

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
FEDERAL ENERGY REGULATORY COMMISSION

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JOINT MEETING OF THE FEDERAL ENERGY REGULATORY  
COMMISSION (FERC) AND THE NUCLEAR REGULATORY  
COMMISSION (NRC)

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WEDNESDAY,  
SEPTEMBER 25, 2019

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ROCKVILLE, MARYLAND

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The Commissions met in the Commissioners= Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Neil Chatterjee, FERC Chairman, and Kristine L. Svinicki, NRC Chairman, presiding.

FEDERAL ENERGY REGULATORY COMMISSION MEMBERS:

NEIL CHATTERJEE, Chairman

RICHARD GLICK, Commissioner

BERNARD L. MCNAMEE, Commissioner

NUCLEAR REGULATORY COMMISSION MEMBERS:

KRISTINE L. SVINICKI, Chairman

JEFF BARAN, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE VIETTI-COOK, Secretary of the Commission

FERC STAFF:

PATRICIA EKE, Energy Industry Analyst, Office of  
Electric Reliability

DAVID HUFF, Electrical Engineer, Office of Electric  
Reliability

ANUJ KAPADIA, Electrical Engineer, Office of  
Electric Reliability

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION (NERC)

STAFF:

MARK LAUBY, Senior Vice President and Chief

Reliability Officer

NRC STAFF:

ERIC BENNER, Acting Deputy Director for Reactor

Safety Programs and Mission Support, Office of

Nuclear Reactor Regulation (NRR)

ANNA BRADFORD, Deputy Director, Division of

Licensing, Siting, and Environmental Analysis,

Office of New Reactors (NRO)

MEENA KHANNA, Acting Deputy Division Director,

Division of Materials and License Renewal, NRR

## 1 PROCEEDINGS

2 9:03 a.m.

3 NRC CHAIRMAN SVINICKI: Good morning, everyone,  
4 and welcome to this morning's meeting. This is one of our somewhat  
5 routine -- and we try to have these on a fairly regular schedule -- joint  
6 convenings of the U.S. Nuclear Regulatory Commission as well as the  
7 Federal Energy Regulatory Commission. So, we are joined by our  
8 colleagues from FERC today. We welcome you to the NRC.

9 We do alternate locations. So, our quarters are a little  
10 bit tighter here at the table. Apologize for that. But it's wonderful to  
11 have you here today.

12 We are meeting in public session on a number of topics,  
13 but, in general, I would just casually characterize these meetings as we  
14 have responsibilities and authorities that kind of touch each other. They  
15 don't I think in the strictest sense overlap, but it is important I think both  
16 for our expert staffs to work closely, which they do throughout the course  
17 of the year, but I think it's also extremely useful to have the members of  
18 each Commission convene as well.

19 And I will recognize the Chairman of FERC for any  
20 opening comments he would like to make, Mr. Chatterjee, and then, other  
21 members, if they would like to.

22 So, Neil, please.

23 FERC CHAIRMAN CHATTERJEE: Thank you, and

1 good morning, everyone. I'd like to thank Chairman Svinicki, the  
2 Commissioners from the Nuclear Regulatory Commission, and their staff,  
3 for welcoming FERC participants to the NRC Headquarters.

4 Both of our Commissions play a critical role in ensuring  
5 that our nation's critical infrastructure remains safe, affordable, and  
6 secure for all Americans. Last year was the first time I attended this joint  
7 meeting, and I was impressed with the information shared between both  
8 Commissions.

9 Like my predecessors, I'm committed to carrying out the  
10 Memorandum of Agreement between our organizations which states that  
11 we mutually coordinate, prioritize, integrate, and manage tasks related to  
12 the nation's electric power grid reliability and nuclear power plant safety  
13 and security, including but not limited to coordination of activities related  
14 to cybersecurity, physical protection, and emergency response. I'd like to  
15 thank staff from both Commissions and from NERC for the presentations  
16 that they have prepared. These presentations will highlight the critical  
17 nature of our work in the areas of electrical reliability and infrastructure  
18 security, both cyber and physical.

19 Specifically, among other topics, we will hear from  
20 FERC staff an overview of their joint report with NERC and its regional  
21 entities on the South Central U.S. Cold Weather Bulk Electric System  
22 Event that occurred on January 17th, 2018, emphasizing the importance  
23 of planning for extreme cold and communicating during times of system

1 stress.

2 We will also hear from FERC staff on energy storage  
3 technologies and the implementation status of FERC Order 841 which  
4 dealt with electric storage.

5 Finally, FERC staff will provide an update on several  
6 FERC cybersecurity rulemakings and lessons learned from our  
7 cybersecurity audits.

8 So, again, I want to thank the Chairman, the NRC  
9 Commissioners, and the NRC staff for their hospitality, and I look forward  
10 to hearing all of the presentations prepared by both FERC, NRC, and  
11 FERC staff, and NERC.

12 Thank you.

13 NRC CHAIRMAN SVINICKI: Thank you very much,  
14 Chairman Chatterjee.

15 Would either member of the Federal Energy Regulatory  
16 Commission like to make an opening statement? Please proceed.

17 FERC COMMISSIONER GLICK: Thank you. Thank  
18 you, Madam Chair. I want to thank the NRC for hosting us this year. I  
19 actually got a lot out of last year's meeting, and I think today we'll be  
20 doing the same.

21 I also want to thank the staff for their work, their hard  
22 work in planning all this, both Agencies. It's been very helpful and I  
23 appreciate the information that you provided.

1                   Nuclear power continues to play an important role in the  
2 nation's electricity mix, and it's important to note, especially this week  
3 during which the United Nations held its Climate Change Summit in New  
4 York, that nuclear energy, because it's a greenhouse gas, emissions-free  
5 resource, is going to play a significant role in helping some of the states  
6 meet their clean energy goals.

7                   As our electric grid evolves, it also faces new and  
8 evolving threats. Cybersecurity is a critical priority for both FERC and  
9 the NRC, and I look forward to the presentation on the NRC's  
10 Cybersecurity Program that we're going to be receiving in a little bit.

11                  I appreciate the opportunity to be here today, and I want  
12 to continue the good work and relationship between our Agencies. So,  
13 thank you very much.

14                  NRC CHAIRMAN SVINICKI: Thank you very much,  
15 Commissioner Glick.

16                  Commissioner McNamee, would you like to make a  
17 statement?

18                  FERC COMMISSIONER MCNAMEE: Great. Thank  
19 you, and thank you for hosting us today. And thank you for everybody  
20 who's here.

21                  And I also want to thank the staffs at the NRC, FERC,  
22 and NERC for being here and for the work that they've done in helping  
23 prepare for this.

1                   Reiterating what my colleagues have said, the  
2 importance of nuclear energy to our electric system can't be overstated.  
3 It currently provides about 20 percent of our electric generation, and it  
4 does provide an important source of electricity for our nation.

5                   I think it's appropriate that we meet on an annual basis  
6 to talk about these issues together and the importance that nuclear power  
7 plays in our country. It is also important that we talk about grid reliability,  
8 cybersecurity issues, and discuss issues about new innovation. I know  
9 that the NRC, especially from my time when I was at DOE, knowing how  
10 you look into the issues of licensing and how new technology develops is  
11 vitally important to helping move this country forward in nuclear energy.  
12 So, I thank you for the work that you do on that.

13                   I look forward to today's event, to the conference, and  
14 look forward to learning a lot. Thank you.

15                   NRC CHAIRMAN SVINICKI: Thank you very much,  
16 Commissioner.

17                   Would any member of the NRC Commission like to  
18 make a statement? Commissioner Baran?

19                   NRC COMMISSIONER BARAN: Just briefly join you in  
20 welcoming our FERC colleagues. It's great to have you here.

21                   I think it is maybe the fourth time I've done the joint  
22 FERC-NRC meetings, and I've found them always to be very valuable.  
23 There are so many common areas of interest where maybe we don't



1 overlap, but, as the Chairman said, our jurisdictions touch. And so, I'm  
2 looking forward to the presentations.

3 Thanks for being here.

4 NRC CHAIRMAN SVINICKI: Thank you very much.

5 Any other member? Commissioner Caputo?

6 NRC COMMISSIONER CAPUTO: I will add my  
7 welcome to our FERC colleagues. Thank you for coming, and to all of  
8 the FERC, NERC, and NRC staff for preparations for today.

9 I really enjoyed my first meeting, joint meeting, last year  
10 as a new Commissioner. So, I'm eager for the discussion today. Thank  
11 you.

12 NRC CHAIRMAN SVINICKI: Thank you.

13 Commissioner Wright?

14 NRC COMMISSIONER WRIGHT: Thank you so much.

15 Again, I want to join everyone in welcoming our FERC  
16 colleagues here. It's been a pleasure to get to know you in the very short  
17 time that we've been here. And like Commissioner Caputo, if it wasn't  
18 our first meeting, it was our second, you know, and it was like drinking  
19 from a fire hose. So, I feel your pain on that.

20 Thank you so much for being here, and I look forward to  
21 the dialog.

22 NRC CHAIRMAN SVINICKI: Thank you very much.

23 With that, now we will begin with the presentations.

1 And I think as we've done in years past, we will begin with Mr. Mark  
2 Lauby, who is the Senior Vice President and Chief Reliability Officer of  
3 NERC, for his presentation.

4 Please kick us off. Thank you.

5 MR. LAUBY: Thank you, and I really appreciated the  
6 invitation. Delighted to be here, and I enjoy coming to the NRC,  
7 especially because of the intimate way in which we interact.

8 So, just out of the box, I wanted to explain --

9 MS. VIETTI-COOK: I'm just going to get that a little  
10 closer to you.

11 MR. LAUBY: All right. Thank you very much. Is that  
12 better?

13 NRC CHAIRMAN SVINICKI: It is, and I would just note  
14 our microphones have a really small sweet spot. So, just sometimes  
15 we'll adjust. Please don't be offended. Thank you.

16 MR. LAUBY: Thank you.

17 Just to explain briefly, NERC has multiple functions  
18 when it comes to looking forward and looking at the risks on the bulk  
19 power system as well as, then, measuring the ongoing performance. We  
20 have our long-term reliability assessment, of course, that looks 10 years  
21 out. We have a Reliability Issues Steering Committee that's going to be  
22 coming out with a report in November, looking forward at what are the  
23 emerging risks on the bulk power system. That helps us kind of tee off

1 as to what to monitor on an ongoing basis.

2                   And then, we gather lots of data and information around  
3 the performance of the system. That is what we put together into our  
4 State of Reliability Report that's on an annual basis. Usually, it's out in  
5 June, so June looking at 2018, and maybe doing a bit of a comparative to  
6 earlier years. That's what you're going to be seeing today.

7                   We've kind of re-scoped the report a little bit to make it  
8 a little bit easier to read, we hope, kind of set up for computers, rather  
9 than printing paper out like old people like me do all the time. I've got to  
10 have my paper copies. But a lot of folks do things on their computers.  
11 So, we set it up that way.

12                   So, getting into the key findings and recommendations  
13 in that report, we found that 2018 had no non-weather Category 3, 4, and  
14 5 events. These are categorizations which kind of tell us about the  
15 relative severity. And we did have a hurricane, of course, Michael and  
16 Florence, which were at Category 3, and those were weather-related.

17                   Extreme weather events continue to be a leading  
18 contributor to the largest generation and distribution outages we saw in  
19 2018. But we did also see a better-than-expected performance in the  
20 Texas fleet because they've had tight reserve margins there. What that  
21 means is that we traditionally get a reserve margin based on some  
22 statistical analysis that takes us to about one event in 10 years. And that  
23 usually generates kind of a reserve margin. Then, we call that kind of a

1 target, and that's total generation divided by total load, and then, we get a  
2 percentage.

3                   So, they're getting tighter there because they've been  
4 having an acceleration in some of the units that are retiring. And even  
5 this year, I think they are at about 7 percent reserve margin, which makes  
6 engineers a little bit worried because you don't have as much flexibility if  
7 certain things happen on the system. But they were able to navigate that  
8 in 2018, and it appears that they also did that in 2019 as well. They will  
9 be doing an after-action review on that.

10                   We continue to see a downward trend in relay  
11 misoperations. That's always been one of those things that 1 in about 12  
12 operations ends up being a misoperation. We're trying to drive that  
13 number down, working with the industry, working with the manufacturers,  
14 like Schweitzer, relaying.

15                   We are seeing improving our stable frequency  
16 response. That's important because, as we start replacing generating  
17 plants with asynchronous, you know, with inverter-based, you lose some  
18 of that heft. So, how is our frequency response against events? And  
19 emerging reliability challenges we found in the inverter-based resources.  
20 And I'll get into that a little bit more, but, basically, the way they were  
21 operating.

22                   Next one, please.

23                   This is kind of "by the numbers," you might say. I

1 would focus some of your attention on the 99.92 percent of the time that  
2 there was no operator control load shedding. That essentially was one  
3 event, and I believe it was in Nova Scotia or New Brunswick. And it was  
4 for seven hours. So, if you take 7 over 8760, then you get to that  
5 number.

6 We can also see how many DOE OE-417 reports were  
7 received, 233; how many messages were in the Reliability Coordinator  
8 issues, our information system, 1855. We had one Level 2 alert, and it  
9 was around those inverters. A Level 2 means we go out and we ask for  
10 information to be sent back to NERC. We, then, wrap up a report to  
11 FERC on the results, and then, use that information to see the extended  
12 condition and next steps. So, that kind of gives you an idea kind of by  
13 the numbers and the year.

14 Next slide, please.

15 So, from an event analysis perspective, this kind of  
16 gives you an idea of the number of events we have. We gather  
17 information about individual line outages, generator outages, but also we  
18 look at events. And sometimes we do a deep dive to learn, get the  
19 lessons learned on each one of those events. And you'll see the number  
20 of Category 1, 2, and 3 to each other. You also see a relative  
21 comparison over there to the right, as well as some of the major causes,  
22 being, for example, design and engineering. Management and  
23 organization is what we see when we do the deep-dive events analysis.

1                   The next slide, then, of course, this is kind of our event  
2 analysis trends. This is when we select an event that occurs, be it a 1, 2,  
3 or 3, and then, we do a dive, working with the industry partners and  
4 regional entities. And how many reports we received, 856; how many  
5 did we actually do a deep dive on, 378. And you can see the major  
6 causes. Again, as I mentioned before, we're seeing management and  
7 organization. This is something we need to work with industry on a little  
8 bit more. Design and engineering being part of the issues around  
9 events, and then, finally, equipment failures, and that kind of thing.

10                   You'll see an overall of 116 megawatts. This is an  
11 average loss of load, but not due to weather; everything under equipment  
12 failures, et cetera. Then, you'll see an interesting trend here where the  
13 amount of average load being lost is going down, even though the  
14 number of events went up. So, that may be more around design of the  
15 system itself.

16                   Next slide, please.

17                   Let's look a little bit more now at some of the reliability  
18 indicators.

19                   Next slide.

20                   Here, this includes weather, this particular set of trends  
21 on transmission-related events that resulted in load being shed. That's  
22 why you're seeing that going up closer to 200 megawatts versus the other  
23 one being about 116. But the number has gone down, as well as the

1 amount of megawatts on average has gone down, too. So, things seem  
2 to be getting better. And this does include weather.

