
4 attendees. In each case, they represent a broad spectrum of  
5 stakeholders. These workshops, I think, are a great example of an  
6 effective public outreach sponsored by both NRC and DOE.

7 Slide 9. So, we believe that planning for readiness is  
8 critical to our long-term success in reviewing advanced reactor  
9 applications. However, we have asked ourselves whether or not we  
10 would be able to review a design for a non-light water reactor if it were  
11 submitted today. The answer is that yes, we could perform that review,  
12 however, it would not be anywhere near as efficient as it would be ten  
13 years from now.

14 If we go back many years, NRC's predecessor agency,  
15 the Atomic Energy Commission licensed three commercial non-LWRs  
16 that were constructed and operated. First was Fermi 1, a  
17 sodium-cooled fast reactor which operated until 1972. The second  
18 was Peach Bottom, a high temperature gas-cooled reactor which  
19 operated until 1974. And the third was Fort Saint Vrain, which was  
20 another high temperature gas-cooled reactor of much larger size than  
21 Peach Bottom Unit 1 and that was operated until 1989.

22 In the mid-1980s and into 1990, the NRC staff also  
23 completed pre-application safety evaluation reports for a sodium-cooled  
24 fast reactor, as well as a modular high temperature gas reactor.

1                   So, from these experiences, it is clear that the current  
2 regulatory framework can support licensing of these designs today.  
3 However, we have work to do to achieve our goal of assuring NRC  
4 readiness to efficiently and effectively review these designs. We have  
5 set the pace of our activities to be commensurate with the industry  
6 maturity, as well as their deployment goals. And at this point, DOE's  
7 deployment goal of 2030 and NRC's review readiness goal of 2025 are  
8 aligned.

9                   Slide 10, please. So, I would like to switch topics now  
10 to talk about our preparations related to small modular reactors. This  
11 chart shows the current list of utilities and vendors that have  
12 approached NRC with specific plans to move small modular reactor  
13 projects forward to a review stage.

14                   So, I will start with the vendor NuScale. NuScale  
15 began pre-application discussion with the staff around 2008 and they  
16 expect to submit an application for design certification for a small  
17 modular reactor, which is an integral light water reactor, by the end of  
18 this calendar year. So, I would just say, Commissioner Svinicki, it is  
19 the end of this calendar year, 2016.

20                   So, on May 12, 2016, the NRC received an application  
21 for an early site permit for a small modular reactor site at the Clinch  
22 River site in Tennessee. TVA expects to follow-up with a combined  
23 licensed referencing a small modular reactor on the site in the mid-2018  
24 time frame.

1                   Utah Associated Municipal Power Supply, or as we like  
2 to call it, UAMPS because it is a lot faster that way, UAMPS expects to  
3 submit a combined license referencing the NuScale design at a site  
4 within DOE's Idaho National Laboratory in early 2018.

5                   So, clearly, the SMR industry has moved from a  
6 concept to a licensing reality. The NRC is in a strong position to  
7 conduct those reviews efficiently, while meeting our mission of safety  
8 security and environmental responsibility.

9                   In the next few slides, I will be discussing work that has  
10 been done to facilitate these reviews, beginning with some policy  
11 issues.

12                   So, if we go to Slide 11, please. In 2010, the staff  
13 submitted SECY-10-0034 to the Commission, which identified key  
14 technical and policy issues, whose resolution was seen as critical for  
15 the review of SMR technology. Resolution of these issues is also  
16 critical to NRC's ability to conduct efficient and effective reviews.

17                   We have discussed these issues a number of times in  
18 a number of public presentations, as well as previous commission  
19 papers and meetings. This slide lists those issues for which the staff  
20 has received direction from the commission or that are covered by our  
21 existing regulations or guidance. An example is control room staffing  
22 for small or multi-modular facilities. The current requirements for  
23 operator staffing prescribed a number of operators required per unit and  
24 per control room.

1                   The regulation doesn't address the situation where  
2 three or more units are controlled from a single control room. So, in  
3 SECY-11-0098, the staff indicated that it would address this issue  
4 through the use of exemptions. In fact, the existing version of the  
5 standard review plan contains adequate guidance for performing the  
6 exemption request evaluations. The staff is using this guidance in its  
7 pre-application discussions with NuScale.

8                   As experience is gained in performing the operator  
9 staffing exemption requests, we will evaluate whether additional  
10 guidance is needed.

11                   So, slide 12, please. So, this chart shows the status  
12 of the remaining issues from the 2010 SECY paper. Two issues of  
13 particular interest to the SMR applicants include emergency  
14 preparedness and fees.

15                   In SECY-15-0077, the staff proposed an approach to  
16 changing the emergency preparedness requirements such that license  
17 applicants for SMRs and other technologies could demonstrate the  
18 acceptability of a smaller emergency planning zone. The Commission  
19 directed the staff to engage in a rulemaking and a rulemaking plan was  
20 recently provided to the Commission for your consideration.

21                   Finally, the NRC staff reviewed and endorsed an NEI  
22 proposal on how the Part 170 fees could be revised for small modular  
23 reactors. After detailed evaluation by the staff, a revision to Part 170  
24 was proposed to the Commission, which led to rulemaking to codify that

1 change. And in fact, the final rule was published on May 24, 2016  
2 closing this issue.

3 So, we are continuing our efforts to resolve the  
4 remaining issues over the next few years. Slide 13, please.

5 As I have noted previously, we have initiatives  
6 underway to improve the efficiency of our reviews for non-LWRs and  
7 small modular reactors. For the anticipated NuScale review, we are  
8 implementing what we call a safety-focused review. It began with the  
9 development of design-specific review standards for NuScale, where  
10 the staff went through the standard review plan and identified those  
11 sections that apply to NuScale. We are now using risk insights of the  
12 design that we have garnered through pre-application activities to  
13 determine what review areas could be stressed and those that could be  
14 reduced.

15 We are doing this so that our review will focus our  
16 attention on the most significant technical areas of the design. I will  
17 describe this further on the next slide.

18 We are also emphasizing the quality of staff  
19 information requests and each request for additional information is  
20 receiving senior management review.

21 Our goal here is to assure that the request for  
22 additional information issued from the office are of appropriate quality  
23 and focus on the most important safety issues affecting the design.

24 We are also investigating whether we can develop

1 what we call requests for additional information templates that can more  
2 quickly be filled out by the staff, improving the efficiency, as well as the  
3 clarity of the information request.

4 And then, finally, we are stressing staff and  
5 management familiarity with the NuScale design. In order for us to  
6 perform a very safety-focused review of this unique design, everyone  
7 involved in the review really must understand the overall safety  
8 principles of the design so that each system, structure, and component  
9 can be put in its appropriate safety perspective. So, NuScale has  
10 conducted detailed familiarization briefings and these sessions were  
11 attended by all the reviewers and their management and were very well  
12 received.

13 Slide 14. So, this slide depicts the key elements of the  
14 safety focused review process. We have a list of all the system  
15 structures and components in the design. There are far fewer than a  
16 large light water reactor, thankfully, and we are listing its risk  
17 significance, whether or not it is safety related in its role in  
18 defense-in-depth. And then we are determining the level of review it  
19 should receive.

20 For instance, if a component or system is of a novel  
21 design, it is not safety-related but it is risk significant and plays a key  
22 role in defense-in-depth, then, we will focus more attention on it, than  
23 on another component that is not.

24 So, slide 15. So, to summarize, I piloted our focus on

1 readiness to conduct reviews for both small modular reactors as well as  
2 non-light water reactors.

3 With regard to non-light water reactors, we have  
4 prepared a vision and strategy document and will implement the  
5 forthcoming action plans so that we are technically and regulatorily  
6 ready to conduct efficient and effective reviews.

7 In the case of small modular reactors, we are  
8 committed to performing a safety focused review of the NuScale design  
9 and are in the midst of determining what areas of the design warrant  
10 the most attention.

11 So, in closing, the NRC and DOE have effectively  
12 collaborated in a number of areas and we continue to do so. Both  
13 organizations have been careful to respect our individual roles and  
14 responsibilities. This collaboration and open communication has  
15 greatly contributed to our progress in these areas.

