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FEDERAL ENERGY REGULATORY COMMISSION

JOINT MEETING OF THE NUCLEAR REGULATORY COMMISSION
AND THE FEDERAL ENERGY REGULATORY COMMISSION

AD06-6-000

Friday, June 15, 2012

9:30-11:30 a.m.

FERC Chairman and Commissioners:

NRC Chairman and Commissioners:

Chairman Jon Wellinghoff

Commissioner Philip D. Moeller

Commissioner John R. Norris

Commissioner Cheryl A. LaFleur

Commissioner William C. Ostendorff

Commissioner Kristine L. Svinicki

Chairman Gregory B. Jaczko

Commissioner George Apostolakis

Commissioner William D. Magwood, IV

1 FERC Staff:

2

3 Robert Snow, Senior Electrical Engineer, Office of Energy
4 Policy and Innovation

5 Ted Franks, Division Director, Office of Electric
6 Reliability

7 Regis Binder, Senior Electrical Engineer, Office of
8 Electric Reliability

9

10 NRC Staff:

11

12 Dan Dorman, Deputy Director for Engineering and Corporate
13 Support, Office of Nuclear Reactor Regulation

14 Marc Dapas, Deputy Director, Office of Nuclear Security
15 and Incident Response

16

17 North American Electric Reliability Corporation (NERC) Staff:

18

19 Mark Lauby, Vice President and Director, Reliability
20 Assessment and Performance Analysis

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

2 (9:38a.m.)

3 FERC CHAIRMAN WELLINGHOFF: I'll call the meeting
4 to order please. This is the time and place that's duly
5 noticed under the Government in Sunshine Act for the joint
6 meeting of the Federal Energy Regulatory Commission and the
7 Nuclear Regulatory Commission. Please join me in the Pledge
8 of Allegiance.

9 (Pledge of allegiance recited.)

10 FERC CHAIRMAN WELLINGHOFF: I want to welcome
11 Chairman Jaczko and his fellow Commissioners here. Thank
12 you all for coming. It's a great pleasure to have this
13 joint meeting. As you all know, FERC and the NRC signed an
14 MOU in September of 2010 to facilitate interactions between
15 the two agencies on matters of mutual interest pertaining to
16 the bulk power system.

17 Our last joint meeting was on March 16th, 2010 at
18 the NRC and this is actually my third joint meeting that
19 we've had with the NRC. And I am glad that FERC could host
20 this meeting and I hope that we can continue the tradition
21 of having these joint meetings. They've been very
22 productive and helpful.

23 We have a full program this morning with three
24 excellent panels, one on the operations of nuclear power
25 plants and their impact on efficient, reliable operation of
26

1 the electric grid; one on cybersecurity activities; and a
2 final panel on station blackout rulemaking and grid
3 reliability standards activities, and we'll also in that
4 final panel include geomagnetic storm issues and the
5 potential challenges to nuclear plants' offsite power due to
6 grid-loading conditions in peak summer times.

7 We do have a full program this morning, and
8 unfortunately we don't have any breaks scheduled. We do
9 have lunch scheduled, however though, and also we have tours
10 for the Commissioners scheduled of our Market Monitoring
11 Center and our Reliability Monitoring Center, and I think
12 you'll enjoy seeing those as well.

13 The panelists will each have five to seven
14 minutes to present, and then we'll have about 20 minutes for
15 questions. So with that, I'll turn it over to Chairman
16 Jaczko if you have any opening remarks or questions.

17 NRC CHAIRMAN JACZKO: Well thank you Jon, and I
18 appreciate being a guest here today of the Federal Energy
19 Regulatory Commission. I think this is either my fourth or
20 fifth meeting, joint meeting like this, and I think it's
21 been a tremendous effort on the part of the two
22 organizations to have these meetings and discuss the issues
23 that are important to both of our organizations.

24 I think the first meeting between our two
25 organizations happened back in August 2003, when we were
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1 dealing with the blackout that affected so much of the
2 Northeastern United States, and of course a number of
3 nuclear power plants. I believe our two Commissions and the
4 hard-working staffs at both of these agencies can take great
5 pride in the open and collaborative working relationship
6 we've developed over the years, culminating, of course, in
7 the memorandum that you discussed.