3 Next slide.

4 Protection rates, annual protection system, this  
5 operation rates. You'll see just a bit of a popup in 2018, but, generally,  
6 overall, the trend you can see is still heading south, which is good  
7 considering we started a little bit over 10, and now we're at about 8, we  
8 have dropped down to about 6 and a half, makes this 7 and a half.

9 And you can also see the regional variance here. Of  
10 course, we work with each one of these regions, especially when they're  
11 over, identify who the folks are and work with those folks to help them get  
12 their arms around what the issues are.

13 As you know, there's a lot of relays. And so, it takes  
14 time to start driving this rate down. Some of it is best practices. Some  
15 of it is newer relays, what have you.

16 Next slide, please.

17 Now Severity Risk Index, this is something we kind of  
18 show every year.

19 Next slide.

20 And it weighs the number of lines that go out, the  
21 amount of megawatts generations. And what you'll see overall is 2018  
22 really was a pretty good year. We had a couple of storms, winter storms  
23 and Hurricane Florence, as I mentioned before, and Michael you can see

1 kind of on the far left side.

2                   If you go to the next slide, you'll see a cumulative as  
3 opposed to a day-to-day. And again, 2018 looked pretty good compared  
4 to the earlier years.

5                   Next slide.

6                   Okay. I mentioned before our alert that went out.  
7 What we found was there was a simple line-to-ground fault on a 500-kV  
8 line, and they lost over a thousand megawatts of solar. It was spread  
9 out, of course, across the system. And working with industry and  
10 manufacturers, we identified two things. One was how they were  
11 calculating frequency, as an instantaneous versus a time-varying. And  
12 the other was that they were kind of just momentarily ceasing to operate  
13 during serious line-to-ground faults or lower voltages.

14                   So, that's not always a good thing, either one of those,  
15 and that's one reason why we're losing our inverter-based resources  
16 there, and mostly within the West, mostly in California and Nevada. But,  
17 of course, it's an issue that could be widespread across North America.  
18 So, we wanted to get our arms around it.

19                   We sent an alert asking folks, you know, how many they  
20 have; can they be fixed, and then, how would they be fixed. And so, in  
21 response to 13.5 gigawatts, you can see over here the flow diagram, that  
22 some did not use momentary cessation. So, they're staying in, staying  
23 put, and that's what you want them to do because that helps support the



1 system when you have an event. Then, of course, those that were using  
2 momentary cessation, the question is, can you fix it, because some of  
3 them may be older inverters, older control systems. And we were able to  
4 kind of get that down to about 1.8 gigawatts couldn't be fully mitigated.  
5 At least they'll know that ahead of time. So, in their operating system,  
6 they'll take that into account. And, of course, then, 2.6 could be  
7 mitigated through settings changes and some are just a fully mitigated  
8 array. The top curve kind of talks a little bit about frequency calculations  
9 and being able to fix that as well. And so, that gives you an idea.

10 We're still following up on this and making sure we've  
11 got full response, and we now kind of understand kind of the -- we've  
12 been writing a host of guidelines and design issues around this, so that  
13 we can get our arms around it. We're also addressing this through a  
14 modification of a standard.

15 Overall, the recommendations: industry needs to  
16 continue to improve their ability to understand, model, and plan for the  
17 system. These new technologies are coming really fast, and we have to  
18 be able to model and simulate and understand, perhaps even real-time  
19 modeling. So, there may be new technologies there.

20 Certainly we need to watch for frequency response  
21 under low-inertia conditions and understand how inverter-based  
22 resources can actually contribute to reliability. They can if you design  
23 them right and call for VARs and call for frequency. They can support

1 the system.

2 Also, the second item, developing comparative metrics  
3 to understand the different dimensions of resilience. And that's actually  
4 a goal NERC is building into its goal for next year.

5 And understand and share information on cyber or  
6 physical security threats, and mitigate those risks through a variety of  
7 approaches. I still believe that you can plan a more robust system, so it's  
8 more resistant to cyber-attack. And we're going to be digging into that  
9 with industry next year.

10 I was also asked to give just a quick overview of where  
11 we are with the EMP Task Force. We've been watching the research  
12 that's being done at EPRI over the last few years that included, first, the  
13 transformers, because there's three wave fronts that occur as a result of a  
14 nuclear blast over the Mother Earth, and E3, which impacts the  
15 transformers. And they found there that there was no damage to  
16 transformers. Generally, again, a voltage collapse issue, which is what  
17 we found with GMD.

18 But there is a concern around the E1, the first pulse.  
19 And they did a lot of research there showing what were the  
20 susceptibilities of certain relays. And so, looking at the results of the  
21 report, we've spun up a group to say, okay, what are the next steps for  
22 NERC? Given that we're still kind of in the middle of the research, how  
23 do we get in front of this issue? How do we start thinking about spec'ing

1 relays, potentially higher sustain rates or design issues. So, we spun  
2 this group up in May of 2019. They're gearing to have our final report to  
3 the Board in November. It's been posted for public comment.

4                   You can see kind of the phased-report approach on the  
5 next slide. This is the Phase 1, Strategic Recommendations. Then, of  
6 course, get some technical committee work ongoing; start doing some of  
7 the design and modeling. And then, of course, get a standard drafting  
8 team up and running, if it makes sense.

9                   And then, I've got kind of different types of topics that  
10 you'll see in that report: policy, government and regulators, what can  
11 they be doing? The research that needs to be done. We've got to look  
12 at generating plants. We've got to understand the impacts on distribution  
13 systems. We've got to understand how we can use different designs to  
14 mitigate the impacts and, of course, mitigation guidelines. How do you  
15 assess your vulnerability, you know, based on different types of blasts  
16 and directions?

17                   What they found, basically, was that the relay itself,  
18 when it gets that E1 pulse, it does not impact it, but it is the  
19 communication cables that come into the relay that induces a current and  
20 voltage which comes into the relay and potentially damages or, at least  
21 worst case, makes it reset. So, you're out there running, thinking you've  
22 got a relay, but you don't.

23                   And then, how do you respond and recover? How do

1 you get back up? What you're on your butt, how do you get back up  
2 again?

3 So, that's kind of a high-level review. The report itself  
4 is out for comment. I think they will be wrapping up those comments  
5 here soon and bringing it to the Board in November.

6 NRC CHAIRMAN SVINICKI: Thank you very much,  
7 Mr. Lauby.

8 Under the informal practice we've developed for these  
9 meetings for topics that fall outside the domain of a Commission, we start  
10 with those members to ask questions. And that makes some intuitive  
11 sense because we're less familiar with the topic.

12 So, for this NERC presentation, we would begin with  
13 NRC. And just kind of informally, I would ask if any of you want to jump  
14 in. Commissioner Baran?

15 NRC COMMISSIONER BARAN: Great. Thanks for  
16 the presentation, Mark.

17 On EMP, the Task Force, is it focused purely on high  
18 altitude nuclear EMP or are you looking at geomagnetic storms and other  
19 similar phenomena?

20 MR. LAUBY: We took on the GMD topic a couple of  
21 years ago. And actually now, thanks to the help with working with FERC  
22 and FERC staff, we have two standards in place for GMD.

23 NRC COMMISSIONER BARAN: Okay.

1 MR. LAUBY: And I hate to conflate EMP and GMD  
2 because the characteristics are different. It's more than a fine point  
3 difference. GMD kind of rolls on for a while and has a certain wave front,  
4 and EMP has a bit of a different, shorter wave front, even though it's an  
5 E3.

6 But we have two standards, one that says, operating, if  
7 you get a warning, how do you pre-position the system? And the second  
8 one is how you plan the system, so that you can be more robust. How  
9 do you identify your vulnerabilities, to what level, and then, what kind of  
10 mitigations are you going to put in place?

11 NRC COMMISSIONER BARAN: So here, you're  
12 focused really more on manmade?

13 MR. LAUBY: That's right.

14 NRC COMMISSIONER BARAN: Okay. And is the  
15 Task Force -- I know you mentioned EPRI -- is the Task Force conducting  
16 its own vulnerability assessments or is it considering assessments  
17 produced by others?

18 MR. LAUBY: We certainly have looked at the ongoing  
19 research. This is an area that does have -- this is an area where there's  
20 a lot of speculation, I'll say. And so, we have looked at the different  
21 reports that are out there, including those from the Air Force, certainly  
22 Oak Ridge. And we also look at EPRI's research.

23 When it comes to vulnerability assessments, the real

1 question is, how do you do them? When you're looking at a substation,  
2 how do you do that vulnerability and risk assessment, so you can understand  
3 what mitigations make sense? So, I think that will be one of the next  
4 steps here, is how to do that.

5 NRC COMMISSIONER BARAN: Okay. And is it  
6 focused mostly on transmission or are you looking at generating assets?  
7 Are you looking at nuclear power plants?

8 MR. LAUBY: Currently, right now, we're looking at the  
9 transmission assets because that's as far as the research takes us.

10 NRC COMMISSIONER BARAN: Okay.

11 MR. LAUBY: But I know that they're doing two things  
12 at EPRI. One is looking at different mitigation strategies. And second of  
13 all, they're looking at the generating plants. Third, they've got to get the  
14 distribution, because, I mean, I don't know where the load is going to be  
15 at at this point.

16 NRC COMMISSIONER BARAN: Uh-hum.

17 MR. LAUBY: You know, what's the impact on cell  
18 phones and homes and commercial operations when they're faced with  
19 this kind of wave front.

20 NRC COMMISSIONER BARAN: Okay. Great.  
21 Thank you.

22 MR. LAUBY: Thank you.

23 NRC CHAIRMAN SVINICKI: Thank you very much.

1 Any others? Yes, Commissioner Caputo?

2 NRC COMMISSIONER CAPUTO: So, you mentioned  
3 research that is being done at EPRI and perhaps within the military. Are  
4 you doing your own research as well or are you simply garnering lessons  
5 from the other research going on?

6 MR. LAUBY: Mostly garnering results from others,  
7 because EPRI doesn't -- I used to work at EPRI. That's a mind slip  
8 there. NERC doesn't do research itself, but we'll fund research. Like  
9 we have funded research on GMD or on minimum voltage requirements,  
10 and that kind of thing. But we don't do research directly ourselves,  
11 though we do tap subject matter experts from across industry who are  
12 able to develop very keen models and simulation tools. But we're not  
13 doing it ourselves.

14 NRC COMMISSIONER CAPUTO: Okay. Thank you.

15 NRC CHAIRMAN SVINICKI: Commissioner Wright,  
16 did you have any questions for this presentation?

17 NRC COMMISSIONER WRIGHT: May I talk to the risk  
18 report for a minute?

19 MR. LAUBY: Sure.

20 NRC COMMISSIONER WRIGHT: Although it's not  
21 about something that you've talked about really here, the report also talks  
22 about some of the challenges associated with staffing.

23 MR. LAUBY: With? I'm sorry?

1 NRC COMMISSIONER WRIGHT: With skilled  
2 workers.

3 MR. LAUBY: Yes.

4 NRC COMMISSIONER WRIGHT: Yes. And given the  
5 turnover in the industry, you know, we're kind of experiencing the same  
6 thing. What actions, if you can talk about it, are you taking to mitigate  
7 the loss of this expertise and the knowledge loss that's out there? And I  
8 guess are there any lessons learned from your end that you could share  
9 with us?

10 MR. LAUBY: Well, that's a good question. We have  
11 been reaching out to universities, and I'll spend time myself going to  
12 promote the power industry. I think a lot of the electric utilities are doing  
13 that more and more as well.

14 So, I see it a couple of ways. One is spend time with  
15 the universities, and even go in deeper. My daughter just started at  
16 Georgia Tech, and I've been working with her to get to engineering most  
17 of her life, because you stay on math, right? Sometimes teachers don't  
18 know what the math is going to be used for, you know, see how practical  
19 it is.

20 So, working with the schools and universities, and then,  
21 also, bringing in co-op students and student engineers, even if they  
22 haven't really picked the power program, because I'm thinking of it from  
23 an engineering perspective, because that's how I got turned into energy,



1 was a power company, Northern States Power said, "Yeah, why don't you  
2 come work for us for a summer?" And then, I stayed with it for the rest of  
3 my career. So, I think making sure you're tight with the educational  
4 system I think will help a great deal.

5 NRC COMMISSIONER WRIGHT: Is there an area  
6 within -- because you're in various levels throughout -- but is there an  
7 area that concerns you more than another?

8 MR. LAUBY: My concern mostly has been the skill  
9 sets.

10 NRC COMMISSIONER WRIGHT: Right.

11 MR. LAUBY: This is not your grandfather's or  
12 grandmother's engineering anymore. You have to worry about cyber and  
13 building that into your designs. Well, how many people coming out of  
14 school in power systems know anything about cyber systems, right? So,  
15 I'm really concerned about the skill sets that we're getting people ready to  
16 help us support the system of the future. Communications, the interplay  
17 between multiple sectors -- gas, electric, communications, water -- getting  
18 that understanding.

19 NRC COMMISSIONER WRIGHT: Thank you so much.

20 NRC CHAIRMAN SVINICKI: Thank you.

21 Before I turn it over to Chairman Chatterjee, maybe I'll  
22 just have one question for you, Mark. You mentioned the new  
23 technologies are coming at you pretty fast and the need to really have

1 high-fidelity modeling and simulation. I know that the Department of  
2 Energy National Laboratories, of course, have been funded to do  
3 extensive modeling of energy systems and things. Does NERC draw on  
4 that? Or do you have kind of centers of competencies or excellence on  
5 the modeling and simulation for the electrical grid system?

6 MR. LAUBY: Yes, we've been working really close  
7 with DOE and Bruce Walker. We're waiting for the NARMS model to  
8 come out. In fact, we have assigned one of our staff just basically  
9 full-time to work with the DOE on the NARMS model itself. So that, when  
10 it comes out, it's something we're going to find useful. And the way I  
11 understand it, I should be getting that model in five days, is what I've been  
12 told, the end of the third quarter. And that will be a starting point,  
13 steady-state gas-electric interplay. And then, once they state that, that  
14 means ending up putting the dynamics in there. And then, the next step,  
15 I guess, is to take and put dynamics in there, as well as cyber systems.  
16 Now we're getting multiple systems. So, we are working closely with  
17 Bruce Walker and his team over there at DOE.

18 NRC CHAIRMAN SVINICKI: Well, thank you very  
19 much. And you obviously are eagerly anticipating it if you have a day  
20 clock going.

21 MR. LAUBY: I'm looking forward to it.

22 NRC CHAIRMAN SVINICKI: So, I hope they get you  
23 what you need on time.

1 Chairman Chatterjee, please.

2 FERC CHAIRMAN CHATTERJEE: Thank you, Mark,  
3 for that excellent presentation and the great work that you and the folks at  
4 NERC do.

5 I just wanted to briefly touch on what you raised about  
6 the attention that NERC is paying to inverter-based resources. And I just  
7 wondering if you could elaborate on where NERC is with that work and  
8 how it may translate into concrete action for industry and government?