16 So, this concludes my remarks and I would like to turn  
17 the presentation over to Bill Dean.

18 MR. DEAN: Okay, thank you, Jennifer. Next slide,  
19 please.

20 Good morning, Chairman, Commissioners. I am  
21 pleased to be with you here this morning to provide you with an  
22 overview of NRC's activities related to subsequent license renewal or  
23 SLR. As Vic noted, I will also spend a minute or two talking to you  
24 about our preparations for being able to license accident tolerant fuel.

1 Next slide, please.

2 This slide illustrates how our aging management  
3 programs or AMPs supplement the regulatory process for assuring  
4 safety during the license renewal period. Through the regulations in  
5 10 CFR Part 54, the NRC established two fundamental safety  
6 principles.

7 First, with the exception of the potential detrimental  
8 effects of aging, the existing regulatory process is adequate for assuring  
9 safe plant operations. Secondly, the licensing basis at the time of  
10 license renewal is not the same as the licensing basis at the time of  
11 initial licensing. It has evolved over time through license amendments  
12 to address operating experience and changes in regulatory  
13 requirements. Each plant's current licensing basis must be maintained  
14 through the license renewal period.

15 The NRC's major focus in approving a license renewal  
16 application is reviewing the aging management programs proposed by  
17 applicants. AMPs are intended to identify and assess age-related  
18 degradation. License renewal reviews concentrate on structures,  
19 systems, and components that are not already covered by other  
20 programs, such as the maintenance rule. Next slide, please.

21 As we know, there are currently a hundred operating  
22 reactors. As of June of this year, the NRC has issued renewed  
23 licenses for 83 units. This includes two units that ceased operations in  
24 2013 and 2014, that being Kewaunee and Vermont Yankee.

1 Initial license renewal applications for 12 units are  
2 currently under staff reviewed and licensees have submitted letters of  
3 intent to the NRC indicating they will submit applications for renewed  
4 license for four additional units.

5 The remaining three sites at the Tennessee Valley  
6 Authority has not yet expressed interest to submit license renewal  
7 applications for the two Watts Bar units. And the remaining operating  
8 that has not applied for a renewed license is Clinton, which Exelon just  
9 announced that they will shut down in 2017.

10 Next slide, please. This slide shows the number of  
11 reactors in relation to their years of operation by the end of 2016. By  
12 the end of this year, 45 units will be in the period of extended operation,  
13 which means they will have been operating for more than 40 years.  
14 Plants in this group will begin to reach the end of the first period of  
15 extended operations or 60 years of operations starting in 2029. It is  
16 anticipated that this group of plants will be the primary source of SLR  
17 applications in the near-term.

18 10 CFR Part 54 allows licensees to submit an SLR  
19 application as soon as they enter the period of extended operation. As  
20 we know, Exelon has recently indicated its intent to apply for  
21 subsequent license renewal for the units at Peach Bottom in the latter  
22 part of 2018 and Dominion has indicated its intent to submit an  
23 application for a subsequent license renewal in 2019 for the two units  
24 at Surry.

1                   Next slide, please. In response to SECY-14-0016,  
2                   which provided the Commission options for how to regulate subsequent  
3                   license renewal, the Commission stated that the license renewal rule  
4                   has provided an effective basis for ensuring safe operation during the  
5                   license renewal period and will continue to be an effective basis for  
6                   subsequent license renewal.

7                   Consistent with the license renewal rule, the focus of  
8                   SLR is on the adequacy of additional aging management activities to  
9                   ensure safe plant operations during the subsequent period of extended  
10                  operation.

11                  As part of our preparatory efforts, the staff has  
12                  developed some strategies to optimize the subsequent license renewal  
13                  application and review process. The staff is also revising applicable  
14                  inspection procedures. Next slide, please.

15                  The top four technical issues to provide assurance for  
16                  safe operation of nuclear power plants for operation from 60 to 80 years  
17                  are related to neutron embrittlement of the reactor pressure vessel,  
18                  stress corrosion cracking and other types of degradation of reactor  
19                  pressure vessel internals, concrete and containment degradation, and  
20                  electrical cable qualification, condition monitoring, and submergence of  
21                  low- and medium-voltage cables.

22                  Industry is responsible for developing the technical  
23                  basis for long-term operation. While much work has been done and  
24                  continues to progress, these issues are not likely to be resolved on a

1 generic basis, when the first applications for subsequent license  
2 renewal are submitted. Therefore, the first applicants will need to  
3 address these issues on a plant-specific basis.

4 In a few minutes, Mike Weber will discuss how the NRC  
5 is collaborating on SLR-related research activities with domestic  
6 organizations such as DOE, through their light water reactor  
7 sustainability program and the Electrical Power Research Institute, as  
8 well as international partners.

9 Next slide, please. The NRC has two major guidance  
10 documents that support license renewal activities to generic aging  
11 lessons learned or GALL Report, which provides acceptable methods  
12 for managing aging, once a plant enters the period of extended  
13 operations and the standard review plan, or SRP, which provides  
14 guidance to NRC staff on how to review license renewal applications.

15 The current GALL and SRP are focused on the effects  
16 of aging beyond 40 years. Both of these documents need to be  
17 updated to support periods of operation beyond 60 years. The NRC  
18 published a draft GALL Report and a draft standard review plan for  
19 public comment to support subsequent license renewal in December of  
20 2015.

21 It is important to note that while the GALL provides  
22 methods acceptable to the NRC on managing aging effects, a licensee  
23 may propose plant-specific alternatives. Currently, the NRC is  
24 evaluating the public comments we received on the draft guidance

1 documents and we expect the final guidance to be issued in July of  
2 2017.

3 Next slide, please. While the GALL Report and the  
4 standard review plan I just discussed provide an acceptable method for  
5 developing and reviewing aging management programs, the license  
6 renewal program embodies a continuous improvement philosophy.  
7 Therefore, as lessons are learned from operating experience and  
8 during license renewal applications reviews, these guidance documents  
9 will be periodically revised to capture new insights or address emerging  
10 issues. As such information emerges, the NRC staff develops license  
11 renewal interim staff guidance or ISGs until such times as the GALL  
12 Report and the SRP can be updated, which is a much more  
13 time-consuming process.

14 But just like the process used to develop the GALL and  
15 the SRP, the ISG process is a transparent process that involves  
16 stakeholders. By issuing ISGs, the NRC is able to improve the  
17 efficiency and effectiveness of the license renewal process by providing  
18 guidance to license renewal applicants relatively quickly until that  
19 guidance can be incorporated into a license renewal guidance  
20 document.

21 Some examples of current ISGs, including aging  
22 management are buried in underground piping and tanks, internal  
23 coatings, and linings, reactor vessel internals, steam generators, and  
24 stainless steel structures and treated borated water. Please note that

1 the current ISGs were incorporated in the SRL draft guidance  
2 documents that are currently under NRC review.

3 Next slide, please. Mr. Carmack, this morning,  
4 discussed DOE's engagement with industry who have recently  
5 expressed significant interest in accelerating the development of  
6 accident tolerant fuel. The Agency has been preparing to address  
7 several matters related to the licensing of accident tolerant fuel over the  
8 past several years. While substantial research remains to characterize  
9 fuel properties and demonstrate performance of accident tolerant fuel  
10 under both normal and accident conditions, as we noted earlier, both  
11 DOE and industry are working on the selection of candidate designs  
12 that can serve as lead test assemblies.

13 The scope of our licensing review will depend on the  
14 level of departure from existing designs that use low enriched uranium  
15 oxide ceramic pellets within zirconium alloy tubing designs. The  
16 technology neutral performance-based aspects of 10 CFR 54.46(c),  
17 which is currently with the Commission for approval, provides a  
18 regulatory framework that supports the introduction and use of accident  
19 tolerant fuels.

20 In a few minutes, Mike will also provide a summary of  
21 the technical aspects associated with the accident tolerant fuel.

22 This concludes my presentation and, since I have teed  
23 up a few topics for Mike, it is only fitting I hand the mike to Mike.

24 MR. WEBER: Thanks, Bill. Could I get the next

1 slide, please?