8 I look forward to the presentations today. I
9 think they all focus in areas where our staffs have worked
10 together on a number of technical issues, which interface
11 both of our agencies' missions: the reliability of the
12 nation's electric grid, cybersecurity and the prolonged
13 station blackouts at reactors due to external events such as
14 geomagnetic storms.

15 So I think it's important that we continue our
16 collaborative efforts on these issues, and I want to thank
17 you, Chairman Wellinghoff and your colleagues for continuing
18 this effort and for expanding these efforts really under
19 your leadership.

20 The challenges posed by all these issues could
21 have a significant safety impact on our nation and our
22 reactor licensees and on dynamic threats that can evolve
23 quickly. So I think it's so important that we continue to
24 have this kind of fruitful dialogue and discussion to ensure
25 that we all carry out our missions effectively and with the
26

1 interests of the American people. Thank you.

2 FERC CHAIRMAN WELLINGHOFF: Thank you, Greg. Do
3 any of the other NRC Commissioners have any opening
4 comments? Commissioner Svinicki.

5 NRC COMMISSIONER SVINICKI: Chairman Wellinghoff,
6 good morning, and I want to thank you and your fellow
7 Commissioners for hosting us here today. This is I think an
8 important opportunity for us to hear about the work between
9 our staffs that goes on certainly on a day-to-day basis,
10 routinely and as issues arise. I share Chairman Jaczko's
11 view that in my experience, it's an extremely effective
12 collaborative relationship, and I'm very pleased we're here
13 today and hope that can continue.

14 FERC CHAIRMAN WELLINGHOFF: Thank you.
15 Commissioner Magwood.

16 NRC COMMISSIONER MAGWOOD: Merely to thank the
17 Chairman. I just want to relate my colleagues' thanks for
18 hosting today's joint meeting. This is my first opportunity
19 to participate in a joint discussion between our
20 Commissions. The issues we have together, I think, are very
21 compelling and very interesting and there is a lot for both
22 of us to learn, and I think it's interesting for the public
23 to see a Commission that almost never worries about cost,
24 and a Commission that always worries about costs, have so
25 many things in common. So again, thank you very much.

26

1 (Laughter.)

2 FERC CHAIRMAN WELLINGHOFF: Thank you. Yes.

3 NRC COMMISSIONER OSTENDORFF: Thank you Chairman
4 Wellinghoff and your Commissioner colleagues for having us
5 today. This is again, along with Commissioner Apostolakis
6 and Magwood, our first meeting down here, and it's I think a
7 very positive sign for us to work with fellow colleagues on
8 issues of common interest. So thank you for having us.

9 FERC CHAIRMAN WELLINGHOFF: You're very welcome.
10 Okay. My Commissioners, anyone?

11 FERC COMMISSIONER NORRIS: Welcome.

12 FERC CHAIRMAN WELLINGHOFF: All right. Then
13 we're ready to get to work. On our first panel we have Dan
14 Dorman from the NRC and Robert Snow from FERC. Dan, go
15 ahead.

16 MR. DORMAN: Chairman Wellinghoff, Chairman
17 Jaczko, Commissioners, thank you for this opportunity this
18 morning.

19 If I could get to Slide 3 of our presentation,
20 I'll jump right in and focus on an update on licensing of
21 nuclear power plants, with a focus on power being added to
22 the grid in the near-term and the future.

23 This slide depicts the locations of new reactor
24 applications before the Commission. There are 10 under
25 active review. We've received actually 18 applications, but
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1 the remaining 8 have been suspended for various reasons.
2 Earlier this year, the Commission, the NRC, approved the
3 issuance of the combined operating licenses for Vogtle Units
4 3 and 4 in Georgia and Summer Units 2 and 3 in South
5 Carolina, and construction is currently underway on those
6 units.

