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

P R O C E E D I N G S

9:03 a.m.

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

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

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

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

So, Neil, please.

FERC CHAIRMAN CHATTERJEE: Thank you, and

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

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

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

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

stress.

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

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

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

Thank you.

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

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

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

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

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

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

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

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

Commissioner McNamee, would you like to make a statement?

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

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

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

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

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

NRC CHAIRMAN SVINICKI: Thank you very much, Commissioner.

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

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

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

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

Thanks for being here.

NRC CHAIRMAN SVINICKI: Thank you very much.

Any other member? Commissioner Caputo?

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

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

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner Wright?

NRC COMMISSIONER WRIGHT: Thank you so much.

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

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

NRC CHAIRMAN SVINICKI: Thank you very much.

With that, now we will begin with the presentations.

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

Please kick us off. Thank you.

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

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

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

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

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

MR. LAUBY: Thank you.

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

as to what to monitor on an ongoing basis.

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

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

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

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

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

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

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

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

Next one, please.

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

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

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

Next slide, please.

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

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

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

Next slide, please.

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

Next slide.

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

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

Next slide.

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

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

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

Next slide, please.

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

Next slide.

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

kind of on the far left side.

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

Next slide.

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

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

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

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

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

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

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

the system.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NRC COMMISSIONER BARAN: Okay.

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

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

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

MR. LAUBY: That's right.

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

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

When it comes to vulnerability assessments, the real

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

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

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

NRC COMMISSIONER BARAN: Okay.

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

NRC COMMISSIONER BARAN: Uh-hum.

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

NRC COMMISSIONER BARAN: Okay. Great. Thank you.

MR. LAUBY: Thank you.

NRC CHAIRMAN SVINICKI: Thank you very much.

Any others? Yes, Commissioner Caputo?

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

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

NRC COMMISSIONER CAPUTO: Okay. Thank you.

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

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

MR. LAUBY: Sure.

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

MR. LAUBY: With? I'm sorry?

NRC COMMISSIONER WRIGHT: With skilled workers.

MR. LAUBY: Yes.

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

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

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

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

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

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

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

NRC COMMISSIONER WRIGHT: Right.

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

NRC COMMISSIONER WRIGHT: Thank you so much.

NRC CHAIRMAN SVINICKI: Thank you.

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

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

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

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

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

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

Chairman Chatterjee, please.

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

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

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

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

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

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

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

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

FERC CHAIRMAN CHATTERJEE: Thank you.

NRC CHAIRMAN SVINICKI: Commissioner Glick?

FERC COMMISSIONER GLICK: Thank you.

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

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

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

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

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

FERC COMMISSIONER GLICK: Thank you.

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner McNamee?

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

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

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

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

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

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

NRC CHAIRMAN SVINICKI: Thank you very much.

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

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

(Laughter.)

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

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

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

NRC CHAIRMAN SVINICKI: Okay. Thank you very much.

And we will begin with Mr. Huff.

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

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

Next slide, please.

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

And we'll just hold on that slide there.

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

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

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

Fahrenheit below normal.

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

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

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

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

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

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

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

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

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

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

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

MISO South's reserves were down to 172 megawatts

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

Next slide, please.

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

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

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

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

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

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

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

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Also, recommendations include:

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

Balancing authorities considering deliverability of reserves to avoid stranded reserves;

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

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

NRC CHAIRMAN SVINICKI: Thank you.

Anuj, please proceed.

MR. KAPADIA: Thank you, Dave.

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

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

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

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

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

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

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

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

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

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Regarding the DER aggregation and the Final Rule,

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

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

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

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

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

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

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

Next slide, please.

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

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

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

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

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

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

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

Next slide, please.

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

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

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

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

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

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

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

NRC COMMISSIONER BARAN: Thanks.

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

governing those winterization procedures?

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

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

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

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

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

generators have an enclosed generator design inside buildings.

NRC COMMISSIONER BARAN: All right. Thank you.