9 MR. LAUBY: Yes. Well, it's, again, another good  
10 question. As soon as we found out about this issue with all the  
11 photovoltaic resources coming offline, we spun up a quick task force,  
12 which included manufacturers; organizations in the West; our regional  
13 partner there, WECC, and just kind of got quickly to the bottom what the  
14 issues were. And then, we formalized that into what we call the  
15 Inverter-Based Resource Task Force, which now I think we're going to  
16 promote to subcommittee. The difference between the two is that one  
17 has longevity and one just gets wound up at the end.

18 And during that, its time right now, a couple of things  
19 have happened. They've created a SAR, so we can improve the  
20 standard, PRC-24. They've had about four guidelines, one on modeling,  
21 one on how you simulate, one on how you might adjust the controls.  
22 And there's over 100 people on this. So, I think there is a great deal of  
23 interest.

1                   And why? Because it's not only going to be impacting  
2 our photovoltaic resources, but battery resources used, as you know,  
3 inverters. Anything that creates DC current or DC voltage has to be  
4 converted to AC. So, even wind uses a lot of inverters. So, we need to  
5 get this right, and working with manufacturers, some of which are in  
6 Europe as well as here in North America, making sure that  
7 they -- because they want their designs to work. They want them to be  
8 there to support the system.

9                   And then, understanding what's the impact on the  
10 system when you have these asynchronous resources which are kind of  
11 separated. You know, the heft is kind of separated from the system by  
12 these inverters. And understand the impacts and frequency response.  
13 So, we're also, then, going through and simulating those with the industry.

14                   So, I think the action is being taken. The adjustments  
15 are being made on the photovoltaics. We know that. We're going to  
16 follow up with them, make sure that it's all been done.

17                   WECC is working with each one of those, looking at  
18 PRC-24 and saying and wondering if they were following that to the "T".  
19 Because momentary cessation versus tripping, what's the difference?  
20 So, yes, we have that kind of a vernacular. But, yes, we're working on it,  
21 yes.

22                   FERC CHAIRMAN CHATTERJEE: Thank you.

23                   NRC CHAIRMAN SVINICKI: Commissioner Glick?

1 FERC COMMISSIONER GLICK: Thank you.

2 So, Mark, you mentioned the after-action review and  
3 that you're doing it with regard to Texas, given the experience this past  
4 summer and the summer before where they had a low reserve margin,  
5 but they managed to keep the lights on.

6 I'm wondering -- and I know that you're probably looking  
7 at this in the review -- do we need to think about reliability a little bit  
8 differently, especially reserve margins? Do we need the excessive, you  
9 know, the substantial reserve margins in some of the regions, or newer  
10 technologies and newer techniques, is that really alleviating some of the  
11 need for high reserve margins?

12 MR. LAUBY: I always think of reserve margins as  
13 really a multi-dimensional metric, not just 10 percent, 15 percent. So, I  
14 think you put your finger on something that's very interesting. We've  
15 been looking at California, Texas, and New England, and saying, what's  
16 happening there and how are they getting through?

17 And one of the answers appears to be energy. And  
18 how do you make sure you plan a system that has enough energy, not  
19 just reserve margins, but energy. Because the way Texas is getting  
20 through is they've got a certain kind of price-responsive loads. So, when  
21 the price gets high, they come off, and that's helped them. That's kind of  
22 built in, you might say, an additional amount of energy reserves, you  
23 might say.

1                   So, I think that's one of the reasons why we're also  
2 interested in this tool that DOE is creating, because we can put a time  
3 component on it and start calculating energy needs, and are there ways  
4 in which we can start thinking about building a system with a sufficient  
5 amount of energy at all times to serve the energy needs of the system.  
6 And that takes you away from this, because there's a lot of assumptions  
7 in reserve margins. There's assumptions of fuel availability and  
8 assumptions on the reliability of the equipment. And this helps us kind of  
9 walk a little bit, step away from that, and really kind of get down to what  
10 my boss called the "secret sauce". So, yes.

11                   FERC COMMISSIONER GLICK: Thank you.

12                   NRC CHAIRMAN SVINICKI: Thank you.

13                   Commissioner McNamee?

14                   FERC COMMISSIONER MCNAMEE: In the  
15 presentation you demonstrated where there's been problems in  
16 transmission. So, it's historical data that tells you where the problems  
17 have been, which, then, rightly so, you want to invest money or you want  
18 to invest in creating a standard to address that. How does NERC  
19 approach dealing with high-impact, but low-frequency events to make  
20 sure that we're focused on things that may not be showing up, but if they  
21 do show up, they're going to have some dramatic impact?

22                   MR. LAUBY: Sure. And, of course, I would say the  
23 GMD would be one of those. I would say EMP would be one of those,

1 right, those high impact, cyber-attack. We've been fortunate in not  
2 having something that's widespread, but we stay in front of those.

3 And so, it's one of those things where I think it's  
4 mentioned in the risk report they look forward; they try to identify some of  
5 those potential high-impact events, even if we haven't experienced them  
6 yet, and make sure we have measures in place, be they through  
7 guidelines; if it makes sense, through a standard, to address them.

8 In my mind, it all comes down to the four quadrants.  
9 High impact, high likelihood, better have a standard there. High impact,  
10 low likelihood, maybe you want a standard there. Highly likely, but no  
11 impact, probably guidelines that are low impact. And so, you kind of go  
12 through the four quadrants. I've lost track.

13 But we're actually putting together a white paper on this  
14 because we want to have a conversation with industry about when is a  
15 standard appropriate, and not the conversation of -- the only answer is  
16 not a standard. I mean, not all things need standards. I get that. But  
17 what things do need standards, and make sure we have a conversation  
18 with industry about it, yes.

19 NRC CHAIRMAN SVINICKI: Thank you very much.

20 Next, we will hear presentations from two of the FERC  
21 staff. First, we will hear from Mr. David Huff, who is an electrical  
22 engineer in the Office of Electrical Reliability. And next, I'm going to  
23 apologize because on our scheduling notice we have Mr. Anuj -- it's

1 spelled Kapadia, but I note your nameplate is different. So, my  
2 apologies, and I'm no stranger to having my name misspelled. But I  
3 really apologize for that.

4 (Laughter.)

5 But he is an electrical engineer with the Office of  
6 Electric Reliability, and he will give the second FERC presentation.

7 And again, please, if you would, would you pronounce  
8 your name correctly? Which of the two is correct?

9 MR. KAPADIA: It's Anuj, Anuj Kapadia. Thank you.

10 NRC CHAIRMAN SVINICKI: Okay. Thank you very  
11 much.

12 And we will begin with Mr. Huff.

13 MR. HUFF: Thank you, and good morning, Chairman  
14 Svinicki, Chairman Chatterjee, and Commissioners.

15 I will provide you an overview of the 2019 FERC and  
16 NERC staff report on the South Central United States Cold Weather Bulk  
17 Electric System Event of January 17, 2018.

18 Next slide, please.

19 I am with FERC's Division of Compliance in the Office of  
20 Electric Reliability. The Division's role is to monitor the compliance of the  
21 users, owners, and operators of the bulk power system with reliability  
22 standards through audits as well as through analyses and investigations  
23 concerning events on the bulk power system.



1                   And we'll just hold on that slide there.

2                   The inquiry which led to the report arose out of two  
3 presentations describing the January 17, 2018, event to FERC staff, one  
4 by the Midcontinent Independent System Operator, or MISO, and the  
5 other, a combined presentation by Southwest Power Pool, or SPP;  
6 Tennessee Valley Authority, or TVA, and Southeastern Reliability  
7 Coordinator, or Southeastern RC, represented by Southern Company, as  
8 well as other joint parties to a settlement agreement between MISO and  
9 SPP; namely, Associated Electric Cooperative, Louisville Gas & Electric,  
10 Kentucky Utilities, and Power South.

11                  Following these presentations, the Commission and  
12 NERC announced a joint inquiry with the regional entities, siting, among  
13 other factors, reports of multiple forced generation outages, voltage  
14 deviations, and near-overloads, and the need to understand and  
15 underscore the importance of seamless Reliability Coordinator, or RC,  
16 interactions.

17                  Next slide, please.

18                  The event occurred on January 17, 2018, when a large  
19 area of the South Central Region of the United States experienced  
20 unusually cold weather due to an Arctic high pressure system moving  
21 from the Northern Plains to the Central and Eastern U.S., which was  
22 forecast several days in advance. This resulted in average temperatures  
23 dropping well below freezing, with temperatures up to 28 degrees

1 Fahrenheit below normal.

2 Next slide, please.

3 Between January 15 and January 19, the  
4 below-average temperatures in this area resulted in a total of 183  
5 individual generators experiencing either an outage, a derate, or a failure  
6 to start. By the start of January 17<sup>th</sup>, morning peak hour, counting the  
7 already planned and unplanned outages, the four RCs had over 30,000  
8 megawatts of generation unavailable in the South Central United States  
9 portions of their footprints. This was approximately 25 percent of the  
10 generating capacity in the event area.

11 Next slide, please.

12 While the significant unplanned outages and derates of  
13 generators in the event area was the primary cause of the event, several  
14 other factors contributed to the bulk electric system conditions faced by  
15 system operators the morning of January 17, including the increased  
16 electricity demand.

17 Most of the affected entities' peak electricity loads  
18 exceeded their forecast 2017-2018 winter peak loads. Further, the peak  
19 loads for the SPP footprint and the MISO South Region broke previous  
20 winter peak records and neared MISO South's all-time summer peak  
21 demand.

22 Also, MISO's Regional Directional Power Transfer, or  
23 RDT, sourced from MISO's generation reserves in their northern area,

1 was used to help cover their record winter electricity demand and  
2 unavailable generation in MISO South. The RDT suddenly increased in  
3 a north-to-south direction, affecting the RC footprints of MISO, SPP, TVA,  
4 and Southeastern RC. The RDT reached a measured maximum of  
5 4,331 megawatts, exceeding MISO's and SPP's agreed-upon limit of  
6 3,000 megawatts.

7 Further, remote generation power transfers, including  
8 MISO's and SPP's dispatch of wind generation and power transfers  
9 between SPP and ERCOT Interconnection, contributed to the bulk  
10 electric system conditions faced by system operators that day.

11 Next slide, please.

12 As a result of the unavailable generation of MISO  
13 South, MISO declared an energy emergency because it had insufficient  
14 reserves to balance generation and load in MISO South's portion of its  
15 footprint, where it initiated voluntary load reduction. In addition, all four  
16 of the RCs experienced constrained bulk electric system conditions  
17 across portions of their footprints spanning all or parts of nine states.

18 Next slide, please.

19 A comparison of below-freezing temperatures and  
20 unplanned generation outages and derates in the event area from  
21 January 15th to 19th indicated a correlation between generation outages  
22 and cold temperatures, meaning that, as temperatures decreased,  
23 unplanned generator outages and derates increased. For this

1 timeframe, of the 44 percent of the unplanned outages and derates that  
2 were related to extreme cold weather, 14 percent were directly attributed  
3 by the generator owners to weather-related causes, including frozen  
4 sensing lines, frozen water lines and valves, and low-temperature cutoff  
5 limits. The other 30 percent were indirectly attributable to weather,  
6 including mechanical causes known to be related to cold weather and gas  
7 supply curtailments to natural-gas-fired generators.

8 Gas supply issues caused by extreme cold  
9 temperatures, including interruptible supply, low gas pressure, and other  
10 pipeline and gas supply issues, led to outages of 38 units, for a total of  
11 approximately 2,200 megawatts. Also, the team found that one-third of  
12 the generator owner-operators did not have winterization procedures, and  
13 temperatures in the area where the cold weather event occurred were  
14 generally above the ambient temperature design specifications for many  
15 natural-gas-fired generating units.

16 Next slide, please.

17 The relevant RCs -- MISO, SPP, TVA, and  
18 Southeastern RC -- had situational awareness throughout the event and  
19 communicated as necessary to preserve system reliability. The RCs  
20 were regularly performing assessments to determine the next courses of  
21 action. MISO issued energy emergency alerts, purchased emergency  
22 energy, and implemented voluntary load-reduction measures.

23 MISO South's reserves were down to 172 megawatts

1 for the morning peak hour ending 8:00 a.m. Central Time, and if the next  
2 worst single generator contingency of 1163 megawatts in MISO South  
3 occurred, it would have likely resulted in firm load shed to maintain  
4 generation and load balance, while simultaneously triggering further and  
5 additional firm load shed in specific areas of the MISO South footprint to  
6 maintain bulk electric system voltages within limits.

7 Next slide, please.

8 The report identifies 13 recommendations to improve  
9 bulk electric system reliability. For generator cold weather reliability, the  
10 team recommends a three-pronged approach, including development or  
11 enhancement of NERC reliability standards, enhanced outreach to  
12 generator owner-operators, and market rules, where appropriate, to  
13 address the following needs:

14 The need for generator owner-operators to perform  
15 winterization activities to prepare for adverse cold weather, including  
16 implementing freeze protection measures, along with adequate  
17 maintenance and inspection of freeze protection elements;

18 And gas-fueled generating units clearly informing their  
19 RC and balancing authority whether they have firm transportation  
20 capacity for the natural gas supply;

21 And the need for generator owner-operators to ensure  
22 the accuracy of the generating plants' ambient temperature design  
23 specifications and share these with the RCs and balancing authorities.

1 Next slide.

2 Finally, the need for RCs and balancing authorities to  
3 be aware of the specific generating units' limitations, such as ambient  
4 temperatures beyond which they cannot be expected to perform, and take  
5 these limitations into account in their operating processes.

6 Next slide.

7 The other 12 recommendations pertain to transmission  
8 reserves, which include:

9 Recommending RCs should perform real-time voltage  
10 stability analysis, in addition to real-time contingency analysis, or RTCA,  
11 for constrained conditions occurring within their own or within adjacent  
12 RC areas, such as those experienced by MISO the morning of January  
13 17, and communicate the results of the analysis to adjacent RC areas.  
14 Real-time voltage stability analysis could assist the RCs in determining if  
15 other mitigation actions are necessary, as well as whether an emergency  
16 condition exists.

17 Next slide.

18 Also, recommendations include:

19 Jointly developing seasonal transmission studies and  
20 simultaneous power transfer studies to be better prepared for seasonal  
21 extreme conditions;

22 Balancing authorities considering deliverability of  
23 reserves to avoid stranded reserves;

1                   And improving load forecasts for extreme days such as  
2     January 17, 2018.

3                   Next slide.

4                   This concludes staff's comments, and following the next  
5     presentation by Anuj, I will be happy to answer any questions you might  
6     have. Thank you.

7                   NRC CHAIRMAN SVINICKI: Thank you.

8                   Anuj, please proceed.

9                   MR. KAPADIA: Thank you, Dave.

10                  Good morning, Chairman Chatterjee, Chairman  
11     Svinicki, and the Commissioners. My name is Anuj Kapadia, and I am  
12     an electrical engineer working in the Office of Energy Infrastructure  
13     Security, recently transferred from the Office of Electric Reliability.

14                  Next slide, please. Next slide.

15                  Today, I will be presenting on FERC's Order 841,  
16     Electric Storage Participation in Markets Operated by Regional  
17     Transmission Organizations, RTOs, and Independent System Operator,  
18     ISOs; and will also give an overview of the electric storage resources.