7 There are also three design certifications
8 currently under review for GE Hitachi's Economic Simplified
9 Boiling Water Reactor, ESBWR, AREVA's Evolutionary Power
10 Reactor, and Mitsubishi's U.S. Advanced Pressurized Water
11 Reactor, and the staff is also reviewing two early site
12 permits for Victoria County station in Texas and for PSE&G
13 in New Jersey.

14 If I can go to Slide 4. This is an aerial view
15 of the Virgil summer site in South Carolina currently under
16 construction. Unit 1 is the operational unit. This shows
17 the area for Units 2 and 3, which the licensee projects
18 initial operation for Unit 2 in 2017 and Unit 3 in 2018.

19 The next slide shows the Vogtle site in Georgia,
20 with two currently operating units. This shot shows the
21 area around Units 3 and 4, which are projected for operation
22 in 2016 and 2017. All of these units are Westinghouse AP-
23 1000 designs, which would bring roughly 1,000 megawatts each
24 to the grid.

25 The next slide, Slide 6, shows the history, the
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1 cumulative history of power uprates. The red shows power
2 uprates that have been approved by the NRC. The yellow
3 shows projected uprates for the next several years. You can
4 see that over about the last 15 years, uprates to the
5 allowed power of existing units have brought about 5,000
6 megawatts to the grid over the last 15 years.

7 Slide 7 talks a little bit about the operation of
8 the existing plants. Load-following refers to the ability
9 to change the output of a power plant to meet the
10 fluctuating demands of the grid. Nuclear power plants are
11 designed to be baseload-generating plants. Changing
12 electric power output requires changing reactor power either
13 through changing the position of the control rods in the
14 reactor, or by changing the boron concentration in the
15 reactor coolant.

16 Constantly changing reactor power leads to uneven
17 flux distribution within the reactor and uneven fuel burn.
18 The power changes also increase thermal stresses on the
19 reactor vessel. Economically, it's not attractive to the
20 operators to operate nuclear power plants at fluctuating and
21 low-power levels. All of the power uprate applicants have
22 to demonstrate that the change in the maximum power output
23 from the facility will not result in grid stability concerns
24 in their areas during various operating modes of the plant
25 and of the transmission system. This is a factor that our
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1 staff considers in its review of these power uprate license
2 amendments.

3 In addition, we continue to get support from NERC
4 and FERC staff for enforcement discretion cases at nuclear
5 power plants which involve consideration of grid reliability
6 and its relationship to nuclear safety. As an example,
7 about a year ago Duke Energy requested the staff grant
8 discretion from enforcing requirements of technical
9 specifications for surveillance of containment isolation
10 valves at Oconee Plant Units 2 and 3 in South Carolina.

11 This request for enforcement discretion was based
12 on impending severe weather. The NRC staff evaluated the
13 basis of their request and contacted the following agencies
14 to fully understand the grid conditions in the vicinity of
15 the plant. It contacted FERC, NERC and the Southeast Region
16 Transmission System Operator, as well as Duke Energy, the
17 licensee for the plant.

18 The transmission system operator confirmed that
19 the transmission system in the area was stressed due to
20 unusually high temperatures during that period of time, and
21 the power reserves were at a minimum, and Duke Energy had
22 made appropriate efforts to procure available reserves from
23 adjacent operators.

24 The next slide talks a little bit more about some
25 other interactions with the staffs of the Commissions. We
26

1 meet on a quarterly basis to share ongoing issues and
2 activities.

3 NRC operates a dam safety program, which covers
4 nine dams, seven supporting the ultimate heat sink for
5 operating reactors, and two connected with fuel facilities.
6 And over the past 20 years under our memorandum of
7 agreement, FERC has provided support to our dam safety
8 program. We use FERC's expertise and their personnel for
9 our direct field inspections and evaluations of these dams.

10 Our most recent inspection was at Lake Anna in
11 Virginia in March.

12 Another example of the coordination between our
13 staffs: last fall, there was an 11-minute system disturbance
14 in the Pacific Southwest leading to cascading power outages
15 affecting approximately 2.7 million customers in parts of
16 Arizona, Southern California and Baja, California and
17 Mexico.