2 As Vic already alluded to, and as you have heard in the  
3 prior panel, the NRC has a long-standing cooperative partnership with  
4 the Department of Energy. And so, it is my pleasure this morning to  
5 appear before you, Chairman and Commissioners, to talk about how  
6 are we enhancing nuclear safety through that partnership both through  
7 research and through educational grants?

8 Now, you will notice a great deal of similarity not just  
9 with what the Department of Energy presented but also what my  
10 colleagues have presented in this panel and that similarity reflects the  
11 synergy and the focus on those topics that are most relevantly  
12 significant in terms of our nuclear safety focus.

13 If I could go to the next slide, please.

14 I will touch on only a few examples of our collaboration  
15 between the Department of Energy and NRC. These include ensuring  
16 safety for subsequent license renewal, learning from the accident at  
17 Fukushima-Daiichi, reviewing accident tolerant fuels and issuing  
18 educational grants.

19 Next slide, please. In terms of ensuring long-term  
20 safety for subsequent license renewal, as Bill has already alluded to,  
21 we are focused on aging management programs to specifically address  
22 the materials degradation phenomena and these include topics that I  
23 will get to in a moment on neutron embrittlement of reactor pressure  
24 vessels, reactor internals, concrete aging, and also cable aging.

1                   Our cooperation with the Department occurs through  
2 the light water reactor sustainability program or LWRS. This program  
3 specifically focuses on that period of extended operation for 60 to 80  
4 years. And you have heard already a brief description of that both by  
5 the Department of Energy and by Bill.

6                   Our expanded materials degradation assessment  
7 provides the technical basis for the GALL-3 update, which Bill talked  
8 about. That is specifically the technological information that we rely on  
9 for both the identification and the resolution of the technical regulatory  
10 issues. And that is documented in NUREG/CR-7153 in a five-volume  
11 set.

12                   The objective of the staff's work in this area is to resolve  
13 technical and regulatory issues before the first application for  
14 subsequent license renewal. While we may not get there, that is  
15 clearly our objective and that is consistent with the Commission's  
16 direction to the staff. And we are working in this area in collaboration  
17 with the Department of Energy, as well as the Electric Power Research  
18 Institute, the National Laboratories, and our international partners.

19                   Next slide, please. Specifically on the degradation  
20 issues that we are resolving, the upper left-hand corner, you can see  
21 work on reactor pressure vessel embrittlement, where we are  
22 developing criteria to evaluate embrittlement of the pressure vessels.

23                   On the right-hand side of that upper corner, you see  
24 some embrittlement trend curves, which reflects the integration of

1 assessment of world-wide surveillance data on the reactor pressure  
2 vessels.

3 In the lower left-hand corner, you can see a photo of  
4 concrete that has been adversely affected by alkali-silica reaction.  
5 This is another project where we are working not only with the  
6 Department but also with the Electric Power Research Institute and we  
7 are trying to understand the phenomena, as well as how do you  
8 evaluate the impacts of alkali-silica reaction in the field and evaluate the  
9 impact on structural integrity, as well as block expansion.

10 And that coin is in that photo for scale, so you can get  
11 a sense of the large cracks.

12 In terms of the upper right-hand corner, the focus is on  
13 vessel internals and cracking specifically here of the pressurized water  
14 reactor baffle bolts. This is caused by irradiation-assisted stress  
15 corrosion cracking. In this program, we are focused on austenitic  
16 stainless steel plates and welds, as well as cast austenitic stainless  
17 steel.

18 The photo that you see on the top there is cracking of  
19 a baffle bolt from Salem Unit 1. That is very similar to the baffle bolts  
20 you have heard a lot about in the media recently at Indian Point Unit 2.

21 And then finally, in the lower right-hand corner, you  
22 have just a shot of some cables at a nuclear power plant. While a lot  
23 of work has been done in the high rad field and high temperature field,  
24 not as much work has been done historically on the aging of the cables

1 in a low radiation and a low temperature environment.

2 And as Bill talked about, we are looking at both dry and  
3 submerged cables in our evaluation of this area.

4 Next slide, please. Shifting to the lessons learned  
5 from Fukushima-Daiichi, and I will point out that this was talked about  
6 at the most recent briefing for the Commission on the progress on the  
7 post-Fukushima improvements, this represents an area of cooperation  
8 collaboration not only with the Department of Energy but also with the  
9 Government of Japan, other international counterparts, and, again, with  
10 the Electric Power Research Institute.

11 I highlight three specific studies here. The first is what  
12 we call the Benchmark Study or otherwise known as BSAF and the  
13 purpose of this work is to collect and assess data to validate severe  
14 accident codes and modeling and it also supports our Japanese  
15 colleagues in their recovery and decommissioning of the Fukushima  
16 plants.

17 The first report for Phase 1 of this work was completed  
18 earlier this year. That report focused on the first six days of the  
19 accident, where models were used as well as the information available  
20 from the sites to forecast the phenomena that occurred during that time  
21 period and compare with what we have actually observed. That work  
22 was completed, as I mentioned, in March 2016 and the best estimates  
23 presented in that analysis are useful in predicting the possible location  
24 of the reactor core debris for the three units that suffered the accident

1 at Fukushima.

2 The next phase, Phase 2 of this Benchmark Study  
3 started last year and should be completed by 2018 and that extends  
4 that focus from the first six days to the first three weeks approximately.

5 The second project is the Senior Expert Group on  
6 Safety Research Opportunities Post-Fukushima, otherwise known as  
7 SAREF. This project operates under the Nuclear Energy Agency and  
8 it is specifically looking at research needs in approximately the three- to  
9 five-year window. I am happy to report that at the recent meeting of  
10 the Committee on Safety and Nuclear Installations at the NEA, the  
11 committee approved this report. So, we would expect to see this report  
12 be published and released for use later this fall.

13 Like the Benchmark Study, this specifically focuses in  
14 on those research needs that would support the forensics, both  
15 in-vessel and ex-vessel phenomena that occurred at Fukushima.

16 And then finally, the U.S.-Japan Civil Nuclear Energy  
17 Research Development Working Group. And the focus here is on the  
18 forensic analysis for the Fukushima plants, as well as any technological  
19 gap analysis. And this work is being done with the Department of  
20 Energy, as well as the Japanese Nuclear Regulatory Authority and the  
21 owner and operator of those plants, the Tokyo Electric Power  
22 Company.

23 If I could go to the next slide, please. Shifting to the  
24 review of accident tolerant fuel, we have already heard a lot about the

1 background and the origins of the program so, I will focus in on what  
2 are we doing working with the Department of Energy in this area.

3 First, we have been participating in the routine biannual  
4 meetings of the Advanced Fuel Campaign. We send staff from my  
5 office, the Office of Nuclear Regulatory Research to observe and then  
6 report back and then share with colleagues, not only in research but  
7 also in NRR and NRO.

8 Secondly, the Halden Reactor Project Program Review  
9 Group meetings. This is another cooperative research project through  
10 the nuclear energy agency specifically allowing for international  
11 collaboration to assess and to confirm fuel performance as new designs  
12 are evolved to actually test them and evaluate to confirm that they do  
13 in fact perform as expected.

14 And finally, under the Accident Tolerant Fuel Working  
15 Group, the offices at the Nuclear Regulatory Commission are working  
16 together to establish this working group between my office, Nuclear  
17 Reactor Regulation, and New Reactors to anticipate the licensing and  
18 technical issues that would be associated with the qualification of fuels  
19 for use in the commercial fleet. And we are ensuring that in research  
20 that there is an adequate technical basis to support the use of these  
21 accident tolerant fuels.

22 The photo you see there is of TRISO particle fuel and  
23 this work has been underway since the 1980s. And we heard in the  
24 recent Advanced Reactor Workshop that this fuel might be qualified or

1 the testing and demonstration to support qualification might be  
2 completed by 2021, 2022 time frame.

3 So, it is a long-term program that is required to  
4 demonstrate the safety and that is our focus throughout our cooperation  
5 with DOE on the accident tolerant fuel.