19                  Next slide. Next slide.

20                  On November 17th, 2016, the Commission issued a  
21     Notice of Proposed Rulemaking, NOPR, proposing to require each  
22     RTO/ISO to revise its tariff to establish a participation model consisting of  
23     market rules recognizing the physical and operational characteristics of

1 electric storage resources and which accommodates their participation in  
2 the wholesale markets. The NOPR also proposed new market rules to  
3 allow distributed energy resource aggregators to participate directly in the  
4 wholesale organized markets.

5 Next slide, please.

6 In February 2018, the Commission issued a Final Rule  
7 requiring RTOs/ISOs to establish a participation model ensuring electrical  
8 storage resources are eligible to provide all capacity energy and ancillary  
9 services they are technically capable of providing. The Final Rule  
10 proposed the following:

11 RTO/ISO tariffs should include bidding parameters that  
12 reflect the physical and operational characteristics of electric storage  
13 resources.

14 Electric storage resources be able to be dispatched and  
15 set the wholesale market clearing price as both a wholesale seller and  
16 wholesale buyer.

17 RTO/ISO tariffs establish a minimum-sized requirement  
18 for electric storage resources not to exceed 100 kilowatts.

19 And last, electric storage resources be able to pay the  
20 wholesale price for charging energy that they resell back into the  
21 wholesale markets.

22 Next slide, please.

23 Regarding the DER aggregation and the Final Rule,



1 actually, the Commission recommended that more information was  
2 needed and did not take final action in the Final Rule establishing new  
3 separate proceedings.

4 In February of 2018, Order 841 was issued. In  
5 December of 2018, the entities filed their compliance filing with the  
6 Commission. Staff is currently reviewing them and will provide direction  
7 back to the RTOs/ISOs.

8 Next slide, please. Next slide.

9 Order 841 defined electric storage resources as a  
10 resource capable of receiving electric energy from the grid and storing it  
11 for later injection to the electric energy back to the grid.

12 An electric storage resource has bidirectional electric  
13 and storage capabilities and is characterized by both power capacity,  
14 which is megawatts, and energy capacity, which is megawatt per hour.

15 Next slide, please.

16 This slide shows a few examples of electric storage  
17 technologies. The difference between the first two type of batteries,  
18 which are solid-state and flow batteries, is that the conventional batteries  
19 store energy in a solid electrode system, while the flow batteries rely on  
20 storing charge in at least one liquid. Examples of solid-state include  
21 lithium ion, solid sulfur, lead acid, and nickel cadmium batteries.

22 Flywheels store energy kinetically with spinning rotor.  
23 The compressed air energy storage utilizes compressed air to create an

1 important energy reserve. Pumped hydro, which charges large-scale  
2 reservoirs of energy with water, and lastly, advanced rail energy storage  
3 stores energy by raising the elevation of mass against the force of gravity  
4 and recovers the stored energy as the mass is returned back to the  
5 original location.

6 Next slide, please.

7 This slide shows a few examples of storage projects.  
8 The first one was a gas leakage at the Aliso Canyon facility which  
9 resulted in constraint to the grid. The solution for this was three large  
10 storage projects totaling to 70 megawatts and 280 megawatt-hours.

11 The second was a project of PG&E, replacing three gas  
12 plants with 568 megawatts of storage capacity. This project is scheduled  
13 to be completed and to come online by the end of 2020.

14 The third is a hybrid project of 100 megawatts of  
15 storage in SoCal Edison. This is a project which is combined with 1284  
16 megawatts of a gas-fired plant. Commercial operation for this project is  
17 scheduled to be 2021.

18 The last is a proposed pumped hydro project in Arizona  
19 totaling to 2,000 megawatts. This project is scheduled to be online  
20 between 2025 and 2028.

21 Next slide, please.

22 This slide shows U.S. utility scale battery storage power  
23 capacity as of March 2019. The two largest operating utility scale battery

1 storage sites in the United States as of March 2019 provide 40  
2 megawatts of power capacity each.

3 In the U.S., 16 operating battery storage sites have  
4 been installed with a power capacity of 20 megawatts or greater. As of  
5 March 2019, the total current operating utility scale battery storage is 889  
6 megawatts, and planned to come online through 2023 is 1623. If these  
7 planned facilities come online as scheduled, total U.S. utility scale battery  
8 storage power capacity would nearly triple by the end of 2023. The  
9 largest two sites account for 725 megawatts and are planned to start  
10 commercial operation in 2021, which is why you see the spike in the  
11 2021.

12 Next slide, please.

13 This slide shows a breakdown of operating battery  
14 storage by state. Of the 889 megawatts of installed operating battery  
15 storage reported by states as of March 2019, California, Illinois, and  
16 Texas account for less than half of the storage capacity.

17 Next slide, please.

18 Storage business cases are currently built on  
19 generating revenue streams by providing services to the wholesale  
20 markets or other customers, such as utilities or retail customers, or being  
21 used to avoid investment in more costly infrastructure. The ability to  
22 provide multiple services potentially to multiple entities has long been  
23 touted as the "secret sauce" of electric storage resources. Removing

1 technical and regulatory barriers to be able to engage in multiple-use  
2 applications will help unlock more value for the energy storage resources.

3 Next slide, please.

4 Bulk battery storage capacity continues to grow, driven  
5 by state-led policies and rapid cost decreases. State mandates will drive  
6 near-term storage investments. Longer-term cost decreases in lithium  
7 ion and other battery technology will likely lead battery storage to be  
8 increasingly cost competitive. Lastly, additional cost savings may come  
9 from pairing of solar and battery storage projects.

10 This concludes my presentation, and I'm happy to take  
11 any questions you may have.

12 NRC CHAIRMAN SVINICKI: Well, thank you both for  
13 those presentations.

14 For the FERC presentations, we will begin once again  
15 with questions from the NRC Commissioners. Does anyone want to  
16 jump in? Commissioner Baran? Thank you.

17 NRC COMMISSIONER BARAN: Thanks.

18 I have a question on cold weather, and then, one on  
19 electric storage. On cold weather, the NRC has regulations requiring  
20 nuclear power plants to have procedures to prepare for cold weather or  
21 winter storms. And we actually inspect those procedures. I'm trying to  
22 get a sense of what the situation is for non-nuclear generating assets.  
23 Do they have similar winterization procedures and are there standards

1 governing those winterization procedures?

2 MR. HUFF: Currently, there are no requirements for  
3 winterization for the non-nuclear generators or for generation in the  
4 reliability standards.

5 NRC COMMISSIONER BARAN: Is it pretty common,  
6 though, that they have formal winterization procedures?

7 MR. HUFF: What the team found as far as for the area  
8 that was affected by this event, the team found that one-third of the  
9 generator owner-operators did not have winterization procedures, which  
10 two-thirds, they did find that they did have procedures for winterization.

11 NRC COMMISSIONER BARAN: And do you have a  
12 sense? Is that something that differs, depending on kind of the  
13 geographic area of the country? Is it more common to have winterization  
14 procedures up north and less common down south, where this occurred?

15 MR. HUFF: The team didn't analyze outside of the  
16 event area, but the team did analyze -- and it's included in the  
17 report -- some differences and it provides an understanding of the  
18 differences between the northern and southern construction of generating  
19 units. And what's found in kind of the southern areas of the United  
20 States, there's open-frame construction for generators that, as long as  
21 they would have freeze protection measures in place when the  
22 temperature dropped, that would help prevent the freezing, but they're  
23 exposed in more the southern areas versus the northern, where the

1 generators have an enclosed generator design inside buildings.

2 NRC COMMISSIONER BARAN: All right. Thank you.

3 And in terms of the market experience with electric  
4 storage, I know this is going to be very market-specific, but is there kind  
5 of any general statements that can be made about the effect electric  
6 storage has on wholesale electricity prices during the day versus at night?

7 Does it generally reduce them during the day and increase them at  
8 night? I'm trying to understand how more electric storage capacity would  
9 affect the revenue of nuclear power plants that generate electricity  
10 throughout the night when demand is low.

11 MR. KAPADIA: I would say the storage can be used,  
12 say, for example, by a nuclear plant to actually store energy when you  
13 don't have that much of a load, and then, use it the next day. And that's  
14 why I think the whole system cost would reduce overall.

15 NRC COMMISSIONER BARAN: Okay. And do you  
16 have a sense of, you know, if we're talking about nuclear generating  
17 units, the kind of overall effect it has on their revenue from wholesale?

18 MR. KAPADIA: I don't have the costs per se, but I  
19 would assume it would go down.

20 NRC COMMISSIONER BARAN: Thank you.

21 NRC CHAIRMAN SVINICKI: Thank you.

22 Other members of the NRC? Commissioner Caputo?

23 NRC COMMISSIONER CAPUTO: Hi. I'd like to just

1 take Commissioner Baran's question a little bit further in terms of  
2 winterization procedures. How close was the correlation between the  
3 generation sources that were lost with the lack of winterization  
4 procedures? Was there a direct correlation or were there cases where  
5 they had winterization procedures and they were still ending up in a  
6 shutdown?

7 MR. HUFF: The team did not analyze that relationship  
8 where winterization procedures didn't exist as far as how that impacted  
9 that availability of that generator. But what the report contains  
10 information on, and what we did analyze, was that there is a 0.7  
11 correlation between temperature decrease and the unavailability of the  
12 generation in the event area. So, that was the level that we focused on.

13 NRC COMMISSIONER CAPUTO: So, there may be  
14 situations where generators had procedures and followed their  
15 procedures and they still came off, and vice versa?

16 MR. HUFF: Yes, or -- yes.

17 NRC COMMISSIONER CAPUTO: Where they may  
18 not have had winterization procedures, but they did stay on?

19 MR. HUFF: Yes. Yes.

20 NRC COMMISSIONER CAPUTO: Okay. Thank you.

21 NRC CHAIRMAN SVINICKI: Thank you.

22 Commissioner Wright?

23 NRC COMMISSIONER WRIGHT: Thank you so much.

1 David, I like your name, by the way.

2 (Laughter.)

3 You know it does mean "beloved" in the Hebrew.

4 So, let me ask you a question about the generator  
5 owner-operators thing. How likely are they to implement your  
6 recommendations? Do you have a sense?

7 MR. HUFF: Well, for the first recommendation, it's a  
8 recommendation for a three-pronged approach, which one is a  
9 recommendation for a standard to be developed, which it's a process  
10 that's been established under the nuclear reliability standards, and NERC  
11 leads that. So, that will be a process where there will be a proposal for a  
12 standard, or a standards authorization request is the starting point. And  
13 then, that will be an industry-driven process to move that forward and to  
14 come up with the right language for the standard. So, the generator  
15 owner-operators are stakeholders in that process. So, they can weigh-in  
16 on the development of that standard, so that it's the appropriate approach  
17 there.

18 The other two approaches, market rules, the RTOs, the  
19 Regional Transmission Organizations, and the Independent System  
20 Operators, they may come up with protocols and have those established  
21 that the generator owner-operators to be part of that market, and would  
22 then need to follow those protocols to be participating in that market. So,  
23 that one would be driven from the ISO/RTO end.



1                   So, there are some voluntary aspects to the generator  
2 owner-operators moving this forward and what the team is  
3 recommending, but the standard is one of the approaches that is a  
4 backstop in the sense to establish winterization steps.

5                   NRC COMMISSIONER WRIGHT: So, if we continue to  
6 see what appears to be a lot of record-breaking seasonal changes right  
7 now, do you expect future generation outages, even if all the  
8 recommendations were put into place? And if so, what type of other  
9 potential remedies do you foresee or are you considering?

10                  MR. HUFF: Well, the team, with the recommendations  
11 that are in the report, the goal is that they would remediate or they would  
12 alleviate those conditions. So, those generators that would take those  
13 steps to winterize would, then, be available. The other component of  
14 that is that the generator may elect not to winterize, but at least they are  
15 making their design specification and what they've implemented at their  
16 plant accurate, and they're communicating that to the Reliability  
17 Coordinator and balancing authorities, so that they know that the  
18 generator won't be available during those cold weather times.

19                  So, I think that all of those steps in place will help  
20 alleviate the event, the conditions that were experienced during this  
21 event.

22                  NRC COMMISSIONER WRIGHT: I've got one more  
23 question. And I kind of want to understand the hot and cold thing a little

1 bit more. So, what kind of increase in failures or stress and grid reliability  
2 do you see related to cold weather as opposed to hot weather? And how  
3 are hot weather grid reliability actions, how are they similar or how do  
4 they differ from those of cold?

5 MR. HUFF: If I understand your question, our team  
6 was focused on looking at the event, and this was a winter event.

7 NRC COMMISSIONER WRIGHT: Right, right.

8 MR. HUFF: So, generators, you know, for what we're  
9 talking about, not having freeze protection measures is an issue in the  
10 winter --

11 NRC COMMISSIONER WRIGHT: Right.

12 MR. HUFF: -- but wouldn't necessarily be an issue at  
13 all as far as making sure that those units are available in the summer.  
14 They're going to have to have enough ventilation, and so forth, to be  
15 available, so that they can operate those units to their full capability  
16 during the summer. So, that would not come into play there. The team  
17 was focused really looking at the winter, the winter issues.

18 NRC COMMISSIONER WRIGHT: Fair enough.

19 Thank you.

20 NRC CHAIRMAN SVINICKI: Well, thank you both for  
21 the presentation. And everyone's questions were so precise. So, I was  
22 kind of sitting here thinking about the benefit of these meetings  
23 sometimes is that we can explore our intellectual curiosity. I also have a

1 take-away from all of these meetings where my feeling is I'll take the  
2 simplified problem set of nuclear safety and security regulation over what  
3 my colleagues at the FERC have to deal with.

4 (Laughter.)

5 I have that feeling. It's like that I think Greek mythology  
6 where everyone lays their issues out on the table and you'll happily take  
7 your own set of problems back and let everyone take their set.

8 But I had an opportunity this summer -- so this is about  
9 electric storage -- to visit with some folks who run, well, we used to call  
10 them "server farms". I don't know. Are they data centers? So, it's the  
11 cloud. You know, it's the people running these facilities that have such  
12 huge power needs.

13 But something I hadn't thought about is their incredibly  
14 rigorous demand for power quality and reliability, because they have  
15 everyone's iPhone photos and things we can't live without. But they are  
16 really, obviously, investing a lot in R&D on storage.

17 And so, when the presentation mentioned that we do  
18 forecast perhaps that we will continue to see this kind of rapid adoption or  
19 investment in storage capacity here in the United States, is it truly that the  
20 technology of storing the energy, is there a cost decrease in that that's  
21 rapid in the same way that, you know, photovoltaics and things have just  
22 seemed kind of almost leapfrogs of technology innovation and  
23 cost-effectiveness? Is it a bunch of things working in concert? But is

1 the technology itself just becoming cheaper?

2 MR. KAPADIA: The technology is definitely getting  
3 cheaper. From what I understand, between 2010 and 2018, the average  
4 cost of lithium ion batteries, which are widely used right now, has fallen by  
5 85 percent.

6 NRC CHAIRMAN SVINICKI: Wow.

7 MR. KAPADIA: And according to Bloomberg Energy  
8 Finance, a research firm forecast that the cost will continue to fall by  
9 another 45 percent by 2024. So, it's definitely getting cheaper.