18 This grid perturbation was a result of a
19 switching error, and power instantaneously redistributed
20 throughout the Southern California system. This
21 redistribution of power created sizeable voltage deviations
22 and equipment overloads that resulted in the automatic
23 shutdown of the San Onofre Nuclear Generating Station's two
24 units in Southern California.

25 We were invited to participate in the FERC-NERC
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1 investigation of this event, which we greatly appreciate,
2 and while our staff's focus was primarily on the impact on
3 the San Onofre station, and our response and the response of
4 the San Onofre station to the event, our staff gained useful
5 insights in the overall grid response to this perturbation.
6 We greatly appreciate that coordination, and that completes
7 my presentation.

8 FERC CHAIRMAN WELLINGHOFF: Thank you, Dan. Bob,
9 welcome.

10 MR. SNOW: The first slide, please. Hi. My name
11 is Bob Snow. I'm a senior engineer in the Office of Energy
12 Policy Innovation.

13 The purpose of my presentation is: (1) to walk
14 through a simplified example of a grid operation of a
15 wholesale electric market; (2) is to show the interplay
16 between the types of resources on the existing transmission
17 grid and the grid operator's action to ensure reliable
18 delivery of firm demand; and (3) to mention a few of the
19 FERC's policy initiatives to help ensure that under our
20 rules alternative resources like responsive demand and
21 electric storage are able to provide flexibility to grid
22 operators.

23 This presentation uses regional maps of
24 locational energy prices to show how the grid's load,
25 generation, demand-side resources and transmission
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1 limitations interact in an area with significant amounts of
2 both wind and nuclear generation.

3 Second slide or you didn't give me the first
4 slide yet. Ah, there we are. In the organized energy
5 markets regulated by FERC, the energy markets are dispatched
6 to serve firm load using the least-cost resources on both
7 the supply side and the demand side. The dispatch is
8 subject to limitations that our facilities must operate
9 within their thermal, voltage and stability ratings, both
10 normally and after an unexpected event, such as the outage
11 of a transmission line or a large generating plant.

12 Individual resources submit bids to supply
13 electric energy, or reduce their use of energy. The price
14 bids of generators are shown in this slide. The bids are
15 stacked--are showing resources like hydro and wind bid at
16 near zero. Nuclear plants bid very low also. The low bids
17 signal a willingness to be dispatched at almost any price.
18 Grid operators call on the bid resources from the lowest to
19 the highest until the demand is met.

20 The resource that meets the last increment of
21 demand is said to have cleared the market, and its bid price
22 is paid to all of the resources at that price or lower for
23 the time period, assuming unconstrained operations. Again,
24 looking at this graph, if the net demand for an hour is the
25 first vertical line on there, on kind of the left hand side
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1 of the chart, the clearing price is \$30, while it will rise
2 to \$180 per megawatt hour, if the demand rose to the right-
3 most vertical line. Therefore, as the demand changes during
4 the day, the prices increase or change. Importantly, if the
5 transmission system is not capable of delivering the output
6 of the lowest cost resources, generation output or load
7 consumption is modified by the grid operator to allow all
8 firm load to be served.

9 Depending on the location of any transmission
10 constraints, the resources available either generation
11 demand response or storage acting as supply, any one of
12 those could be the solution. And so the characteristics and
13 flexibility of the resources affect which resources are in
14 fact used, so affecting the price that electric customers
15 pay.

16 Third slide, please. This slide and the next
17 provide an example of how the location of generating
18 resources and transmission constraints affect grid
19 operations. In this slide you see the location of the
20 nuclear plants in the region near Chicago. They have a
21 total capacity of 19.4 gigawatts electric, with 11.4
22 gigawatts west of Chicago.

23 The red and yellow color lines on the slide show
24 the location of the major transmission constraints on a hot
25 day in July. Transmission limits are set by the facility
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1 ratings and other system criteria. Operating within the
2 ratings and satisfying those criteria are required for
3 reliable system operation.

4 Next slide. This slide shows the location of the
5 wind resources in the region. There were a total rating of
6 10.6 gigawatts of wind generation in MISO at the end of 2012
7 projected, with 10.3 in existence in 2011.