6 And finally on developing the workforce, in my office  
7 we are looking forward to the transfer of the educational grants program  
8 from the Office of the Chief Human Capital Officer to the Office of  
9 Nuclear Regulatory Research because we see an opportunity here for  
10 synergy between the research that we conduct and the development of  
11 the workforce through the educational grants. As the Commission is  
12 aware, the Omnibus Appropriations Act of 2009 established this  
13 program as a coordinated program not only with NRC and the  
14 Department of Energy but also with the National Nuclear Security  
15 Administration, where each of those entities is funded in the range of  
16 \$15 million per year to support educational grants programs.

17 NRC, we have issued numerous grants to universities,  
18 colleges, trade schools in 35 states and Puerto Rico that have  
19 supported the development of over 100 faculty, more than 2,700  
20 students and that has been through about 370 grants that have been  
21 issued to date.

22 And of course, the focus is on the development of the  
23 workforce in the areas of nuclear engineering, in health physics, and in  
24 related nuclear science and engineering fields that would support

1 certainly what we do and the Department of Energy does in nuclear  
2 safety.

3 And the Commission is well aware of this from the  
4 Chairman's recent letter to Chairman Rogers of the Appropriations  
5 Committee and other members of Congress back in May that reported  
6 to the Congress on the status of our grants program.

7 So with that, I would like to thank you for your attention  
8 and I will return the briefing to our EDO, Victor McCree.

9 MR. MCCREE: Thanks, Mike.

10 Mr. Chairman, Commissioners, as you have heard, we  
11 have made notable progress. We are making notable progress on a  
12 number of fronts, due in no small part to the positive very healthy open  
13 collaboration we have with our DOE colleagues and in a way that is  
14 consistent with our principles of good regulation and we look forward to  
15 continuing that.

16 With that, that concludes our presentation and we  
17 would be happy to respond to your questions.

18 CHAIRMAN BURNS: Well thank you all for the  
19 presentations. It was a good overview from both looking at issues  
20 related to the existing fleet of reactors and the possibility of further  
21 extension with this subsequent license renewal two, technologies we  
22 are looking at now and are reviewing now to being prepared for those  
23 that come. I think that is important for us in terms of trying to anticipate  
24 or position ourselves well for existing, as well as potentially for future

1 reviews and future challenges that may become before. Although, as  
2 Commissioner Svinicki said and remarked earlier, that is often very hard  
3 to understand where that may be.

4 Actually just a clarifying question, Mike. The BSAF is  
5 also an NEA -- isn't it also an NEA-sponsored project? One of the  
6 things related to -- and I found it interesting we are focusing in terms of  
7 the lessons learned from Fukushima. And there is always a lot of  
8 international cooperation, both multi-nationally and also on more one to  
9 one with the Japanese.

10 One of the things, turning to the -- and a lot of that has  
11 impact for us in terms of looking at the question of accident tolerant  
12 fuels, whether they might be something that is implemented in the next  
13 decade or so.

14 One of the things, sort of shifting from that into looking  
15 at the license renewal, is there international work on sort of long-term  
16 operation that has been done that informs us or have we  
17 somewhat -- my impression sometimes in talking with counterpart  
18 regulators is we are looking sort of beyond where they are now. So, I  
19 don't know.

20 And really any one of you might be able to comment on  
21 that.

22 MR. DEAN: I think I probably would agree with your  
23 assessment, Chairman that I think we are a little bit cutting edge in  
24 terms of where we are looking at the 60 to 80. You know a number of

1 us, certainly a lot of our European counterparts are just struggling now  
2 with looking at life beyond 40, as you get to the fourth ten-year review  
3 period.

4 So, I just was over in France and talking with some of  
5 my counterparts at ASN and getting some information on some of the  
6 things they are focusing on just for that fourth term review. So, I think  
7 we are a little bit ahead of them in that regard.

8 CHAIRMAN BURNS: And I know they have  
9 expressed, and again, in interactions I have had, they are interested in  
10 I think what we are looking at. So, I know that is something we do and  
11 certainly in cooperation through IAEA or through NEA exchange but I  
12 would continue to encourage that because I think -- well, as I think we  
13 have seen even with the baffle bolt issue, when that issue when  
14 identified I think in the 1990s, some of it was operating experience in  
15 the French reactors or whatever. So, that continued cooperation I  
16 think is important in the aging management issues that arise from our  
17 perspective on license renewal.

18 MR. DEAN: Yes, and just to underscore that, just a  
19 couple of weeks ago we had a pretty successful international  
20 conference that we supported here where we had Brazil, Mexico, and  
21 Argentina representatives here. And I think some other countries are  
22 looking for similar sort of collaborative activities to learn about license  
23 renewal, not the subsequent license renewal but just license renewal  
24 itself.

1                   CHAIRMAN BURNS: Okay, good. Mike, one of the  
2 questions I might ask with respect to the Integrated University  
3 Program -- oh, do we have -- do you want to add something?

4                   MR. LEE: Yes, Richard Lee from Research. You  
5 asked about the accident tolerant fuel. NEA does have a group looking  
6 into that, too.

7                   CHAIRMAN BURNS: Okay.

8                   MR. LEE: And also under the DOE's Civil Nuclear  
9 Engineering Working Group, under the LWR program, they also have  
10 the accident tolerant fuel. So, the Japanese and U.S. is working very  
11 closely on that.

12                  CHAIRMAN BURNS: Okay, thank you very much.  
13 Thanks for that addition.

14                  I think my question on the Integrated University  
15 Program, to what extent does -- you know mentioned in terms of the  
16 universities in terms of developing faculty, developing students who  
17 may be in nuclear engineering, to what extent is some of these grants  
18 going into things like development of craft or particular professions that  
19 are basically you need to put the thing together? Because that is a  
20 question that has come up from some of our interest in numbers in the  
21 Congress. To what extent do the programs develop craft and trade  
22 type skills?

23                  MR. WEBER: So, thank you for that question. I  
24 mentioned we had issued about 370 grants during the course of our

1 integrated university program. About 70 of those grants have been  
2 issued to trade schools. So, it is roughly about a fifth of the grants.

3 It is a competitive grant process and so we must  
4 respond to the applications that we have received. We have also been  
5 doing outreach to encourage a better understanding of potential  
6 applicants about the level of quality that we would seek to achieve and  
7 how best to be responsive to the notice of opportunity of the availability  
8 of those grants.

9 CHAIRMAN BURNS: Okay, thanks, Mike.

10 And Jennifer, a couple of questions for you. One thing  
11 I notice in terms of the schedule for design certification with respect to  
12 NuScale and then the UAMPS -- I agree it is easier to remember than  
13 whatever it stands for and then I always get challenged what does the  
14 acronym stand for sometimes. But the UAMPS COL, one of the things  
15 I see there I see sort of deja vu all over again and that is I recall in terms  
16 of looking at the time frame where you are coming to a potential  
17 decision on design certification for the NuScale SMR and then looking  
18 at the UAMPS COL, the thing that, the word that popped into my mind  
19 was Vogtle and the AP1000 rise design certification and the timing of  
20 the COL. I mean I don't know, at this point, whether we have  
21 anticipated that but it does seem to me something we may need to be  
22 sensitive to or understand what may happen. Because as we know,  
23 there were issues of finalization of the design cert for AP1000, which  
24 then affected the timing of how we proceeded through the COL.

1                   So, I don't know if we have thought about that at this  
2 point or what we see the potential challenges are. But any sort of  
3 insights, at this point, somewhat a little bit distant but not too far on the  
4 curve.

5                   MS. UHLE: So, to answer that question, the NuScale  
6 review -- I'm trying not to look at Commissioner Svinicki when I say this,  
7 so it will likely come in by the end of the calendar year. We are looking  
8 to do roughly a 40-month, 39- to 40-month review that will include  
9 rulemaking.

10                   So, most of the review will be done within a few years.  
11 So, that is roughly 2019.

12                   Let's see UAMPS is looking to come in mid-2018.  
13 Well, the first part of their review for the combined license would be also  
14 the environmental impact statement and the site characteristics. So,  
15 we are aware of that. If there were to be any design changes,  
16 obviously, to NuScale that were anticipated by UAMPS that could cause  
17 some conflict. But if the review does go smoothly, as we do expect it  
18 to at this point, based on all our pre-application activities, we don't really  
19 see that that would be a problem looking at their need to come in in the  
20 2018 because of the focus on the site being the first part of it.