10 NRC CHAIRMAN SVINICKI: So, as you all look at  
11 these issues, I assume, then, you're kind of preparing yourself for an  
12 overall portfolio of assets in the U.S. system that would have a greater  
13 and greater degree of energy storage? I know some of these data  
14 centers also, you know, they want to be selling some power back into the  
15 system. So, it gets to a very complicated, multi-variable equation, but it's  
16 another change dimension that it seems like the FERC analysts have to  
17 kind of build into their models and be thinking about its systemwide  
18 effects.

19 MR. KAPADIA: Absolutely.

20 NRC CHAIRMAN SVINICKI: Which should be  
21 advantageous, I would think. I mean in terms of the overall system.

22 MR. KAPADIA: It can be used as a generator and can  
23 be used as a load. So, it's definitely an advantage for the system.

1 NRC CHAIRMAN SVINICKI: Okay. Thank you very  
2 much.

3 I'll turn it over to Chairman Chatterjee.

4 FERC CHAIRMAN CHATTERJEE: Thank you,  
5 gentlemen, for those excellent presentations and all the good work that  
6 you do on these projects.

7 I've been very bullish on storage because it can provide  
8 many services. One of the possible uses that has been proposed for  
9 storage is in system restoration from a black-start condition. Obviously,  
10 one critical element of black-start is getting offsite power back to nuclear  
11 facilities as quickly as possible. How could the use of storage help a  
12 utility during black-start operations? And have we seen any utilities or  
13 RTOs moving to integrate the use of storage into their black-start plans?

14 MR. KAPADIA: I am not aware of anyone using the  
15 black-start as of yet, but that is definitely an application which the industry  
16 is looking forward for. It can be used as a cranking part. I mean, you  
17 know, when you lose all the generators, when you actually need a  
18 cranking part, you can actually just crank up a battery and use it as a  
19 cranking part to maybe just open up a generator or turn it on, or  
20 something along those lines. So, it can be used as a restoration, but I  
21 don't think the industry is using it right now.

22 FERC CHAIRMAN CHATTERJEE: That's very helpful.

23 Another possible application that's been discussed for

1 storage is energy arbitrage. In other words, when there's excess  
2 electricity and discharging during peak hours, we know that nuclear plants  
3 in certain parts of the country have struggled with negative pricing during  
4 certain hours. Could the proliferation of storage resources help address  
5 some of those issues?

6 MR. KAPADIA: Absolutely. Going back to  
7 Commissioner Jeff's question, I think you can store the energy while it's  
8 negative, and then, actually use it for the next day, increasing the revenue  
9 for the whole system. Actually, decreasing the cost for the system, but  
10 increasing the revenue for the resource.

11 FERC CHAIRMAN CHATTERJEE: Thank you for that.

12 Dave, you mentioned that we've had previous cold  
13 weather events like this over the last several years. Have we seen any  
14 specific performance issues with nuclear generators during these events?

15 And also, I know that, as a result of these events, NERC has developed  
16 best practices for generator weatherization. Are those generally  
17 applicable to nuclear as well, and if so, how have the operators done in  
18 implementing those recommendations?

19 MR. HUFF: As far as nuclear, there's not been seen  
20 an issue with the winterization. The issues have been seen in the most  
21 recent event here, the January 2018, or January 17, 2018 event was  
22 gas-fired generators. They were a large percentage impacted by  
23 weatherization.

1                   As far as practices go, there have been generators that  
2 have taken advantage of those best practices that have come out since  
3 the 2011 Southwest U.S. event that occurred in February of 2011, and  
4 especially the area of ERCOT-Texas, which was one of the areas, a large  
5 portion of that 2011 event, and they've implemented some protection  
6 measures regarding winterization and have had success there.

7                   FERC CHAIRMAN CHATTERJEE: Thank you.

8                   NRC CHAIRMAN SVINICKI: Thank you.

9                   Commissioner Glick?

10                  FERC COMMISSIONER GLICK: Thank you.

11                  I just wanted to follow up on Chairman Chatterjee's  
12 questions, some of the other questions regarding winterization. But  
13 primarily, I'm just curious if you have statistics of what the percentage of  
14 the plants, the 25 percent of the plants that were out, how they broke  
15 down between gas, nuclear, coal, other technologies.

16                  MR. HUFF: Taking gas a little farther, 70 percent of  
17 the generators that were unplanned outages during that January  
18 15th-to-19th timeframe, 70 percent were natural-gas-fired generators.  
19 By megawatts, it was 74 percent of the megawatts that were, of the  
20 unplanned outages, derates, or failures to start, were natural-gas-fired  
21 generators.

22                  FERC COMMISSIONER GLICK: Is that consistent  
23 with some of the other cold weather snaps we've seen in the New

1 England ISO, for instance, and in MISO North, and so on?

2 MR. HUFF: The team didn't analyze those per se, as  
3 far as bringing those into the study and into the report. There have been,  
4 talking about the 2011 event, there were gas-fired generators that were  
5 impacted in that event and tying that to a lack of winterization.

6 FERC COMMISSIONER GLICK: Okay. Thank you.

7 NRC CHAIRMAN SVINICKI: Thank you.

8 Commissioner McNamee?

9 FERC COMMISSIONER MCNAMEE: Following on  
10 Commissioner Glick's question about the natural gas outages, was the  
11 cause primarily mechanical? Was it lack of access to gas? What were  
12 the causes of those natural gas outages?

13 MR. HUFF: There were several causes. There were  
14 ones who had interruptible gas supply. There were some that were  
15 impacted by low gas pressure. And those were the major issues. Some  
16 related to facilities related to gas that caused the unit to not be able to  
17 access the gas supply. So, those were the main areas.

18 FERC COMMISSIONER MCNAMEE: Okay. And  
19 then, I wanted to look at slide 10 on the energy storage discussion. And  
20 I notice in the various examples on slide 10 of the storage examples,  
21 except for pumped hydro, it looks like each of these storage facilities had  
22 about a four-hour storage or four hours of energy that they could  
23 provide --



1 MR. KAPADIA: That is correct. Most of the resources  
2 which have been approved and which are on that page I think are four  
3 hours.

4 FERC COMMISSIONER MCNAMEE: Yes. Okay.  
5 And are you familiar with basically the average megawatt size for a  
6 nuclear facility or a nuclear unit?

7 MR. KAPADIA: I think 1,000-1,200 megawatts.

8 FERC COMMISSIONER MCNAMEE: And that's  
9 usually a two-unit facility, right?

10 MR. KAPADIA: Right. Right.

11 FERC COMMISSIONER MCNAMEE: I'll defer to the  
12 experts.

13 MR. KAPADIA: Yes.

14 FERC COMMISSIONER MCNAMEE: And do you  
15 know what their general capacity factors are? Do they run 24/7? Do  
16 they run for --

17 MR. KAPADIA: The storage?

18 FERC COMMISSIONER MCNAMEE: No, the nuclear  
19 facilities.

20 MR. KAPADIA: The nuclear should be over 97 percent  
21 I think.

22 FERC COMMISSIONER MCNAMEE: Okay.

23 MR. KAPADIA: I guess I want to defer to the NRC

1 folks.

2 FERC COMMISSIONER MCNAMEE: Okay. All right.

3 Thank you.

4 MR. KAPADIA: Thank you.

5 FERC COMMISSIONER MCNAMEE: That's all I  
6 wanted to ask.

7 NRC CHAIRMAN SVINICKI: Well, thank you again for  
8 those presentations.

9 Next, we will hear a series of three presentations from  
10 the NRC staff. We will begin with Mr. Eric Benner, who is the Acting  
11 Deputy Director for Reactor Safety Programs and Mission Support in the  
12 Office of Nuclear Reactor Regulation.

13 Following Eric, we will hear from Ms. Meena Khanna,  
14 Acting Deputy Division Director of the Division of Materials and License  
15 Renewal, again in the Office of Nuclear Reactor Regulation.

16 And after that, we will hear from Ms. Anna Bradford,  
17 who is the Deputy Director, the Division of Licensing, Siting, and  
18 Environmental Analysis in the Office of New Reactors.

19 Eric, would you please lead us off?

20 MR. BENNER: Thank you, Commissioner.

21 So, good morning, Chairmen and Commissioners. I'm  
22 not sure of the exact way to reference that.

23 (Laughter.)

1                   It's the NRC staff's pleasure to be before you today to  
2 talk about our activities. Chairman Svinicki outlined our names.

3                   I'll give a brief history of the interactions and the  
4 formalization of those interactions between NRC, NERC, and FERC.  
5 Meena will discuss the status of the operating fleet, including license  
6 renewal and subsequent license renewal, as well as decommissioning  
7 activities. And Anna will discuss our activities for new and advanced  
8 reactor licensing.

9                   Next slide, please.

10                  So, we've talked a little bit, the other presenters, about  
11 recent significant events. And I'll note that the formalization of the  
12 arrangements between the NRC, FERC, and NERC, the genesis of those  
13 was a previous significant event, the 2003 Northeast blackout. And as a  
14 result of that, we realized with our missions that there was need for some  
15 better understanding of roles and responsibilities.

16                  So, that led to a Memorandum of Agreement with  
17 NERC and a Memorandum of Understanding -- excuse me -- a  
18 Memorandum of Agreement with FERC and a Memorandum of  
19 Understanding with NERC. And both of those were put in place in 2004.

20                  They've both been renewed twice, most recently in 2015, and the NRC  
21 staff feels that those agreements have been very helpful to align on roles  
22 and responsibilities as well as create mechanisms for sharing of  
23 information that I think both Agencies have found useful.

1 More recently in 2015 -- excuse me -- 2018, the NRC  
2 and NERC, or FERC entered into an MOU on the topic of critical energy  
3 and electric infrastructure information, or CEII, as it's referred to on this  
4 slide. That, again, gives us an additional framework for protection of  
5 information that falls under that banner. And I'm happy to report that the  
6 NRC does now have procedures in place to fulfill our obligations under  
7 that MOU.

8 With that, I will turn it over to Meena Khanna.

9 MS. KHANNA: Okay. Thank you, Eric.

10 Good morning, Chairmen and Commissioners. We  
11 appreciate the opportunity to meet with you this morning.

12 My presentation will focus on: one, an overall of the  
13 current fleet of operating reactors; two, a snapshot and update of where  
14 we are with regard to subsequent license renewal, and three, the status  
15 of decommissioning nuclear reactors.

16 The combined output of all U.S. operating reactors in  
17 2018 was over 92,000 megawatts of electricity. The map on this slide  
18 displays the locations of the nuclear power plants by color, which  
19 represents the four NRC Regions. The Regional Offices are located  
20 outside of Philadelphia, Pennsylvania; in Atlanta, Georgia; near Chicago,  
21 Illinois, and lastly, near Dallas, Texas.

22 Since the 1970s, the NRC has approved a number of  
23 power uprates at these existing facilities ranging from 1 to 2 percent up to

1 extended power uprates on the order of 7.5 to 20 percent. These power  
2 uprates have added approximately 7900 megawatts electric of additional  
3 capacity to the U.S. domestic fleet of reactors. The Agency also expects  
4 to receive applications in the next three years for additional power  
5 uprates, yielding an additional 60 megawatts of electricity. Beyond that,  
6 we do not anticipate many additional power uprate requests.

7 Licensee decisions to continue to operate or  
8 decommission and to pursue license renewal or subsequent license  
9 renewal are driven heavily by economics, particularly with the competition  
10 from other low-cost sources of electricity generation.

11 Next slide, please.

12 The NRC has issued renewed licenses for all but eight  
13 reactors of the operating fleet. Of the eight, the NRC has received letters  
14 of intent indicating that licensees will submit applications for license  
15 renewal for three units, and those include Clinton and Comanche Peak  
16 Units 1 and 2. Watts Bar Units 1 and 2 have not indicated an intent for  
17 license renewal. Diablo Canyon Units 1 and 2 will not pursue license  
18 renewal since the units will be shutting down at the end of their current  
19 operating license in 2024 and 2025, respectively.

20 On July 26th of this year, First Energy Nuclear  
21 Operating Company indicated that they have reversed their plans to shut  
22 down the Perry Nuclear Power Plant as a result of the Ohio Clean Air Act.  
23 To date, FENOC has not formally notified the NRC of any specific plans

1 regarding license renewal. Currently, there are no applications for initial  
2 license renewal under NRC staff review.

3 The graph on this slide provides information on how  
4 renewed licenses have or will affect the contribution of nuclear power  
5 plants to the nation's energy portfolio in the coming decades. Also, the  
6 graph reflects the planned shutdowns between 2019 and 2025.

7 The red line on the graph reflects the generating  
8 capacity if power was only generated during the initial 40-year licenses.  
9 Next, the blue line that shifts to the right shows the generating capacity  
10 with both approved and potential license renewals for which we have  
11 received letters of intent for three units, as I indicated earlier. Far to the  
12 right, the orange line shows the potential generating capacity if all plants  
13 that renew their original license also receive a subsequent license  
14 renewal approval, which leads to our next topic of discussion.

15 Next slide, please.

16 Subsequent license renewal is a term that we use to  
17 describe plants seeking to operate beyond 60 years. As some plants  
18 have passed 40 years of operations, industry interest has been  
19 expressed for subsequent license renewal to allow for plant operation to  
20 80 years. The Commission has stated that the license renewal rule has  
21 provided an effective basis for ensuring safe operation during the license  
22 renewal period and will continue to be an effective basis for subsequent  
23 license renewal.

1                   The staff issued subsequent license renewal guidance  
2 in July of 2017 in anticipation of these applications. The NRC received  
3 its first subsequent license renewal application in January 2018, and the  
4 staff is currently reviewing three subsequent license renewal applications.

5       Those are for Turkey Point Units 3 and 4, Peach Bottom Units 2 and 3,  
6 and Surry Units 1 and 2. The staff's goal is to complete the review of the  
7 subsequent license renewal applications in 18 months.

8                   We expect an application in 2020 for North Anna Units  
9 1 and 2. Also, an industry survey conducted by Nuclear Energy Institute  
10 has identified additional interest for subsequent license renewal  
11 applications beyond 2021.

12                   Last Thursday, Duke Energy issued a press release  
13 indicating that it will seek subsequent license renewal for the 11 reactors  
14 that they operate. Duke expects to submit the subsequent license  
15 renewal application for the Oconee Nuclear Station in 2021, followed by  
16 its other nuclear stations. The NRC has budgeted for the review of two  
17 subsequent license renewal applications in fiscal year 2021.

18                   It is the industry's responsibility to develop the technical  
19 basis demonstrating safety for long-term operations. The top four  
20 technical issues that are being addressed in the subsequent license  
21 renewal application reviews are: neutron embrittlement of the reactor  
22 pressure vessel; stress corrosion and other types of degradation of  
23 reactor pressure vessel internals; concrete and containment degradation,

1 and electrical cable qualification and condition monitoring.

2 Next slide, please.

3 The economic and other factors that I just discussed  
4 also impact utilities' decision-making on whether to decommission  
5 operating reactors. The map shows you what you certainly already  
6 know, the North American Electric Grid interconnections and the eight  
7 regional reliability entities which NERC oversees. I included this in my  
8 presentation to help convey the impact of power reactors coming offline  
9 due to decommissioning.