And in terms of the market experience with electric storage, I know this is going to be very market-specific, but is there kind of any general statements that can be made about the effect electric storage has on wholesale electricity prices during the day versus at night? Does it generally reduce them during the day and increase them at night? I'm trying to understand how more electric storage capacity would affect the revenue of nuclear power plants that generate electricity throughout the night when demand is low.

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

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

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

NRC COMMISSIONER BARAN: Thank you.

NRC CHAIRMAN SVINICKI: Thank you.

Other members of the NRC? Commissioner Caputo?

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

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

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

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

MR. HUFF: Yes, or -- yes.

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

MR. HUFF: Yes. Yes.

NRC COMMISSIONER CAPUTO: Okay. Thank you.

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner Wright?

NRC COMMISSIONER WRIGHT: Thank you so much.

David, I like your name, by the way.

(Laughter.)

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

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

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

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

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

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

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

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

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

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

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

NRC COMMISSIONER WRIGHT: Right, right.

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

NRC COMMISSIONER WRIGHT: Right.

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

NRC COMMISSIONER WRIGHT: Fair enough. Thank you.

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

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

(Laughter.)

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

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

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

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

the technology itself just becoming cheaper?

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

NRC CHAIRMAN SVINICKI: Wow.

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

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

MR. KAPADIA: Absolutely.

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

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

NRC CHAIRMAN SVINICKI: Okay. Thank you very much.

I'll turn it over to Chairman Chatterjee.

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

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

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

FERC CHAIRMAN CHATTERJEE: That's very helpful.

Another possible application that's been discussed for

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

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

FERC CHAIRMAN CHATTERJEE: Thank you for that.

Dave, you mentioned that we've had previous cold weather events like this over the last several years. Have we seen any specific performance issues with nuclear generators during these events? And also, I know that, as a result of these events, NERC has developed best practices for generator weatherization. Are those generally applicable to nuclear as well, and if so, how have the operators done in implementing those recommendations?

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

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

FERC CHAIRMAN CHATTERJEE: Thank you.

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner Glick?

FERC COMMISSIONER GLICK: Thank you.

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

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

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

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

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

FERC COMMISSIONER GLICK: Okay. Thank you.

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner McNamee?

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

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

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

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

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

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

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

MR. KAPADIA: Right. Right.

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

MR. KAPADIA: Yes.

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

MR. KAPADIA: The storage?

FERC COMMISSIONER MCNAMEE: No, the nuclear facilities.

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

FERC COMMISSIONER MCNAMEE: Okay.

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

folks.

FERC COMMISSIONER MCNAMEE: Okay. All right. Thank you.

MR. KAPADIA: Thank you.

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

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

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

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

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

Eric, would you please lead us off?

MR. BENNER: Thank you, Commissioner.

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

(Laughter.)

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

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

Next slide, please.

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

So, that led to a Memorandum of Agreement with NERC and a Memorandum of Understanding -- excuse me -- a Memorandum of Agreement with FERC and a Memorandum of Understanding with NERC. And both of those were put in place in 2004. They've both been renewed twice, most recently in 2015, and the NRC staff feels that those agreements have been very helpful to align on roles and responsibilities as well as create mechanisms for sharing of information that I think both Agencies have found useful.

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

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

MS. KHANNA: Okay. Thank you, Eric.

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

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

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

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

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

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

Next slide, please.

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

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

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

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

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

Next slide, please.

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

The staff issued subsequent license renewal guidance in July of 2017 in anticipation of these applications. The NRC received its first subsequent license renewal application in January 2018, and the staff is currently reviewing three subsequent license renewal applications. Those are for Turkey Point Units 3 and 4, Peach Bottom Units 2 and 3, and Surry Units 1 and 2. The staff's goal is to complete the review of the subsequent license renewal applications in 18 months.

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

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

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

and electrical cable qualification and condition monitoring.

Next slide, please.

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

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

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

Next slide, please.

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

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

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

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

MS. BRADFORD: Thank you, Meena.

Next slide, please.

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

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

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

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

forward.

Next slide, please.

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

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

Slide 11, please.

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

exceed the planned schedules.

Next slide, please.

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

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

Next slide, please.