8 Slide 5. Now that you have a picture of the
9 location of the nuclear and wind resources and of the
10 transmission system, I'm going to go through a system in
11 operation, starting at about one o'clock in the morning on a
12 July day, a hot July day. The color on this graphics are
13 the prices associated with a grid operator action to meet
14 customer demand at lowest prices while operating reliably.
15 The dark blue areas show electric prices near zero dollars
16 per megawatt hour, indicating a combination of low loads,
17 available resources and limited transmission capacity to
18 move those resources to higher-priced areas.

19 At this 1:00 a.m. slide, you would expect the
20 loads are low and costs are low. If there were no
21 transmission limitations, the power would be pushed
22 everywhere on the system. The entire region would be one
23 uniform color. However, you see the one high price location
24 in red, where prices are \$200 a megawatt hour. There are
25 known transmission constraints in a large coal unit in this
26

1 area. Such generation within flexible and low-cost output
2 must be continued to operate despite the low demand.

3 Planning ahead for what is expected to be a peak
4 day, the grid operators have to had to run higher cost
5 resources as insurance that the grid will be operating and
6 can provide all service. The ability of demand to increase
7 at this time, such as industrial load consuming more or
8 storing energy, could be of assistance in the blue area, as
9 well as industrial load consuming less or storage in the red
10 area. Nuclear units, of course, are not considered as
11 flexible or dispatchable, as my colleague just mentioned a
12 moment ago.

13 Slide 6, please. Here at 6:00 a.m., people are
14 starting their day and the demand is starting to increase.
15 The price is not uniform because of limitations on the
16 transmission paths. The blue areas continue to have low-
17 cost generation with a limited transmission available to
18 deliver to the higher cost areas.

19 Further, the grid operator is running low-cost
20 resources in the blue area. That's kind of an insurance
21 against the transmission or large generator outages near the
22 Chicago load area. Finally, low prices generally provide an
23 economic signal to generators to reduce output or load to
24 increase their consumption.

25 However, the blue area contains most of the wind
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1 plants, as well as the Quad City Nuclear Plant. Both kinds
2 of resources run full-out, regardless of the price signals.
3 We say nuclear power and often wind are not dispatchable.
4 In the orange areas where power costs are about \$76 a
5 megawatt hour, more generation and/or load demand or the
6 output of storage was needed to meet that demand.

7 Slide 7, please. Electric demand increased
8 throughout the morning and by 1:00 p.m., more expensive
9 resources are needed to meet the demand. The price of
10 electricity is high over large areas, but not everywhere.
11 The major population areas are seeing prices of over \$200 a
12 megawatt, or other areas are still seeing very low prices,
13 because of the appearance of new transmission constraints,
14 different transmission constraints.

15 For example, prices are low around the Quad City
16 Nuclear Plant. The closest of these very low-cost areas and
17 high cost-areas mean that power is trapped in the low-cost
18 area by transmission limitations along the interface between
19 the blue and the red areas. It cannot physically move to
20 serve other customers reliably that are paying a very high
21 price. A \$200 price reflects the marginal cost to consumers
22 due to these transmission constraints.

23 Next slide, please. This slide shows the prices
24 at 5:00 p.m. near the peak of the day. Now even more
25 expensive generation has been committed to serve demand.
26

1 However, even now, there are locations with low prices. In
2 this case, near the Point Beach and Kiwanis. I'm probably
3 pronouncing that wrong, but close enough, plants that are
4 due to transmission limitations.

5 As the day continues and demand increases and
6 then drops off, grid operators repeat the exercise of
7 dispatching the lowest cost resources, demand controllable
8 generation, controllable demand and storage, to meet load
9 while managing constraints on the system.

10 The FERC has been working to ensure that the grid
11 has enough capability and flexibility to cope with a variety
12 of grid conditions at a reasonable cost. We have acted to
13 remove unnecessary barriers to using more flexible resources
14 while ensuring that their compensation reflects their
15 performance and encouraging transmission expansion. We
16 also have removed barriers to participation of alternative
17 resources, such as demand response and storage in the
18 wholesale markets.