10 The stars on the map show where we either have or  
11 anticipate nuclear power plant closures through 2025. In recent years,  
12 nine units at eight sites, which includes the recent Three Mile Island,  
13 represent a capacity decrease of approximately 7,000 megawatts electric  
14 have begun the decommissioning process. There is an additional eight  
15 units which could be impacted by premature closures due to  
16 decommissioning by 2025, and that could further decrease the electricity  
17 capacity by about 7800 megawatts electric.

18 Perry and Davis-Besse had announced plans to  
19 decommission. However, as I alluded to earlier, in July of 2019, FENOC  
20 reversed its plans to shut down Perry and Davis-Besse as a result of the  
21 Ohio Clean Air Act. This is similar to the situations for Clinton, Quad  
22 Cities Units 1 and 2, and the Fitzpatrick sites.

23 Next slide, please.



1                   The NRC continues its mission to ensure public health  
2 and safety prior to and during the entire decommissioning process. The  
3 NRC has inspection guidance for oversight of power reactors transitioning  
4 to the decommissioning phase as well as following the permanent  
5 cessation of operations. The inspections verify that: one, the licensee's  
6 processes and procedures and programs for decommissioning are  
7 adequate; two, the necessary programs continue from the period of  
8 operation into decommissioning, and three, the safety culture established  
9 during reactor operations is maintained.

10                   Once a plant permanently shuts down, the fuel is  
11 moved to a spent fuel pool where it is cooled for about five years, and  
12 then, transferred into dry-cask storage. Many of the NRC's regulatory  
13 requirements are not needed for assuring public health and safety for a  
14 defueled reactor. Therefore, licensees must submit license amendments  
15 or exemption requests to appropriately reduce the regulatory  
16 requirements they transition into decommissioning.

17                   We are currently applying lessons learned from the  
18 previous licensing reviews into our current reviews and incorporating  
19 those into our ongoing decommissioning rulemaking.

20                   That concludes my remarks, and I will now turn the  
21 presentation over to Anna Bradford.

22                   MS. BRADFORD: Thank you, Meena.

23                   Next slide, please.

1                   Good morning, Chairmen and Commissioners. I'd like  
2 to take a few minutes today to update you on the progress being made in  
3 our new Light water Reactor and Advanced Reactor Programs.

4                   As we mentioned last year during this meeting, we're in  
5 the process of reviewing a design certification application for the NuScale  
6 Small Modular Reactor. This past July, we completed Phases 2 and 3,  
7 which means that we have developed Draft Safety Evaluations for all of  
8 the review areas and discussed those evaluations with our independent  
9 advisory committee. In some cases, there are open items that remain to  
10 be resolved, and we continue to address those. We are currently on  
11 schedule to complete the entire safety review by September 2020.

12                  On August 14th of this year, we completed the  
13 mandatory hearing for the Early Site Permit for a Small Modular Reactor  
14 at the Tennessee Valley Authority site. And Early Site Permit determines  
15 whether a specific site may be suitable for a nuclear reactor and allows  
16 an applicant to bank that site for future use. TVA has not yet decided  
17 which SMR technology they would use in a possible future combined  
18 license application.

19                  Additionally, the Utah Associated Municipal Power  
20 Systems, or UAMPS, recently announced that they have reached the  
21 megawatts threshold that they had set for themselves in order to begin to  
22 pursue a combined license for a NuScale SMR at a site in Idaho. We  
23 look forward to working with them and determining a schedule for moving

1 forward.

2 Next slide, please.

3 Earlier this year, we received a letter from General  
4 Electric-Hitachi stating that they would like to begin pre-application  
5 interactions on their Small Modular Reactor design, which they call the  
6 BWRX-300. As the name implies, this will be a Small Modular Reactor  
7 with an output of 300 megawatts electric.

8 Also, we received an application from a company called  
9 Nuclear Development asking that we transfer the construction permit for  
10 Bellefonte to them, so that they can complete construction of two  
11 partially-constructed units and eventually apply for an operating license.  
12 In April of 2019, after reviewing their application, we requested that they  
13 provide additional information in the areas of quality assurance and  
14 technical qualifications. As of August 28th, we have received the  
15 additional information that we requested from the applicant, and we are  
16 reviewing it at this time.

17 Slide 11, please.

18 In addition to those licensing activities, we are  
19 overseeing the construction and startup preparations for Vogtle Units 3  
20 and 4 in Georgia. Southern Nuclear Company currently plans to load  
21 fuel in November of 2020 and 2021, with commercial operations  
22 beginning approximately six months later. This is an area of high focus  
23 for the NRC and we are ensuring we have the resources to meet or

1 exceed the planned schedules.

2 Next slide, please.

3 For this meeting, I wanted to find a metric that helps to  
4 communicate the progress being made at the two units. It's hard to  
5 numerically capture progress because so many different fronts are being  
6 worked on at once. But one way to look at it is with respect to closing  
7 out the inspections, tests, analyses, and acceptance criteria, or ITAAC,  
8 that must be completed by the licensee and verified by the NRC before  
9 the plant can load fuel.

10 We review the ITAAC to ensure that the plant has been  
11 constructed in accordance with the design, the regulations, and the  
12 Atomic Energy Act. As you can imagine, because most of the ITAAC  
13 needs to be completed and checked near the end of construction, we are  
14 expecting and prepared for a bow wave of these. However, we have  
15 already closed out about 20 percent of the approximately 450 ITAAC per  
16 unit and have also approved Southern's plans for closing out another 64  
17 percent. These percentages are shown in the pie chart on this slide.  
18 We're confident we have the resources and skills needed to complete  
19 these as the project moves forward.

20 Next slide, please.

21 There continues to be a significant stakeholder interest  
22 in the development and licensing of Advanced, also known as Non-Light  
23 water, Reactors. Advanced Reactors thermal powers can range from

1 less than a megawatt to thousands of megawatts and can have a variety  
2 of cooling materials, fuel types, and safety systems. The variety of  
3 possible designs, which I will show on the next slide, contributes to the  
4 need to develop technology-inclusive approaches instead of prescriptive  
5 requirements for each design.

6           The NRC expects Advanced Reactors to have  
7 enhanced safety margins and safety features as described in the NRC's  
8 Advanced Reactor Policy Statement. These margins and safety features  
9 should provide for greater operational flexibility than current reactors and  
10 allow for more efficient licensing review.

11           We made significant progress over the past year in  
12 continuing to implement our action plans, and we continue to prioritize the  
13 resolution of key policy issues. And its efforts, we work closely with our  
14 counterparts at the U.S. Department of Energy and have engaged  
15 extensively with external stakeholders and international counterparts.  
16 For example, we continue to chair the Working Group on the Safety of  
17 Advanced Reactors through the Nuclear Energy Agency in Paris and the  
18 IAEA SMR Regulators' Forum in Vienna, where we share information on  
19 Advanced Reactor Safety and regulatory issues with international  
20 regulators. Additionally, we just signed a Memorandum of Cooperation  
21 with the Canadian Nuclear Safety Commission to enhance cooperation  
22 on Advanced Reactor licensing activities.

23           To address specific policy issues over the past year, the

1 NRC staff has issued papers to our Commission regarding functional  
2 containment performance criteria for Non-Light water Reactors, options  
3 and recommendations for physical security for Advanced Reactors, and a  
4 proposed rule for emergency preparedness for Small Modular Reactors  
5 and other new technologies. All of these papers have the potential to  
6 affect where Advanced Reactors could be located in the future. For  
7 example, the proposed rule on emergency preparedness could lead to  
8 changes in the Emergency Planning Zone sizes for new reactor designs.

9 Over the past several years, the NRC has been  
10 engaged with the industry-led Licensing Modernization Project, or LMP,  
11 with the goal of establishing technology-inclusive, risk-informed, and  
12 performance-based regulatory guidance for licensing Advanced Reactors.

13 Industry's LMP document, also called NEI-18-04, outlines a systematic  
14 approach for use by reactor developers regarding topics that are  
15 fundamental to the safe design of Advanced Reactors. On May 13th,  
16 2019, the NRC staff issued a Draft Regulatory Guide for public comment  
17 proposing to endorse the NEI-18-04 methodology to inform the contents  
18 of applications.

19 Lastly, the Nuclear Energy Innovation and  
20 Modernization Act, or NEIMA, was signed on January 14th, 2019, and it  
21 has several provisions related to Advanced Reactors. Consistent with  
22 Section 103 of NEIMA, the NRC plans to build off of the guidance that I  
23 just mentioned to complete a rulemaking to establish a

1 technology-inclusive regulatory framework by December 31st, 2027.

2 Next slide, please.

3 The NRC continues to interact with a broad range of  
4 Advanced Reactor developers as we prepare for potential applications in  
5 the next several years. This slide illustrates the wide range of Advanced  
6 Reactor designs under development. It is a large and diverse landscape,  
7 and this slide is not all-inclusive in that it only shows the developers that  
8 are members of the industry's Advanced Reactor Technology Working  
9 Groups.

10 Five designers responded to our Request for  
11 Information of potential applicants to inform our budgeting process, and  
12 those particular developers are shown in the shaded boxes on this  
13 graphic. Our most significant pre-application interactions have been with  
14 Oklo and Kairos Power, where we have been reviewing several of their  
15 pre-application reports.

16 We have noticed a recent increase in possible interest  
17 in microreactors from end-users and designers. The NRC has not  
18 defined microreactors, but the Department of Energy uses this term to  
19 describe a reactor that is capable of producing 1 to 20 megawatts of  
20 thermal energy and that is factory-built, transportable, and self-regulating.

21 For example, the reactor design would utilize passive safety systems  
22 and would not require a large number of specialized operators. The  
23 safety, security, and environmental reviews of microreactors might

1 warrant even more flexible approaches as they tend to comprise simpler  
2 designs with emphasis on inherent and passive features.

3                   Organizationaly, we continue to use a core-team  
4 approach for the Oklo and Kairos pre-application reviews, which provides  
5 stability and consistency to the designer while ensuring efficient use of  
6 available NRC resources. This approach has been working successfully,  
7 and we plan to continue to use this approach to support other Advanced  
8 Reactor developers. We have made substantial progress in preparing  
9 for the submittal of an application for an Advanced Non-Light water  
10 Reactor.

11                   This concludes this panel's presentations, and we are  
12 prepared to answer any questions you may have. Thank you.

13                   NRC CHAIRMAN SVINICKI: Thank you very much,  
14 Anna, Meena, and Eric.

15                   And for these topics, we will turn first to our FERC  
16 colleagues, and I will turn to Chairman Chatterjee.

17                   FERC CHAIRMAN CHATTERJEE: Thank you all for  
18 very informative presentations. Nuclear is such an important resource  
19 for the grid.

20                   Just a couple of questions. In the past few years, we  
21 have heard that the NRC and the nuclear industry were considering  
22 options on possibly providing some of the nuclear reactors with  
23 load-following capability or ramping capability. Is this still under



1 consideration?

2 MR. BENNER: I know that certain utilities are looking  
3 into that. We've been supporting those licensees with questions they  
4 may have. There certainly is nothing in our regulations that prohibits  
5 plants from doing that.

6 FERC CHAIRMAN CHATTERJEE: Thank you for that.

7 Obviously, from the presentation, you guys seem to  
8 have a sense of what units may seek a license renewal, but is there a  
9 point at which the NRC expects those predictions to firm up, so we can  
10 just have a better sense in predicting what the nuclear generation  
11 capacity changes might be over the next decade?

12 MS. KHANNA: Thank you, Chairman Chatterjee, for  
13 that question. So, we've been trying really hard to maintain the latest  
14 information as far as expected subsequent license renewals as well as  
15 initial license renewals that we still have to complete. So, the best that  
16 we can do is we continue to have dialogs with industry. We do get some  
17 informal information from them, but until they actually publicly announce  
18 it, then we really can't, yes, publicly announce that to others. But we  
19 continue to ask them to share that knowledge with us because we want to  
20 make sure that we are prepared as well. And then, we also want to  
21 make sure that we have the information to ensure that we have an  
22 appropriate budget for that year to do those reviews.

23 FERC CHAIRMAN CHATTERJEE: Makes sense.

1 Thank you.

2                   Finally, Anna, for the Advanced Reactors, what might  
3 some of the drivers or considerations for selecting one design over  
4 another be? Are there costs or performance considerations that would  
5 help to benefit grid operators?

6                   MS. BRADFORD: In terms of selecting a design, I  
7 assume you mean by industry?

8                   FERC CHAIRMAN CHATTERJEE: Uh-hum.

9                   MS. BRADFORD: Okay. Not the NRC?

10                  FERC CHAIRMAN CHATTERJEE: Yes.

11                  MS. BRADFORD: All right. So, the industry, I think  
12 they would take into account all of those things. Where do they want to  
13 place the reactor? How much capacity do they need? Because they  
14 range from very small to very large. Do they want to put it in a location of  
15 a previous coal plant, which I know some industry members are thinking  
16 about. So, there is a wide range of things that they need to consider,  
17 which I think leads to that wide range of possible designs that you saw in  
18 that slide.

19                  FERC CHAIRMAN CHATTERJEE: That's very helpful.

20 Thank you all again.

21                  NRC CHAIRMAN SVINICKI: Thank you.

22                  Commissioner Glick?

23                  FERC COMMISSIONER GLICK: Thanks.

1 I just wanted to follow up a little bit on Chairman  
2 Chatterjee's second question, which was with regard to the expectation  
3 about requests from industry in terms of license extensions, and so on.  
4 Obviously, we have a proliferation or an increase in zero-marginal-cost  
5 technologies, and that certainly impacts. Especially in competitive  
6 markets, that has a big impact. And you mentioned that there is a  
7 significant number of retirements, although we're certainly seeing  
8 announcements. You mentioned Duke and others and the issue in Ohio.

9 I'm curious if you do any economic analysis, though, of  
10 where you think nuclear is headed from an economic perspective; how  
11 competitive that technology will be in the future compared to other  
12 developing technologies and existing technologies.

13 MS. KHANNA: So, I'm not aware of us looking at the  
14 economics of the various industries and everything. Obviously, there is  
15 competition out there, right, with the renewables and everything. So, I  
16 can tell you that what we're trying to do is make sure that we're regulating  
17 at the appropriate level. We're looking back at our processes. We're  
18 making sure that we're also implementing risk-informed decision making  
19 where we can, and we're doing everything that we can to make sure that  
20 we are regulating in an efficient and effective manner while still ensuring  
21 safety. So, I'll leave this for --

22 MR. BENNER: Yes, and to build onto that, because  
23 we don't know. We have done what we've called the Futures

1 Assessment, which has tried to look at potential landscapes, both to  
2 prepare the NRC for whatever may come, but part of that activity is to try  
3 to develop better signposts, so we can be nimble to respond to where the  
4 industry as a whole is going. But we would not personally do an  
5 economic analysis of the viability of any individual plant.

6 FERC COMMISSIONER GLICK: In general, do you  
7 see that some of the newer technologies that Anna was just mentioning  
8 about Advanced Reactors, and so on, is that something that would  
9 potentially be more economic than some of these bigger, 1,000-megawatt  
10 facilities?