21                   CHAIRMAN BURNS: Okay. It is something I think to  
22 pay attention to. And to the extent we have any lessons learned, I  
23 recall lessons learned from that, the experience going through Part 52,  
24 I would encourage the staff to be sensitive to that.

1                   The last question I am going to ask -- I didn't think I was  
2 going to talk about liability very much today but one of the things that  
3 struck me, I think, on slide 12, we look at sort of a to be done, and it  
4 talks about insurance and liability, which I presume is primarily the  
5 Price-Anderson application or the application of Price-Anderson or in a  
6 way the appropriate footprint for Price-Anderson for the small modular  
7 reactor and it says future rulemaking, if needed.

8                   And I vaguely remember, I have a few brain cells that  
9 still remember the SECY from 2010 on the various issues here. How  
10 do we deal with that in the meantime? Because if I look at a potential  
11 rulemaking here and, given the time even ambitious time, how is that  
12 going to intersect with the potential UAMPS type application, again?  
13 And as I recall -- what are the primary issues?

14                   My recollection of the primary issue has to do with for  
15 a small modular reactor, are you going to do the same kind of insurance  
16 level that you require for a quote large, although that is even a varying  
17 thing, a large light water reactor?

18                   MS. UHLE: That is exactly correct. And it also  
19 is -- are you doing it on a per module basis or are you taking a look at  
20 the entire complex, which could be up to 12 different modules in the  
21 case of NuScale. So, how would you evaluate that total power? And  
22 then looking at potentially scaling what the insurance would cover and  
23 what the insurance fees would be.

24                   So, that is part of the issue. We owe you a paper, a

1 Commission paper, looking to the end of 2016 into 2017 to frame that  
2 out in more detail. So, we will be providing that later.

3 I will ask Mike Mayfield if he would like to provide any  
4 more detail.

5 MR. MAYFIELD: Getting up and down, Chairman, is  
6 exciting.

7 This has been a long-standing issue. If you only look  
8 at a single NuScale module, they are not going to trip the thresholds at  
9 roughly 50 megawatts. However, if you look at as few as two modules,  
10 using two modules at the same time, now you trip the insurance  
11 thresholds.

12 So, it is a question of looking at this is one of several  
13 multi-module reactor issues that we have been looking at. The timing  
14 with this, we have been struggling with this since 2010. What to do?  
15 What do you really consider multi-module failures? And this is one  
16 that, as Jennifer pointed out, now that we have a better PRA from the  
17 applicant, meaning NuScale, we are going to get some better insights  
18 in how to look at the multi-module failure issue.

19 CHAIRMAN BURNS: Okay. So, yes, I think a  
20 takeaway from what you said Mike is that given what we are looking at  
21 is probably a one-unit module application or am I wrong about that?

22 MR. MAYFIELD: No, the design cert is for 12  
23 modules. And then the question is what will --

24 CHAIRMAN BURNS: But UAMPS.

1 MR. MAYFIELD: It depends on what UAMPS --

2 CHAIRMAN BURNS: What UAMPS will do, right.

3 Because the design cert doesn't trip Price-Anderson.

4 MR. MAYFIELD: Exactly.

5 CHAIRMAN BURNS: It is only the COL.

6 MR. MAYFIELD: But it is unlikely UAMPS will come

7 in for a single module.

8 CHAIRMAN BURNS: Okay.

9 MR. MAYFIELD: It is a very expensive facility for only  
10 50 megawatts.

11 CHAIRMAN BURNS: So we might have to face that  
12 and we might or might not be ready with the rulemaking.

13 MS. UHLE: Well, I would say that looking at the  
14 UAMPS schedule with NuScale being completed in say the 2020 time  
15 frame, including the rulemaking, and then the UAMPS coming in the  
16 2018, they would be, again, looking about the 2020 time frame to have  
17 a COL, if all goes smoothly. So, that gives us, from this point, three  
18 plus years for rulemaking.

19 If we determine that we need rulemaking, I would say  
20 that it is very unlikely that an applicant for a COL would be using just  
21 one module. So, then you trip over that 100 megawatt threshold.

22 In fact, when you look at the NuScale package, you can  
23 buy one module, six, or twelve, based on how the systems are shared.  
24 And I believe UAMPS, I am very certain, actually, that UAMPS is looking

1 to do all 12.

2 CHAIRMAN BURNS: All right, thanks. I'm over.  
3 Commissioner Svinicki.

4 COMMISSIONER SVINICKI: Thank you all for your  
5 presentations and for all the work that you and your teams have been  
6 doing on these issues since the Commission last met on similar topics.

7 Jennifer, I am going to begin with you and the response  
8 you gave to the chairman on the hard scrub of a potential schedule for  
9 the NuScale design certification.

10 Now, at the risk of being criticized for picking on  
11 schedules kind of incessantly, I do think that I would take just practicality  
12 and transparency over optimism on schedules because when we hear  
13 that the financial community and others feel that the regulatory process  
14 is not stable or predictable, I think that although they would like a quick  
15 review, they would take a predictable time frame. If it was really going  
16 to be done in six years, I think if they could know that it was going to  
17 take six years, they would begin with -- because then they could build  
18 their planning around that time frame.

19 You and your predecessor have taken a lot of looks at  
20 Part 52. You have looked at recent experience. You have done a lot  
21 of lessons learned reviews and I think that you have some very solid  
22 suggestions and changes. You mentioned doing more of the  
23 safety-focused review, taking a very hard scrub of the request for  
24 additional information, bringing perhaps returning to a discipline and

1 rigor on those things. Looking at the acceptance review of the  
2 applications themselves and applying -- well, it is a possibility to  
3 supplement, of course, an application, what level of rigor do we need to  
4 bring to that?

5 But I also look at how have we performed recently.  
6 The most recent design certification for the ESBWR took over a decade.  
7 And I acknowledge that there were unique circumstances there. There  
8 were technical issues to be resolved. But I think that it is reasonable  
9 to predict that with the novelty that NuScale might bring to some  
10 aspects, there will be issues to resolve with NuScale as well.

11 So, I really don't want to be the skunk at the garden  
12 party but I keep hearing 40, 39 months. The last one we did took over  
13 a decade and it was a large light water reactor. I know I have said this  
14 and it is very demoralizing to everybody but I think that the community  
15 that wants some predictability in the licensing process would rather just  
16 have us not be overly optimistic in some of these schedules. And while  
17 I don't accuse you all of doing that as I dug into the background  
18 information for this meeting, I was reminded of what a thoughtful look  
19 NRO and others have taken at how we could perhaps be more  
20 safety-focused and more efficient in these reviews. But I think that it  
21 will be a validation of a lack of a lack of predictability in the licensing  
22 process if we don't temper some of our optimism if, indeed, we are guilty  
23 of optimism.

24 The other thing I noted is something talked about but

1 not yet adopted by NRC that I, at this moment, do not react terribly  
2 favorably to, was giving a schedule of 40 months for an SMR review but  
3 having new mechanisms within which we would stop the clock or pause  
4 it during periods where we waited in receipt of information, I  
5 acknowledge the creativity of that but I am not sure that that is what  
6 people are looking for when they want us to just say what do you  
7 forecast the schedule of this review taking.

8 So, I think that we are feeling pressure to show that we  
9 can do these efficiently but -- well, I guess I will ask you to react and  
10 knowing that you take very very seriously, because we have had a lot  
11 of one-on-one discussions about this, you take very seriously any kind  
12 of schedule that you are going to put out there. How do you react to  
13 this vague unease I have about us being a little too optimistic?

14 MS. UHLE: Well, I would say that looking at the past,  
15 obviously, that would make you -- would put you in a position to  
16 potentially be skeptical here.

17 I would try to focus maybe on the information we have  
18 today and that is taking a look at the KHMP review. KHMP review --

19 COMMISSIONER SVINICKI: And that would be for  
20 the APR-1400.

21 MS. UHLE: That is the APR-1400. That design, we  
22 completed Phase 1 on time. We are looking at completing Phase 2  
23 here going into the fall on time.