19 Last slide, all right. In sum, the grid
20 operators must manage the flow on the grid to operate the
21 grid reliably, taking into account all significant
22 contingencies, including the outage of large conventional
23 generators. Grid management utilizes the dispatchable and
24 non-dispatchable generation, demand-side resources and
25 storage systems to meet the firm demand at lowest cost.

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1 Having electric prices that vary by location is
2 an essential part of grid management in organized markets.
3 These locational marginal prices induce resources to respond
4 appropriately to transmission constraints, assuming they can
5 respond. If they can't, that's just it. Having more
6 controllable resources, more controllable generation,
7 storage and demand response, especially in the right
8 locations to help maintain reliability and manage the cost
9 of serving customers.

10 Thank you.

11 (Microphone interference begins.)

12 FERC CHAIRMAN WELLINGHOFF: Great. Thank you,
13 Bob. That was good. I don't know what that (noise) is, but
14 in any case, hopefully we can figure out what the noise and
15 stop it. Dan, thank you as well.

16 We'll go to some questions. In fact, I have a
17 short comment and a question for you, and then I'll go to my
18 colleagues. I believe that the efficiency and reliable
19 operation of the grid is essential, and the operation of
20 various supply resources in that grid in an efficient,
21 reliable way is the way to do that.

22 But we also need to recognize that we can't look
23 at any particular resource in isolation. You have to look
24 at --

25 (Microphone interference increases.)

26

1 FERC CHAIRMAN WELLINGHOFF: Okay. I'll turn off
2 one of my microphones. I think that did it. It was me all
3 along.

4 (Laughter.)

5 FERC CHAIRMAN WELLINGHOFF: But as I say, we
6 can't look at any resource in isolation, and I think you two
7 have illustrated that. We have to figure out how to look at
8 them as a whole. They all have unique operating
9 characteristics. Nuclear power has unique characteristics.
10 Wind has unique characteristics, coal has. Each one has
11 unique characteristics, and certainly nuclear power plants
12 that are operating do have a good track record with high
13 capacity factors.

14 But there are some aspects of their operation
15 that I have some concern over. Some nuclear power failures
16 appear to be major and persistent. Of the 132 nuclear units
17 that were built and licensed, and this is statistics that
18 I've developed recently that were out there, that's
19 research, 21 percent were permanently shut down because of
20 intractable reliability or cost issues related to
21 reliability.

22 Further, 27 percent have suffered one or more
23 forced outages of at least a year, which I find to be pretty
24 incredible, and I guess we can look at the SONGS unit now,
25 which is one that may be in that category, and is causing
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1 some significant problems in Southern California.

2 I know that I said that everything's going to be
3 fine in Southern California, but it's only going to be fine
4 because of some extraordinary efforts, taking some
5 mothballed plants out of their mothballs and getting the gas
6 plants operating and looking at demand response and other
7 things as well.

8 Admittedly when the remaining 68 units work well,
9 their output is commendable, steady and dependable. They
10 average a 90 percent capacity factor, which is very high.
11 However, there seems to be a number of persistent and
12 perhaps unique reliability issues, and I want to just list
13 them and then see if I can get your comments on them.

14 One is that routine refueling, as I understand
15 it, it is coordinated with the grid operators, but it shuts
16 down the typical nuclear power plant for 37 days every 17
17 months. Then apparently there have been, in certain
18 instances in locations in Europe and the U.S., prolonged
19 heat waves have shut down or derated nuclear plants because
20 their source of cooling water gets too hot.

21 Of course, we have the issue of a major accident,
22 natural disaster or even a terrorist attack at one nuclear
23 plant in some instances causes all others in the same
24 country to shut down, and we can talk about Japan there,
25 certainly what happened with the Fukushima situation. So
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1 that's one that's out there.

2 Another issue and we talked about the 2003
3 blackout, you know, unscheduled outages can result in many
4 nuclear units failing simultaneously and without warning in
5 a regional blackout. At the start of the August 14th, 2003
6 North American blackout, nine U.S. nuclear units totaling
7 7800 megawatts were running perfectly with 100 percent
8 output. But after emergency shutdown, they took two weeks
9 to restart fully.