11 MS. BRADFORD: So, again, we wouldn't have done  
12 an economic analysis ourselves, but there are a lot out there that the  
13 industry has done. And that, obviously, is a very important point to them.  
14 Some of them are trying to get below a certain dollar amount per  
15 megawatt, you know, so that it is cost-effective. And so, it just depends  
16 on where they're going to put it, what their customer base is, what the  
17 design is, all of that. It's a lot of factors to consider.

18 FERC COMMISSIONER GLICK: Thank you very  
19 much.

20 NRC CHAIRMAN SVINICKI: Thank you.

21 FERC COMMISSIONER MCNAMEE: For the various  
22 technologies that are being proposed, are most of them U.S. technologies  
23 or are they coming from foreign developers?

1 MS. BRADFORD: It ranges across the board. There  
2 are some that are U.S.-based, others that are in Canada, others that are  
3 in other countries that I know of as part of the SMR Regulators' Forum.  
4 The ones that we've been talking to the most I believe are mostly  
5 American-based.

6 FERC COMMISSIONER MCNAMEE: That's it. Thank  
7 you.

8 NRC CHAIRMAN SVINICKI: Thank you.

9 Anna, I'll just ask a quick question. Maybe you could  
10 elaborate a little bit on your slide that was the landscape of Advanced  
11 Reactors in terms of the engagement of the companies on that slide.  
12 You did mention which we have had the most maybe substantive or  
13 frequent engagement with. But how much does it vary? Are there  
14 companies on there that we've had essentially little-to-no engagement  
15 with? I just thought it would be helpful to characterize a little more  
16 specifically, because they're not all at the same level maybe in advancing  
17 their designs or engaging the NRC.

18 MS. BRADFORD: That's absolutely true. So, some of  
19 them we might have had one meeting. Others we might have just met at  
20 an Advanced Reactor conference and they said, "Hey, we want to come  
21 in and talk to you. Here's our design." So, these are the ones we are  
22 aware of. And then, as you said, there are some that we've been dealing  
23 with quite a lot, Oklo and Kairos. So, it's a broad spectrum there for

1 sure.

2 NRC CHAIRMAN SVINICKI: Thank you very much.

3 Other questions? Commissioner Baran?

4 NRC COMMISSIONER BARAN: Just a quick clarifying  
5 point in response to Chairman Chatterjee's question about when you  
6 would have more certainty about plants seeking subsequent license  
7 renewal to go to 80 years. What's not clear from this is oftentimes  
8 people are submitting those applications for the next 20 years way in  
9 advance of their existing license expiring. And so, with the exception of  
10 the few plants that you mentioned that have announced plans to shut  
11 down in the next few years, are there any, like if you're looking at the next  
12 decade, are there any plants now that have their license renewed that  
13 would expire in that timeframe, or is it all further down the horizon?

14 MR. BENNER: It's all further down the horizon.

15 NRC COMMISSIONER BARAN: Okay. Thanks.

16 NRC CHAIRMAN SVINICKI: Thank you.

17 Any other questions? Commissioner Caputo?

18 NRC COMMISSIONER CAPUTO: I guess one  
19 question I would have just in terms of plants that are potentially closing  
20 prematurely, some of those decisions seem to hinge on auctions that take  
21 place in some of the regional operating systems. Do we track that at all?  
22 Or do we maintain some sort of an awareness of that? Or do we strictly  
23 just wait for licensees to come in?

1 MR. BENNER: We maintain awareness. I mean,  
2 obviously, in our interactions with individual licensees, they will transmit  
3 information as to say, hey, here's the next time we're coming up for  
4 auction. And we don't have the specific values and everything, but they  
5 give us a heads-up as to that will be a decision point for them.

6 NRC COMMISSIONER CAPUTO: So, in some cases,  
7 if they clear a particular auction, do we get a sense that that gives them  
8 sort of a three-year window or a two-year window, or something, where  
9 they're confident they'll continue before they hit that next decision point?

10 MR. BENNER: I think it depends on the individual  
11 market and the arrangement and the bid they put in. I'm not sure if  
12 there's unilateral durations of how those markets work. But, usually,  
13 they'll tell us. They say, "Yeah, we're likely good for this duration."

14 NRC COMMISSIONER CAPUTO: And so, some of  
15 that might also depend on contracts, long-term contracts?

16 MR. BENNER: Uh-hum.

17 NRC COMMISSIONER CAPUTO: And we don't  
18 necessarily get a sense of that at all because that's business proprietary.

19 NRC COMMISSIONER CAPUTO: Okay. Thank you.

20 NRC COMMISSIONER WRIGHT: I have one. Eric,  
21 when a plant closes, I'm sure there's some kind of risk assessment done  
22 and I'd like to just kind of have you tell me what kind of interactions do we  
23 have with FERC and NERC when a plant announces, because that

1 capacity coming offline has got to affect the grid somehow. And is there  
2 some kind of a planning that takes place with that?

3 MR. BENNER: Not so much on that regard from the  
4 standpoint of -- fortunately, there's been, for most of these plants, there's  
5 been lead time. So, I think what factors into those individual markets is  
6 there's enough time to figure out what's going to happen in that individual  
7 market. So, we haven't had explicit communications with FERC as to  
8 those things. We think that the other communications around the plant  
9 shutting down take care of that issue.

10 NRC COMMISSIONER WRIGHT: Fine.

11 NRC CHAIRMAN SVINICKI: Well, thank you again to  
12 all the presenters at the table.

13 And as the final element in our public session, we will  
14 hear presentations on cybersecurity activities from the FERC and NRC  
15 staff. So, we'll just pause for a moment while we reset the table.

16 Thank you again to all of our initial presenters.

17 I guess we couldn't squeeze two more people in on  
18 your side.

19 (Laughter.)

20 So, we're going to reset here.

21 But thank you all.

22 (Whereupon, the above-entitled matter went off the  
23 record at 10:47 a.m. and resumed at 10:48 a.m.)



1                   NRC CHAIRMAN SVINICKI:   Okay, as our next  
2 presenters are taking their seats, again we will hear two presentations  
3 now on cybersecurity activities.   First, we will hear from the FERC.  
4 Patricia Eke is an energy industry analyst in the FERC's Office of Electric  
5 Reliability.

6                   Following that, we will hear from Ms. Shana Helton who  
7 is the Director of the Division of Physical and Cybersecurity policy in  
8 NRC's Office of Nuclear Security and Incident Response.   Please  
9 proceed.

10                  MS. EKE:   Testing, all right, great.   Well, good  
11 morning.   My name is Patricia Eke and I work for the Office of Electric  
12 Reliability, and I will be presenting on Orders number 850, Order 848, the  
13 CIP-012 NOPR, and the Audits Lessons Learned Report.   Next slide.  
14 Next slide, please?

15                  On October 18, 2018, Order 850 for Supply Chain Risk  
16 Management Standard was approved.   The Commission approved three  
17 Reliability Standards collectively known as the Supply Chain Standards to  
18 mitigate cybersecurity risks associated with the supply chain for the bulk  
19 electric system cyber systems.   The Supply Chain Standards become  
20 effective July 1, 2020.   Next slide, please.

21                  The Supply Chain Standards Requirements include  
22 requiring entities to develop, implement, and view a supply chain  
23 cybersecurity risk management plan.

1                   It also requires entities to be aware of all active vendor  
2 remote access sessions taking place on the entity's system, and it also  
3 requires entities to verify software integrity and authenticity to ensure that  
4 software being installed was not modified without awareness of the  
5 software supplier and is not counterfeit. Next slide, please.

6                   FERC directed NERC to study certain categories of  
7 assets not currently subject to the Supply Chain Standards. On May 28,  
8 2019, NERC filed Cybersecurity Supply Chain Risks: Staff Report and  
9 Recommended Actions.

10                  Further study is to determine whether new information  
11 supports modifying the standards to include low-impact BES cyber  
12 systems with external routable connectivity. The formal data request to  
13 address this issue was submitted August 19, 2019. Next slide, please.

14                  Regarding Order number 848, this was issued by FERC  
15 July 19, 2018. This order directed NERC to develop and submit  
16 modifications to the NERC Reliability Standards to augment the  
17 mandatory reporting of cybersecurity incidents, including incidents that  
18 might facilitate subsequent efforts to harm the reliable operation of the  
19 bulk electric system. Next slide, please.

20                  NERC filed proposed Reliability Standard CIP-008-6,  
21 which is the Incident Reporting and Response Planning Standard, and  
22 this filing was done March 3, 2019. It was approved by FERC on July  
23 20, 2019, and the standard becomes effective January 1, 2021. Next

1 slide, please.

2 Consistent with the Commission's directive, the  
3 approved standard also requires certain minimum information be included  
4 in the incident reports such as suspicious activity. It also includes  
5 deadlines for submitting the incident reports and requires the incident  
6 reports to be sent to DHS-NCCIC, or its successor, in addition to E-ISAC.

7

8 NCCIC means National Cybersecurity Communications  
9 and Integration Center, and E-ISAC is Electricity Information Sharing and  
10 Analysis Center. Next slide, please.

11 Now I'm going to discuss the CIP-012 NOPR, which is  
12 on communications between control centers. This NOPR was issued by  
13 the Commission April 18, 2019. It proposes to approve Reliability  
14 Standard CIP-012, which was submitted by NERC in response to a  
15 Commission directive in Order 822.

16 The NOPR proposes to direct NERC to modify the  
17 reliability standard to require protections regarding the availability of  
18 communication links and data communicated between bulk electric  
19 system control centers. It also has to clarify the types of data that must  
20 be protected. The comments were due July 24, 2019. Next slide,  
21 please.

22 In 2018, Staff issued a CIP Audits Lessons Learned  
23 Report. This was on March 29, 2019. The 2018 CIP Audits Lessons

1 Report was released, recommendations from lessons learned during  
2 Commission-led CIP audits, and the report was based on audits that were  
3 conducted in fiscal year 2018.

4 OER, which is the Office of Electric Reliability, led the  
5 CIP Reliability Standards Audits. The Office of Enforcement assisted in  
6 conducting the audits as well, and the Office of Energy Infrastructure  
7 Security assisted with analyzing the data that went into the report. Next  
8 slide.

9 There was also a similar report that was released in  
10 2017 that covered audits from fiscal year 2016 to 2017. The 2018 report  
11 had 13 recommendations and I just have a few included on the slide just  
12 to give you an idea of what the recommendations look like.

13 For example, there's a recommendation to consider  
14 implementing encryption for interactive remote access that is sufficiently  
15 strong, and there's also a link provided on the slide where you can access  
16 the report because it is public.

17 And with that, that concludes my presentation. Thank  
18 you.

19 NRC CHAIRMAN SVINICKI: Thank you. Shana,  
20 please proceed.

21 MS. HELTON: Good morning. I'm pleased to have  
22 the opportunity to brief both Commissions regarding the NRC's power  
23 reactor cybersecurity program. Next slide, please.

1                   Today's regulatory framework, our regulations,  
2 guidance, and oversight, along with industry's implementation of their  
3 NRC-approved cybersecurity plans, gives the NRC reasonable assurance  
4 that digital computer and communication systems and networks  
5 associated with safety, security, and emergency preparedness functions  
6 are adequately protected against cyber attacks.

7                   Today, I will update you on the NRC's ongoing  
8 cybersecurity inspection program, insights from the full implementation  
9 inspections we've completed so far, and the NRC's plans going forward.  
10 Slide three, please.

11                   At the last joint commission meeting between NRC and  
12 FERC in 2018, we briefed you on the full implementation of the operating  
13 reactor licensees' cybersecurity programs, which was accomplished by  
14 December 31, 2017.

15                   Now we are in full implementation, which includes the  
16 implementation of technical controls for all of the critical digital assets  
17 identified by licensees in their cybersecurity plan.

18                   Critical digital assets are those assets that if they fail,  
19 could result in an adverse impact to safety, security, and emergency  
20 preparedness functions, including support systems.

21                   Per the NRC's regulations, licensees shall apply and  
22 maintain defense-in-depth protective strategies, as well as mitigate the  
23 adverse effects of cyber attacks on critical digital assets.

1 Full implementation also includes provisions for incident  
2 response training and drills, protections against supply chain threats such  
3 as validating vendors, configuration management, and audits.

4 As of this past August, NRC staff has completed 35 full  
5 implementation inspections. Each inspection is two weeks long and our  
6 inspection teams are comprised of two regional inspectors and two  
7 technical support contractors.

8 Occasionally, staff from the NRC headquarters location  
9 will support and/or observe the inspections.

10 Our staff has found that in most instances, licensees  
11 understand what it takes to fully implement the NRC's cyber requirements  
12 and have adequately implemented their cybersecurity programs.  
13 Inspections have identified findings of very low safety significance.

14 Additionally, the industry has implemented an effective  
15 operating experience program, learning from the completed inspections  
16 and implementing corrective actions to ensure that their programs comply  
17 with regulatory requirements. Slide four, please.

18 I'd like to highlight a few focus areas we have observed  
19 from the inspections that we have completed to date. The NRC is  
20 working with industry in each of these focus areas to develop and  
21 improve existing guidance.

22 The first focus area listed on the slide is the portable  
23 media and mobile device program. An effective implementation of a

1 transfer kiosk to mitigate the portable media and mobile device cyber  
2 attack factor is vital to the licensee's defense strategy.

3           The transfer kiosks are integral in ensuring that the use  
4 of portable media and mobile devices to transfer files such as software  
5 and virus signature updates from the lesser protected networks to the  
6 more highly protected networks and assets does not allow a cyber attack  
7 to bypass security controls.

8           The second focus area I'd like to highlight is the quality  
9 of the critical digital asset and system assessments. Our inspectors  
10 have observed that the documentation of how the licensees assess their  
11 critical digital assets could be improved.

12           The quality and fidelity of the licensees' assessments  
13 not only impacts the NRC staff's ability to understand the licensee's  
14 cybersecurity implementation, but it also has the potential to impact the  
15 licensee's configuration management process in the future. Industry has  
16 acknowledged this challenge and is working to improve their assessment  
17 processes.

18           The third focus area I'd like to highlight is related to the  
19 licensees' vulnerability assessment program. This program identifies  
20 emergent vulnerabilities as identified by the Department of Homeland  
21 Security and other sources and evaluates them for potential updates to  
22 critical digital assets.

23           The large number of critical digital assets has

1 challenged the licensees' ability to ensure that appropriate updates such  
2 as software patches are incorporated.

3                   While the NRC believes it is important for licensees to  
4 improve their programs in this arena, we also believe that plants are  
5 adequately protected as there is substantial defense-in-depth in  
6 licensees' cybersecurity programs.

7                   Licensees are making progress in addressing this focus  
8 area with the help of guidance recently developed by industry and NRC  
9 staff.

10                   The last focus area I'll discuss on this slide relates to  
11 the ongoing monitoring and assessment program. Licensees and their  
12 cybersecurity plans committed to numerous ongoing monitoring and  
13 assessment requirements.

14                   Inspection showed that either licensees could not meet  
15 these commitments in the required time or the commitments were already  
16 encompassed in other programs implemented by the licensee.

17                   As a result, licensees implemented alternative  
18 approaches to address monitoring and assessment program  
19 requirements. The NRC performs an in-depth review of these alternative  
20 approaches during each inspection to ensure compliance with the  
21 regulations. Slide five, please.