24 We have had a couple of issues that we have

1 highlighted to the vendor that they needed to spend more time on and  
2 get additional resources. And they have done that. However, we  
3 have continued to engage with them to specifically outline where they  
4 are not responding to our request for additional information in a timely  
5 way that will impact the schedule.

6 So, I would say that --

7 COMMISSIONER SVINICKI: And I would say on that  
8 I think that communicating more clearly cause and effect up front, that  
9 is a very helpful thing to say that you know if this is doing to take an  
10 additional eight months, then I think it is fairly logical and I would hope  
11 there would be good acceptance by applicants that that would push out  
12 the ultimate -- we can't be reviewing information we don't have.

13 MS. UHLE: Right, and that was the purpose of our  
14 discussion in the case study paper that I think you are referring to. So,  
15 I think what we are trying to do now is be much more proactive in our  
16 communication at highlighting to senior management in the vendor  
17 organization that they need to ramp up their game or focus attention  
18 and instead of perhaps in the past not being quite so proactive.

19 I would say in the case of NuScale why we think we  
20 can complete the review as we have budgeted and projected in large  
21 part is because we have had very, very good pre-application  
22 discussions. In addition, we have identified the policy issues that we  
23 feel have been resolved that are pertinent to them and then the review  
24 if very simple, with large margins.

1                   COMMISSIONER SVINICKI: And again, I want to  
2 acknowledge that your responses to Chairman Burns were about  
3 NuScale. There has been a tremendous amount of pre-application  
4 engagement there, which I know informs your estimates.

5                   And again, at the end of day, if issues need to be  
6 resolved, they need to be resolved. What I am arguing for is just  
7 greater communication and transparency. And I think you have  
8 indicated that is something you are already adopting for design  
9 certification reviews in-house now. And I think that will be helpful. I  
10 think the frustration grows around the long-term TBDs on the public  
11 schedules and people just don't know what to make of that. And I think  
12 a larger community beyond just NRC and the applicant is watching the  
13 progress of these activities.

14                   And so I think that is helpful what you have done and I  
15 know you will continue to keep your eye on it.

16                   I wanted to ask you, your slide 7 talked about code  
17 cases. It is interesting. I know it is a little bit of a detailed topic. I  
18 don't think it gets a lot of attention. I know that a number of national  
19 laboratories, Oak Ridge, Idaho, Argonne are working on the  
20 development of code cases which, as you explained, will ultimately  
21 bubble up and form the basis for code rules that we will review.

22                   Beyond maybe medical devices and aircraft, I think that  
23 nuclear has got to be right up there with the most involved process for  
24 the qualification of like new materials and new alloys prior to their

1 introduction into regulated facilities. What is your general sense of  
2 where we are on that whole code development that would undergird the  
3 kind of materials innovation that I think vendors want to adopt?

4 MS. UHLE: Well, there is actually a particular material  
5 name. I am certainly not a materials engineer. So, I am going to give  
6 Mike Mayfield some advance warning.

7 But there has been a look at advanced reactor  
8 materials. Hastelloy, in particular, is a high temperature material.

9 So, Division 5 of ASME Code Section 3, which is  
10 design that has already been in place for several years and there is  
11 already work that has been done to fine tune that. We have not  
12 reviewed that because none of the light water reactors operated at  
13 those temperatures.

14 So, in the case of something like ASME, I think we are  
15 in good shape. We do have to review it and determine if there is  
16 anything that needs further attention.

17 In the other areas, for example, of the use of  
18 non-restrictive examination techniques for various components, in the  
19 case of NuScale, they have taken a look at eddy current probes and  
20 whether or not it can be used for their helical steam generator.

21 So, people are thinking ahead about the importance of  
22 having the codes ready to go.

23 COMMISSIONER SVINICKI: It sounds like it is kind  
24 of pacing along with the actual design and technology development.

1 MS. UHLE: Yes, with the maturity of the design.

2 COMMISSIONER SVINICKI: So, I won't make Mr.  
3 Mayfield get up again, since he has asked for some mercy on that.

4 MS. UHLE: And we do have, through our standards  
5 executive in the Office of Research, we do have a couple of meetings  
6 per year with the standards development organizations to project what  
7 it is we would like them to focus on because it is efficient. If it is done  
8 in the code, then we can endorse if we find it acceptable. And that  
9 provides, obviously, efficiency for us.

10 MR. WEBER: In fact, if I could add, Commissioner,  
11 we and the staff in NRO are collaborating on developing a plan for how  
12 we would prioritize what codes we would need to review and in what  
13 sequence, so we could support the continued development of those  
14 codes for advanced reactors.

15 COMMISSIONER SVINICKI: That's great. I think  
16 that will be very informative to have a prioritization there.

17 And I just wanted to close with a comment from Mr.  
18 Dean on subsequent license renewal. As you referenced, in 2014, the  
19 Commission did not approve the staff's recommendation to proceed to  
20 rulemaking to fundamentally, perhaps, alter the scope, albeit in modest  
21 ways of license renewal for subsequent license renewal. The  
22 Commission, instead, approved basically validated the current  
23 regulations are adequate for beyond 60 years. However, the  
24 Commission did direct the staff to look at guidance and other

1 documents.

2 I will say, though, that there could perhaps be a  
3 temptation or a tendency in the development of guidance to embed  
4 within there an expectation that might go beyond what the regulations  
5 require. Now, I acknowledge that guidance is not regulations but we  
6 all know how this works and that if there is guidance of something that  
7 the staff would approve for compliance, there is a strong incentive to  
8 move towards that, if you are going to submit for subsequent license  
9 renewal. And there is a disincentive, although you acknowledge that  
10 applicants could provide other mechanisms of compliance. We all  
11 know that the benefit of guidance is that if you do it that way, the NRC  
12 is saying that it will be approved.

13 So, have you received any public comment on the draft  
14 guidance updates that would indicate that there is a concern that an  
15 expectation of something beyond the current regulations for license  
16 renewal is being embedded in that guidance?

17 MR. DEAN: So, and I will have Jane Marshall come  
18 up and give you a little bit more detailed rundown.

19 We did get some substantial comments on the draft  
20 GALL and the standard review plan that I think some entities have taken  
21 some exception to. I don't know if it crosses that line about embedding  
22 some of that that would have been in regulations but maybe Jane can  
23 offer a few more insights in that regard.

24 MS. MARSHALL: Okay. We have been having a

1 series of public meetings on the draft GALL and SRP for SLR. And we  
2 are working through any difference of opinion between the NRC staff  
3 and the interested public, must notably, the industry. And we are down  
4 to a handful of issues. Many of the apparent differences were case of  
5 not explaining clearly enough what the staff's expectations were.

6 COMMISSIONER SVINICKI: And is it still the  
7 schedule to finalize that mid-2017, that guidance?

8 MS. MARSHALL: Yes.

9 COMMISSIONER SVINICKI: Okay, thank you very  
10 much. Thank you, Mr. Chairman.

11 CHAIRMAN BURNS: Jane, will you just identify  
12 yourself for the record, so we have it for the transcript and your position?

13 MS. MARSHALL: Jane Marshall, Acting Director for  
14 the Division of License Renewal.

15 CHAIRMAN BURNS: Okay, thanks.

16 Commissioner Ostendorff.

17 COMMISSIONER OSTENDORFF: Thank you,  
18 Chairman. Thank you all for your presentations.

19 Vic, I agree with you that the Agency is making notable  
20 progress here. So, that is the big picture, a comment that you made  
21 that I agree with.

22 Jennifer, let me ask you -- I'm going to make one  
23 comment and then I am going to ask you a question.

24 I have had a chance, through various speaking

1 engagements this calendar year, to talk a lot about small modular  
2 reactors and advanced non-light water reactor efforts and so forth.  
3 And I acknowledge the exchange with Commissioner Svinicki on  
4 scheduling, which some pragmatic, realistic observations based on past  
5 experience, which are important.

6 I have received positive feedback on NRC staff,  
7 pre-licensing, pre-application submittals by NuScale senior leadership  
8 in three different meetings I have had with them this year. And I know  
9 that working very hard, there is only so much you can do, however, until  
10 the application is submitted.