10 They achieved zero output on the first day that
11 the grid was back up. They achieved a .3 percent output on
12 the second day, 5.7 percent on the third day, 38.4 percent
13 on the fourth, 55.2 on the fifth and 66.8 on the sixth. The
14 average capacity loss was 97.5 percent for three days, 62.5
15 percent for five days and it took them really, as I say, two
16 weeks before they were fully operating.

17 So again we couldn't rely upon them certainly to
18 restart the grid--black start issues there. And there are
19 the issues of course of their inability to provide first- or
20 second-tier frequency response support to the grid. So, you
21 know, with these multiple issues that I've outlined, how do
22 you see that we best mitigate these issues so that we can
23 ensure that we can reliably integrate renewable, or excuse
24 me, nuclear power plants into the grid with other types of
25 resources that have different characteristics, and do it in
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1 the most efficient way? That's kind of the general question
2 for both of you.

3 MR. DORMAN: I think that there are multiple
4 considerations that play into the statistics that you've
5 mentioned, Chairman. First off, it is a relatively slow and
6 deliberate process to start up a nuclear power plant, and
7 will continue to be so. And so you're not going to get the
8 kind of quick response black start that you will get from
9 other sources, particularly in a situation like the blackout
10 in 2003.

11 In some respects I go back to the Hurricane
12 Katrina that came through this region a number of years ago.
13 And in that instance, I believe the Surry and North Anna
14 plants were back online fairly quickly. We do have some
15 responsibilities with FEMA to ensure the offsite emergency
16 response capability after a hurricane like that.

17 But the power of those plants at that time was
18 limited because of the grid capacity following the damages
19 from the hurricane. So they were--that contributed to their
20 slowness in coming up. I don't recall specifically in the
21 grid blackout in 2003 to what extent that was a contributing
22 factor to the rate at which those nuclear power plants
23 returned.

24 The other factor that would play in, from our
25 perspective, is when there is a perturbation of a nuclear
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1 power plant that shuts down abruptly from 100 percent power,
2 there is some probability that you're going to get some
3 safety-related equipment that may not respond exactly the
4 way we expected, and we want to understand that before we
5 allow that plant to restart, particularly when there may be
6 questions of the stability of the grid.

7 So those are factors that can contribute to the
8 rate at which you're going to be able to bring nuclear power
9 plants back under those circumstances. Going to the
10 comments on the capacity factor, and the contribution of
11 unplanned outages in particular, you noted the roughly 90
12 percent capacity factor that the industry operates under
13 today.

14 If you go back 25-30 years, that was in the
15 neighborhood of 60 to 65 percent. There's been significant
16 progress by the operators in supporting the sustained
17 reliable operation of those facilities. So I think at this
18 point, you're not going to get a whole lot more out of that.
19 There will continue to be unplanned outages to some degree.

20 The San Onofre situation, obviously, is that's of
21 very high concern to our Commission and our staff, because
22 of the causes that contribute to the sustained duration that
23 that outage will be.

24 FERC CHAIRMAN WELLINGHOFF: Mike.

25 MR. SNOW: I agree with your comment that the
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1 operators need to have many different tools, understanding
2 the limitation of dispatchable or non-dispatchable, both
3 demand as well as generation. Good planning, good
4 operations, covers all of the events that happened because
5 of either natural or man-made events occurring on the
6 system.

7 Your comment on the 2003 blackout, I wasn't with
8 the Commission at that time. Actually I spent that day in a
9 control room putting the system back together again in part
10 of that system. So our, the plants, the company I was
11 working with at the time had a couple of nuclear power
12 plants that bluntly stayed up and thank God they did at the
13 time, because they were helping us put the rest of the
14 system back together.

15 But again, it's good people, good preparation and
16 a lot of different resources allow you to put the system
17 back up. And I don't believe that's going to change any
18 time in the near future. Our requirements, the Commission
19 requirements and the reliability standards identify what
20 these entities need to have in place. We don't tell them
21 how to do it; that's for sure.