22                   We conducted a cybersecurity assessment earlier this  
23 year, beginning in January and finishing in June. Our assessment team



1 was constructed to be independent and consisted of staff from the  
2 Cybersecurity Branch in the Office of Nuclear Security Incident Response  
3 and staff from the Office of Nuclear Reactor Regulation, as well as two  
4 independent cybersecurity specialists from Idaho National Lab.

5                   During our assessment activities, staff engaged with  
6 stakeholders, including FERC staff. The assessment team's final report  
7 summarized the feedback we received and was delivered to me this past  
8 July. I tasked the staff to develop an action plan to prioritize short and  
9 long-term improvements to the power reactors' cyber program.

10                   In the near term, staff's efforts will focus on developing  
11 a further risk-informed approach to scoping CDAs related to emergency  
12 preparedness, as well as those related to balance of plant, with the focus  
13 of aligning with the North American Electric Reliability Corporation critical  
14 infrastructure protection standards.

15                   Long-term efforts will focus on making our oversight  
16 program more performance based as we look to define our inspection  
17 footprint in 2021 and beyond.

18                   As we proceed with carrying out the tasks identified in  
19 the action plan, we will be sure to continue to coordinate with FERC,  
20 NERC, and other federal partners and external stakeholders. Next slide,  
21 please.

22                   As shown on this slide, the technology used by the  
23 operating reactor fleet is largely analog except in the instances where

1 licensees have implemented digital upgrades. However, new and  
2 advanced reactors will incorporate as part of their design more modern  
3 technology where systems are more complex, largely integrated, and  
4 digital assets are more sophisticated.

5                   The cybersecurity rule in Title 10 of the Code of Federal  
6 Regulations 73.54 applies to all reactor applicants, including applicants  
7 for new reactors, small modular reactors, and other advanced reactor  
8 designs that Anna discussed in her presentation.

9                   The licensees and applicants are required to submit a  
10 cybersecurity plan in conjunction with their license application, and the  
11 staff will review those plans relative to the licensee's technology at the  
12 time of submittal.

13                   With respect to reactors under construction, the NRC is  
14 currently working with the AP1000 licensee, Southern Nuclear Company,  
15 for Vogtle Units 3 and 4 to better understand key design elements of the  
16 plant and the licensee's schedule to implement the cybersecurity  
17 requirements.

18                   In accordance with the NRC's regulations, the licensee  
19 plans to implement its cybersecurity program in a phased approach,  
20 ensuring appropriate cyber controls are in place prior to fuel receipt on  
21 site, fuel load, and then systems entering service. This concludes my  
22 presentation.

23                   NRC CHAIRMAN SVINICKI: Well, my thanks to you

1 both for very informative presentations. We will begin questions this time  
2 again with FERC, I think, just to even it out. Chairman Chatterjee?

3 FERC CHAIRMAN CHATTERJEE: I appreciate that.  
4 Thank you, and thank you both for those excellent presentations. Supply  
5 chain security is something that's been a focus for us over the last several  
6 years, and I'm very proud of the work we've done to move the ball forward  
7 in this area, but obviously this is an issue that cuts across critical  
8 infrastructure areas.

9 So I'm curious whether you two could talk about the  
10 similarities and differences between the NRC's and NERC's supply chain  
11 standards? I think it would just be interesting to better understand the  
12 different approaches that we've taken on this common issue.

13 MS. EKE: Should I go first?

14 MS. HELTON: Yeah.

15 MS. EKE: All right, I'll start. So the CIP reliability  
16 standards that cover supply chain risk management are really embodied  
17 in three standards. There's CIP-013-1, which requires the entity to  
18 develop, implement, and review a plan that addresses risk for supply  
19 chain risk management.

20 There's also another standard which is CIP-005-6 which  
21 addresses remote access for vendors. So it requires the entity to have  
22 methods in detecting when there is remote access by a vendor, and also  
23 having a method to be able to disable that remote access when needed.

1                   Last, but not the least, we have CIP-010-3 which  
2 focuses on requiring the entity to address risks regarding the software  
3 integrity and authenticity of supply chain.

4                   And so from what I understand, one of the differences  
5 between the NERC CIP supply chain standards and NRC's, which I  
6 believe is the NEI 08-09, which is the systems and services acquisition  
7 family, is that it applies to critical digital assets, acquisition of critical  
8 digital assets, services related to critical digital assets, as well as  
9 components of critical digital assets, following a licensee's cybersecurity  
10 plan to the full implementation date.

11                   In the NERC CIP standards, we don't have that sort of  
12 overarching cybersecurity plan, and I will say that's probably the most  
13 fundamental difference in how both of the frameworks are structured.

14                   MS. HELTON: I think Patricia had a very good answer.  
15 I just would only add that in addition to the guidance that we've  
16 considered acceptable for use in the NEI 08-09 document, which does  
17 address supply chain, our reactor licensees are also subject to the  
18 requirements in 10 CFR Part 50, Appendix B for quality assurance and  
19 quality controls.

20                   So while that's not a direct requirement that says the  
21 words necessarily "supply chain," it does impact their oversight of  
22 vendors and we hold them accountable for that.

23                   FERC CHAIRMAN CHATTERJEE: Thank you both for

1 that. Another thing that we've done that I'm proud of is our cybersecurity  
2 reporting standard that was approved several months ago.

3 Similarly, I would just appreciate if NRC could elaborate  
4 a little bit on your cybersecurity incident reporting standards or regulations  
5 so that we can just understand how you guys approach this issue.

6 MS. HELTON: Sure, we published our event reporting  
7 rule, 10 CFR -- I'm sorry. I'm just blanking on the -- It's 73.77, I believe,  
8 is the citation, back in 2015.

9 So we have a variety of reporting requirements  
10 contained within that rule. Anything that is having an impact directly on  
11 the safety and security of the plant, we'll hear about it within an hour.  
12 We've got four-hour reporting requirements and others contained within  
13 that rule.

14 I'm not sure which differences you were particularly  
15 wondering about, so I --

16 FERC CHAIRMAN CHATTERJEE: I think that --

17 MS. HELTON: If that covers your --

18 FERC CHAIRMAN CHATTERJEE: -- covers it pretty  
19 well. Thank you.

20 MS. HELTON: Okay.

21 FERC CHAIRMAN CHATTERJEE: Thank you both,  
22 and thank you, Chairman Svinicki.

23 NRC CHAIRMAN SVINICKI: Thank you.

1 Commissioner Glick?

2 FERC COMMISSIONER GLICK: Thanks. I just  
3 wanted to maybe start off, Shana, with slide three of your presentation. I  
4 had a couple of questions with regard to that.

5 First of all, you mentioned that you all are 63 percent  
6 complete with your inspections and you'll be 100 percent, I guess, by the  
7 end of next year.

8 How quickly do you start all -- after you finish the 100  
9 percent, do you start all over again? How long does it take to go through  
10 the cycle?

11 MS. HELTON: Thank you for that question. So that  
12 relates directly to the work that we're going to be undertaking as part of  
13 our action plan to look at the overall cyber program, which, you know,  
14 we're taking a look at our regulations, our guidance, but also our  
15 oversight.

16 One thing that I should mention is that we've had some  
17 very intensive -- our team's on site for two weeks at a time for these cyber  
18 inspections. We do want to look at if there's a way to streamline and  
19 make those more efficient and effective going forward.

20 We feel that was an appropriate level of inspection for  
21 looking at the initial full implementation by licensees, but going forward,  
22 we have an interest in further risk informing.

23 Our inspections are already somewhat risk informed,

1 and we think that there's places where we could do more to further risk  
2 inform, as well as perhaps look at performance-based indicators and see  
3 if we could use those to influence our inspection program, so that's work  
4 that we're going to be undertaking in the very near future.

5 FERC COMMISSIONER GLICK: Okay, great, so you  
6 also mentioned in your inspections so far, you've just found findings of  
7 what you call very low safety significance. I was wondering if you can  
8 give maybe an example without revealing too much of what that might  
9 be?

10 MS. HELTON: Sure, in some cases, we've inspected  
11 where licensees may have controls in place. They might be a little bit  
12 different than what was described in their cybersecurity plan. Licensees  
13 are allowed to take alternative measures, but it's mainly a documentation  
14 issue.

15 So in those cases, they've been of low safety  
16 significance, very low safety significance because they do have  
17 appropriate alternative measures in place and there is substantial  
18 defense-in-depth, but they need to reflect that in their cybersecurity plans.

19 FERC COMMISSIONER GLICK: Okay, finally, on  
20 supply chain, and supply chain is clearly one of the biggest threats  
21 throughout, not only in the electric sector, but throughout the economy  
22 wide, but I'm just wondering, you mentioned --

23 It was kind of interesting when you said this. You

1 mentioned obviously that a lot of the nuclear facilities are still analog in a  
2 lot of ways and maybe older equipment.

3           Some have digitized, you mentioned, and I think on the  
4 electric grid, we're facing more digitization probably than you all are on  
5 the nuclear side, but I'm just wondering if that makes the threat of supply  
6 chain cybersecurity incidents less likely because you all are, because  
7 nuclear plants, at least the existing ones, are more analog?

8           MS. HELTON: We have a trend of plants going more  
9 towards digital, and just broadly speaking, I think there can be challenges  
10 with trying to replace an analog design just from the standpoint that that  
11 component may or may not be produced any longer.

12           And manufacturers are moving more and more towards  
13 using digital where they can, so we rely on licensees' configuration  
14 management processes, and as they acquire new systems, they do need  
15 to look at the cybersecurity involved with that.

16           FERC COMMISSIONER GLICK: And how do they  
17 do -- do you have specific requirements about how they address that?

18           MS. HELTON: Yes.

19           FERC COMMISSIONER GLICK: Okay.

20           MS. HELTON: And that's contained in their  
21 cybersecurity plans that they've committed to, as well as a license  
22 condition.

23           FERC COMMISSIONER GLICK: Okay, thank you.



1                   NRC CHAIRMAN SVINICKI: Maybe I'll just kick off on  
2 the NRC side. Commissioner Glick made a reference to, you know, the  
3 whole economy and how interconnected a lot of systems are.

4                   From my vantage point, I think there's been an  
5 emphasis over the last 10 years on really improving interagency  
6 coordination across it. I think Shana had mentioned federal partners.  
7 There's a lot of partnership going on.

8                   Would either of you like to offer your observation or  
9 assessment of how effective, and the improvements that we're trying to  
10 make in terms of, you know, parts of the U.S. government talking to each  
11 other?

12                  Because we're talking electrical systems today, but of  
13 course telecommunications is the backbone for a lot of what's going on,  
14 and then there's financial systems interconnected with  
15 telecommunications.

16                  So how would you characterize the overall level of  
17 interagency coordination? And in addition, this gives you a chance to  
18 say nice things about each other.

19                  MS. HELTON: So, yeah, we have our legally binding  
20 memorandum of agreement, MOUs, of course, but on top of that, I know  
21 at the staff level, we have very frequent communications between FERC  
22 and the NRC.

23                  In the area of cyber, we've done an extensive -- what I

1 consider. I've been in many places in the agency and I think that in the  
2 area of cyber, that's one of the places where we are very, very well  
3 connected.

4 That said, the interagency is a changing landscape and  
5 there's always new groups and subgroups that are popping up, so I think  
6 that we do a good job between our two agencies of keeping each other  
7 well informed of each other's activities.

8 And especially moving forward, as we update our  
9 program for the cybersecurity reactor oversight program, and our  
10 regulations and our guidance, we recognize that there is a strong need to  
11 interact with FERC, especially in the area of balance of plant, so we've  
12 already been engaging in discussions.

13 NRC CHAIRMAN SVINICKI: Thank you. Would you  
14 like to offer an observation as well?

15 MS. EKE: Yes, I'd like to echo Shana's comments,  
16 especially on the staff level. I think we pretty much have been  
17 exchanging information pretty well.

18 In fact, I did see actually someone that I knew here on  
19 supply chain who is like a supply chain guy here, and, you know, we  
20 would reach out and ask questions and exchange information, so it's  
21 been a pretty health process, and an enjoyable one and, yeah.

22 NRC CHAIRMAN SVINICKI: Okay, thank you both.  
23 Other questions? Commissioner Baran?

1                   NRC COMMISSIONER BARAN: I just had a couple of  
2 questions on Order 850 on supply chain cyber. Who are the affected  
3 entities required to comply with Order 850?

4                   MS. EKE: So with Order 850, the entities that comply  
5 are the entities that are applicable to the CIP reliability standards.

6                   NRC COMMISSIONER BARAN: Okay.

7                   MS. EKE: And so the way the applicability portion of  
8 the CIP standards are determined is we have a standard called CIP-002,  
9 which categorizes different BES cyber systems and facilities based on  
10 impact ratings, and so that kind of feeds into the applicability section per  
11 standard.

12                  NRC COMMISSIONER BARAN: And so it's, generally  
13 speaking, generating units and transmission entities?

14                  MS. EKE: So it's mostly high and medium impact BES  
15 cyber systems.

16                  NRC COMMISSIONER BARAN: Okay, and I see that  
17 that standard becomes effective next year. At this point, does the FERC  
18 staff have a sense of how these entities will go about verifying the  
19 integrity and authenticity of software and hardware?

20                  MS. EKE: So really the software integrity piece and  
21 authenticity piece of it really is just making sure that you have methods to  
22 address risks of an attacker exploiting the patching process, so that they  
23 don't deliver, you know, a software that has some kind of compromise in

1 it, and so there are different methods that they can use to do that.

2 NRC COMMISSIONER BARAN: Thank you.

3 NRC CHAIRMAN SVINICKI: Other questions?  
4 Commissioner Caputo?

5 NRC COMMISSIONER CAPUTO: I think I'm going to  
6 get just -- I'd like to ask for a little clarification --

7 NRC CHAIRMAN SVINICKI: Okay.

8 NRC COMMISSIONER CAPUTO: -- on Commissioner  
9 Baran's questions about the affected entities under your regulations. Is it  
10 limited to the grade? You said high and medium impact entities, so is it  
11 grid operators plus generating facilities, or is it generating facilities down  
12 to a certain threshold in size?

13 MS. EKE: Okay, so an example of a high, medium  
14 BES impacts, the high, medium BES impact system would be, for  
15 example, a control center or backup control center that has functions of a  
16 reliability coordinator, or another way to look at it is facility elements that  
17 will create 500 KV and above. That's a high impact BES cyber system.

18 And then for the medium, it would be anywhere from, a  
19 transmission facility from 200 KV to 499 KV, and then low, which is not  
20 affected in this particular reliability standard, is 100 KV to 200 KV.

21 NRC COMMISSIONER CAPUTO: Okay, so a  
22 generating station doesn't fall under these requirements at all?

23 MS. EKE: I'd have to look at the standard to clarify

1 that. Sorry I don't know off the top of my head.

2 NRC COMMISSIONER CAPUTO: Okay.

3 MS. EKE: Yeah.

4 NRC COMMISSIONER CAPUTO: Thank you.

5 NRC CHAIRMAN SVINICKI: Commissioner Wright?

6 Okay, well, with that, again I want to thank these presenters, but also all  
7 of the presenters we've heard from this morning, and with this, we will  
8 now adjourn the public portion of this meeting. Thank you.

9 (Whereupon, the above-entitled matter went off the  
10 record at 11:16 a.m.)