11 Is there anything on the NuScale side of the house that  
12 concerns you that you may not be ready for?

13 MS. UHLE: Well, with any design, the devil is in the  
14 details. And so at this point in time we feel, through the pre-application  
15 activities that we have the major issues identified. However, in any  
16 review, it comes down to the intricate details. In particular, this design,  
17 and it is publicly noted that they would like an exemption from a number  
18 of regulations, including offsite power. So, GDC-17. There is other  
19 areas where they are seeking exemptions. So, although we are aware  
20 of them and we have plotted out what we think our answer would be  
21 with the information that we know now, until we present that to the  
22 Commission to make our final decision, there is obviously a number of  
23 discussions that have to occur.

24 So, I would just say that I think we are aware of the

1 issues that are different than other plants. But until we have actually  
2 completed the review, we don't know what our decision will ultimately  
3 be.

4 COMMISSIONER OSTENDORFF: Okay, that's fair.

5 On the advanced non-light water reactor stage, I just  
6 commend NRO team for their work in getting the vision and strategy out  
7 there. I think it is very important and I have been very pleased with  
8 what I have observed there for your efforts and that of your team mates  
9 there in the organization.

10 Let me ask -- one final point. Going back to NuScale,  
11 but anything else that comes up. I think NRO has done a really good  
12 job of coming to the Commission with new issues or policy questions  
13 that come up. I encourage you to continue that practice. I think it is  
14 important.

15 Bill, let me ask you, then I am going to ask Mike a  
16 question on subsequent license renewal. I will start out with Bill in this  
17 area.

18 I appreciated your slides. You identified various  
19 technical issues that you are looking at. Is there one particular  
20 technical issue that you think requires more research than others, in  
21 order to get to a satisfactory regulatory standpoint foundation?

22 MR. DEAN: So, I will give you my opinion. Mike  
23 might have a different opinion.

24 So, I think, for example, you look at neutron fluence of

1 vessels. I think that is a pretty well-known phenomenon. I think that  
2 we have a pretty substantial amount of understanding of what is going  
3 to transpire there.

4 I think concrete is a little bit less unknown. For  
5 example, we have worked with Department of Energy to extract some  
6 samples from the Zorita facility in Spain so that we can do some  
7 accelerated testing on that. I know from my experiences in Region I  
8 with the alkali-silica reaction issue at Seabrook and the challenges that  
9 existed at the University of Texas in trying to test concrete samples, that  
10 one gives me a little bit of pause.

11 You know things that are involved in reactor vessel  
12 internals, clearly we understand things like stress corrosion cracking  
13 and other phenomena. But again, going through this baffle bolt issue  
14 that Mike alluded to at Indian Point and Salem, you know we saw a  
15 greater number of indications than we were anticipating. So, I think  
16 there is still some emerging unknown things there as these plants age.  
17 But we are all learning lessons and that is why it is important to put in  
18 place appropriate aging management programs that continue to test  
19 and evaluate these areas where perhaps we have some unknowns  
20 about what the future might hold.

21 I don't know, Mike, if you have any --

22 MR. WEBER: Yes, thanks. I would agree with Bill.  
23 The only two items I would add is we have a research project underway  
24 now at NIST, the National Institutes of Science and Technology, where

1 they are also developing the alkali-silica reaction. So, they are actually  
2 casting concrete modules and they are testing them. So, that is going  
3 to address, in part, some of that phenomena.

4 Bill did not specifically address cable aging but that is  
5 one where he recently, through a user need request requested that we  
6 extend the period. That is a little disconcerting as you go longer term.  
7 And it is not just what is happening to the cable but it is the predictability  
8 of what will happen to the cables and when.

9 Will you know that a cable is going to fail at a certain  
10 time, so that the utility could take action on it or we, as the regulators,  
11 could take action to address? I think that is something we are trying to  
12 get our arms around at this point.

13 COMMISSIONER OSTENDORFF: With respect to  
14 the cable issue, is EPRI working in this area?

15 MR. WEBER: Yes.

16 COMMISSIONER OSTENDORFF: Do you think their  
17 research efforts are allowing you to help answer this question?

18 MR. WEBER: Yes, we work in strong partnership with  
19 EPRI. But we are both searching for those answers.

20 MR. DEAN: The one thing I was going to add to  
21 Mike's comment about cabling is that, as Mike indicated in his  
22 presentation, a lot of knowledge about irradiation effects on cabling, a  
23 lot of knowledge about temperature effects, he noted the low  
24 temperature, low irradiation but we are also interested in the combined

1 effects, which is another part of that user need. What about them  
2 together? Is there some sort of synergies or whatever that might exist  
3 in a combined high temperature high radiation environment?

4 COMMISSIONER OSTENDORFF: So, let me ask  
5 one other question to both of you on the same topic again. In your  
6 review of aging management programs from licensees' responsibilities,  
7 have you identified any really good practices in aging of buried cables?

8 MR. DEAN: Well, I may have to punt that to Jane.  
9 Anything, Jane that you are aware of in terms of good practices we have  
10 identified in management of aging of cables?

11 MS. MARSHALL: This is Jane Marshall, Acting  
12 Director for the Division of License Renewal.

13 Licensees have been doing surveillance. So, they get  
14 out and they check the cables. For aging management, cables tend to  
15 fail abruptly and so trying to predict that is still something we are  
16 interested in looking at.

17 COMMISSIONER OSTENDORFF: I ask the  
18 questions because this is not rocket science. This is not quantum  
19 mechanics. It is a pretty basic deterioration mechanism. And so I  
20 think that I encourage you all, as I know you are to pulse industry to see  
21 what they have learned because I have got to learn that there are some  
22 good lessons out there.

23 Thank you. Thank you all.

24 CHAIRMAN BURNS: Thank you, Commissioner.

1 Commissioner

2 COMMISSIONER BARAN: Thanks. I wanted to  
3 follow-up on Commissioner Ostendorff's questions on subsequent  
4 license renewal. And thanks for the update. I was going to ask about  
5 that, your kind of evaluation, you assessment of where things stood on  
6 these outstanding technical issues related to subsequent license  
7 renewal.

8 For some of the items that you have mentioned where  
9 the answers are a little bit more uncertain on concrete degradation, on  
10 cables, I know Bill mentioned earlier, we are not likely to have the  
11 answers to these questions or the research complete in the 2018-2019  
12 time frame when Peach Bottom and Surry applications come in. You  
13 referenced a more kind of plant-specific demonstration that could be  
14 made versus a generic answer.

15 If the underlying kind of research isn't done, if the  
16 technical issues are outstanding, what is that review going to look like?  
17 How would it proceed?

18 MR. DEAN: So, when I refer to plant-specific aging  
19 management programs, so for example, let's take the cable aging issue  
20 we were just talking about. The issue is not so much the cable and the  
21 aging mechanism but it is the predictability about when might it sort of  
22 degrade, in which case you might have a number of cables to grade at  
23 the same time. And so, in that case, until we have the research  
24 complete, that gives a better sense of when we can predict cables might

1 fail. Then, we would require licensees to have an aging management  
2 program that would do probably more frequent testing and assessment  
3 of cables during outages, for example.

4 Concrete, we may have to require them to take periodic  
5 samples of the concrete and test those to evaluate the properties of the  
6 concrete.

7 This baffle bolt issue we just talked about is a good  
8 example in looking at the current license renewal program of 40 to 60  
9 years that we worked with industry to develop a testing methodology to  
10 do ultrasonic testing of these baffle bolts and refining a greater number  
11 of indications than we thought we might. This will help advance the  
12 development of that program and we will revise that aging management  
13 program through industry working groups and so on.

14 MR. WEBER: That's a regulatory success. That  
15 program developed years ago is now bearing fruit, in terms of  
16 confirming that, indeed, there is failure mechanisms occurring affecting  
17 these structures.

18 COMMISSIONER BARAN: Well, let me ask about  
19 baffle bolts for a second. So, I know this is a known phenomenon but  
20 the number of degraded baffle bolts we're seen at Indian Point and  
21 Salem is significantly higher than what would have been expected, I  
22 think. What are we doing to understand -- well, first of all, I am curious  
23 whether you agree with that. I mean do you see it as substantially  
24 higher than what was expected? And if so, what are we doing to

1 understand why?