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

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

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

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

To address specific policy issues over the past year, the

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

Over the past several years, the NRC has been engaged with the industry-led Licensing Modernization Project, or LMP, with the goal of establishing technology-inclusive, risk-informed, and performance-based regulatory guidance for licensing Advanced Reactors. Industry's LMP document, also called NEI-18-04, outlines a systematic approach for use by reactor developers regarding topics that are fundamental to the safe design of Advanced Reactors. On May 13th, 2019, the NRC staff issued a Draft Regulatory Guide for public comment proposing to endorse the NEI-18-04 methodology to inform the contents of applications.

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

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

Next slide, please.

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

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

We have noticed a recent increase in possible interest in microreactors from end-users and designers. The NRC has not defined microreactors, but the Department of Energy uses this term to describe a reactor that is capable of producing 1 to 20 megawatts of thermal energy and that is factory-built, transportable, and self-regulating. For example, the reactor design would utilize passive safety systems and would not require a large number of specialized operators. The safety, security, and environmental reviews of microreactors might

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

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

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

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

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

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

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

consideration?

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

FERC CHAIRMAN CHATTERJEE: Thank you for that.

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

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

FERC CHAIRMAN CHATTERJEE: Makes sense.

Thank you.

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

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

FERC CHAIRMAN CHATTERJEE: Uh-hum.

MS. BRADFORD: Okay. Not the NRC?

FERC CHAIRMAN CHATTERJEE: Yes.

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

FERC CHAIRMAN CHATTERJEE: That's very helpful. Thank you all again.

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner Glick?

FERC COMMISSIONER GLICK: Thanks.

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

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

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

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

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

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

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

FERC COMMISSIONER GLICK: Thank you very much.

NRC CHAIRMAN SVINICKI: Thank you.

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

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

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

NRC CHAIRMAN SVINICKI: Thank you.

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

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

sure.

NRC CHAIRMAN SVINICKI: Thank you very much.

Other questions? Commissioner Baran?

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

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

NRC COMMISSIONER BARAN: Okay. Thanks.

NRC CHAIRMAN SVINICKI: Thank you.

Any other questions? Commissioner Caputo?

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

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

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

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

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

MR. BENNER: Uh-hum.

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

NRC COMMISSIONER CAPUTO: Okay. Thank you.

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

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

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

NRC COMMISSIONER WRIGHT: Fine.

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

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

Thank you again to all of our initial presenters.

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

(Laughter.)

So, we're going to reset here.

But thank you all.

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

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

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

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

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

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

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

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

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

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

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

slide, please.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The large number of critical digital assets has

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NRC CHAIRMAN SVINICKI: Well, my thanks to you

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

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

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

MS. EKE: Should I go first?

MS. HELTON: Yeah.

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

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

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

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

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

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

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

FERC CHAIRMAN CHATTERJEE: Thank you both for

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

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

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

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

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

FERC CHAIRMAN CHATTERJEE: I think that --

MS. HELTON: If that covers your --

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

MS. HELTON: Okay.

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

NRC CHAIRMAN SVINICKI: Thank you.

Commissioner Glick?

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

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

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

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

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

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

Our inspections are already somewhat risk informed,

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

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

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

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

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

It was kind of interesting when you said this. You

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

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

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

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

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

MS. HELTON: Yes.

FERC COMMISSIONER GLICK: Okay.

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

FERC COMMISSIONER GLICK: Okay, thank you.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NRC COMMISSIONER BARAN: Okay.

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

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

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

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

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

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

NRC COMMISSIONER BARAN: Thank you.

NRC CHAIRMAN SVINICKI: Other questions? Commissioner Caputo?

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

NRC CHAIRMAN SVINICKI: Okay.

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

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

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

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

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

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

NRC COMMISSIONER CAPUTO: Okay.

MS. EKE: Yeah.

NRC COMMISSIONER CAPUTO: Thank you.

NRC CHAIRMAN SVINICKI: Commissioner Wright? Okay, well, with that, again I want to thank these presenters, but also all of the presenters we've heard from this morning, and with this, we will now adjourn the public portion of this meeting. Thank you.

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