2 MR. DEAN: So, I think the number of indications that  
3 we have seen is higher than we expected but there still remains work  
4 to be done to evaluate what was the structural capacity of those bolts  
5 that had indications and we won't know that until probably the end of  
6 the summer, when Westinghouse and other testing labs have a chance  
7 to be able to destructive testing.

8 That being said, I think that our engagement with, in  
9 particular EPRI and Materials Reliability Program Working Group will  
10 result in a refined approach that licensees will need to take relative to  
11 looking at the inspection of and maintenance of the baffle-former bolts.

12 As you are aware, Commissioner, it is a combination of  
13 what type of material are they using. What type of designs, is it an  
14 up-flow or a down-flow plant, and all of that? And so I would expect to  
15 see some recommendations that would come out that say for example,  
16 if you don't convert to an up-flow design, then you are going to have to  
17 probably inspect on a more frequent basis, for example. It was  
18 probably an outcome of that.

19 And that conversion is not an inexpensive conversion.  
20 So, a licensee would have to determine do I want to, for example,  
21 replace all of my bolts now at my next outage or do a large sampling  
22 and replace the ones that have indications and what do I want to  
23 convert.

24 So, I think we have to make those sort of business

1 decisions but that is not going to obviate them from having to have likely  
2 a revised inspection and monitoring program as a result of the lessons  
3 that we learned from this. But there is still some more information that  
4 we have to gather before we can sort of finalize what that program  
5 would look like.

6 COMMISSIONER BARAN: So but for the  
7 stakeholders who are out there who are focused on this issue who are  
8 concerned about this issue, what I am hearing you say is that we are  
9 actively looking at is the current frequency of testing adequate. Is the  
10 current type of testing adequate? That is something, as an agency we  
11 are evaluating right now.

12 MR. DEAN: That is correct.

13 COMMISSIONER BARAN: Okay. And it sounds like  
14 you would anticipate that the frequency and potentially even the nature  
15 of the testing, that may very well change.

16 MR. DEAN: So for example, right now, the testing is  
17 to look at the baffle-former bolts in a period of time between 25 and 35  
18 effective full power years of operation.

19 Indian Point 2 was about 31 plus some effective full  
20 power years. So, maybe that 25 to 35, maybe that needs to be  
21 compressed. Maybe you need to look at it in the 25 to 30 effective full  
22 power years, for example. You don't want to look at it too early  
23 because you won't see the phenomena. So, you don't want to inspect  
24 too early. So, I don't know that I would see it slip forward earlier but it

1 has got to be in that sweet spot in terms of when this irradiation-assisted  
2 stress corrosion cracking phenomena occurs and shows the indications  
3 that we are seeing.

4 COMMISSIONER BARAN: And do we know enough  
5 about this phenomenon? Even given the kind of recent data for these  
6 two plants, are we confident that we know enough about this to know  
7 that this is a fast-acting type of phenomenon?

8 In other words, you put in new baffle bolts today at  
9 Indian Point. This isn't something that is going to appear in two years  
10 or three years or five years.

11 MR. DEAN: No, it has taken 25 or 30 plus years  
12 effective full power years, which means over 40 years of operation for  
13 this phenomena to be emerging. And of course they would use -- they  
14 are using baffle bolts of a different stainless steel that is less susceptible  
15 to that. But if they were to put in the 347 stainless steel that currently  
16 existed, there would be another 30 effective full power years before you  
17 would see that phenomenon again on those new bolts.

18 COMMISSIONER BARAN: And for the bolts -- sorry,  
19 to go into a little more detail but I think people are interested in this.  
20 And for the bolts that didn't have an indication, how confident are we  
21 that two or three or five years from now they still won't have an indication  
22 that they have degraded?

23 MR. DEAN: So that is one of the reasons why they  
24 will be doing an inspection at their next outage to evaluate those bolts

1 that didn't show indications this time. And that will help, again,  
2 advance the knowledge of this phenomenon.

3 So, these plants that have this susceptible material and  
4 this susceptible design, over the course of the next several years, as  
5 Cook and Diablo Canyon do their inspections, we will have a much  
6 larger set of data that can provide a greater degree of predictability.

7 COMMISSIONER BARAN: Okay. And based on the  
8 fact, as you mentioned, in terms of the material of the baffle bolts, that  
9 it be a PWR four-loop configuration in terms of the flow, the universe of  
10 plants that we are looking at for this issue, this problem, is Indian Point,  
11 Salem, one of the Diablo units and D.C. Cook.

12 MR. DEAN: That is the near-term group. That is the  
13 four-loop PWRs that have a down-flow and the susceptible material.  
14 But we have to look at all the other ones that have bolted configurations  
15 as well. Obviously, they have not seen the same degree of  
16 degradation but they have seen some indications. And so this MRP  
17 program applies to the entire universe of pressurized water reactors,  
18 not just the four-loop Westinghouse. Those are just the ones that have  
19 the greatest susceptibility of this phenomenon at this point in time of  
20 their life.

21 COMMISSIONER BARAN: Thanks. And with just  
22 this minute and a half I have left, I wanted to kind of ask a bigger picture  
23 question to Vic and Jennifer, however you want to divvy it up, and that  
24 is on the advanced reactor piece.

1                   And I know you all are looking at implementation action  
2 plans and trying to think through what needs to happen over the next  
3 several years to get to 2025 and being ready and the appropriate  
4 sequencing.

5                   Can you talk a little bit about that? What are the key  
6 actions from kind of a regulatory licensing preparation point of view that  
7 have to happen between now and 2025? And what elements can be  
8 done generically early and what elements are going to have to wait until  
9 we know more about a specific application that comes in the door?

10                  MS. UHLE: Well, there are a number of things that we  
11 have been working on that are generic. And an example of that are  
12 the policy issues. So, a lot of the policy issues that were identified for  
13 the small modular plants, if you are having an advanced reactor that is  
14 also smaller, which many of them are, and a lower source term, those  
15 generic issues apply to the non-LWRs as well.

16                  So, part of it is also looking to see the maturity of the  
17 industry. So, at this point in time, I would agree or if the NRC staff  
18 would agree with the previous panel's determination that those designs  
19 that are further ahead are more likely to come in sooner would be the  
20 high temperature gas or the sodium fast designs.

21                  And so, as we have developed the generic -- as we  
22 have resolved some of these generic issues, we then have to then focus  
23 on some that are then design-specific. The HTGR example would be  
24 confinement versus containment, for example.

1                   So, our advanced reactor generic design criteria that  
2                   we recently issued for public comment were on high temperature gas,  
3                   as well as sodium fast. And in those areas that are specific would be  
4                   treated differently in those designs. We have adjusted our design  
5                   criteria to reflect that.

6                   And then, going forward, of course as we try to  
7                   risk-inform our reviews, we are going to need a little bit more design  
8                   information that will be specific to the particular application that may in  
9                   fact come in.

10                   COMMISSIONER BARAN: Thanks.

11                   CHAIRMAN BURNS: Well, thank you all for the  
12                   presentations. This has been an interesting meeting this morning that  
13                   has focused both with the recent staff presentations in the second panel  
14                   but also our presentations from our colleagues at the Department of  
15                   Energy on a variety of topics involving the licensing, oversight and  
16                   regulation of nuclear facilities, both existing and operating and those  
17                   potentially planned for the future. And so we appreciate all the input  
18                   that we have gotten today.

19                   Before we close, although it is not his last commission  
20                   meeting, I think that is next week, I do want to -- it struck me that we  
21                   have heard from sort of three prongs of contributions to the  
22                   development and application of nuclear energy in the U.S. today, in the  
23                   United States Navy, the Department of Energy, and the NRC. And I  
24                   want to acknowledge Commissioner Ostendorff's service in all three of

1 those organizations and for his service here on the Commission. I  
2 think we appreciate it.

3 I think is a meeting you particularly wanted to be able  
4 to participate in so we are glad that you have and I think it has been a  
5 rich discussion today. And we wish him well and appreciate his service  
6 here on the Commission and on these issues.

7 And with that, we will be adjourned.

8 (Whereupon, the above-entitled matter went off the  
9 record at 12:12 p.m.)

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