22 And with that amount of planning, that
23 preparation and understanding a lot of the things that can
24 occur, they're prepared to handle. Now it took a reasonable
25 time to get the system back in 2003. But considering the
26

1 amount of outages, there was very little damage to the
2 system, fortunately. That's why it took so quickly to get
3 back.

4 The plants being offline, I think we expect that
5 to occur. It's not unusual that that happened. So in the
6 planning you understand that, and make sure you have enough
7 resources.

8 FERC CHAIRMAN WELLINGHOFF: Chairman Jaczko.

9 NRC CHAIRMAN JACZKO: I have one question just
10 going to the issue of the electricity market which is
11 something that's a little bit foreign to us, or to me in
12 particular. But one of the assumptions we generally have
13 made is that nuclear units generally operate at a profit
14 ultimately. Whether it's on an hourly basis, I don't
15 necessarily know. But certainly on a daily basis, that they
16 tend to be selling power at prices below the costs, or
17 certainly the routine costs for operation.

18 Are you seeing markets now in which that's not
19 the case, that some of the nuclear units are operating
20 below, are selling power below-cost on, I don't know if it's
21 on an hourly basis or on a daily basis or any time during
22 that process?

23 MR. SNOW: As I identified, that nuclear units
24 bid very, very low, sometimes zero, sometimes very -- you
25 know, maybe at their marginal cost. They are price-takers.

26

1 Whatever the price the market identifies, the clearing
2 prices that one of my slides identified, they're quite happy
3 with doing that.

4 At any given hour, at one hour, the locational
5 marginal price at their bus may very well be below their
6 marginal cost. And as a, you know, tiling in for that hour,
7 they may be at a loss. But they operate with the long view
8 in mind, and to my understanding nuclear plants are a good
9 business. People wouldn't be building these plants if they
10 didn't think they were a good business.

11 So we've not seen anything yet. My crystal ball
12 is cracked and fuzzy on what may happen in the future, but
13 thus far, it doesn't seem -- a given hour, yeah. I think
14 the example I was trying to give you here showed some of
15 those hours on a very hot day in July.

16 NRC CHAIRMAN JACZKO: Thank you.

17 FERC CHAIRMAN WELLINGHOFF: Thank you. Any other
18 questions?

19 NRC COMMISSIONER SVINICKI: Dan, in your
20 presentation, you touched on, I think it was the nine dams
21 that we inspect and that we had the opportunity to have FERC
22 accompaniment of dam experts on those inspections. You did
23 not mention and could you address if there's any cooperative
24 activity going on between the NRC and FERC staff on the
25 generic issue that we have under investigation of upstream
26

1 dam failure. Are we coordinating with FERC on that, and if
2 so, what does that collaboration consist of?

3 MR. DORMAN: Yes. The issue that you referred to
4 we've encompassed into a broader issue in our Fukushima
5 follow-up, as you know, to look at the flooding hazard
6 reanalysis for each nuclear power plant. A number of
7 facilities have upstream dams with varying degrees of
8 incorporation into their existing licensing basis, and most
9 of those dams are FERC-regulated dams.

10 So our hydrology folks will be working with FERC
11 in evaluating the reliability of those dams, the risk of
12 over-topping or of sunny day failures, and the contributors
13 that those would provide, and how to incorporate those into
14 an assessment of the flooding hazard analysis for the
15 nuclear plants.

16 FERC CHAIRMAN WELLINGHOFF: Phil.

17 FERC COMMISSIONER MOELLER: I want to thank the
18 NRC staff for being involved in the San Diego outage or
19 Southern California outage report. It highlights the
20 interdependent nature of all of our resources, the fact
21 that, you know, definitions of the bulk electric system are
22 involved. As we move to a system where we're going to be
23 using more natural gas to generate electricity, these kinds
24 of trends will only increase.

25 The second point is to highlight
26

1 the way this agency can affect the NRC is that you mentioned
2 the capacity factors that are now at around 90 percent. If
3 you go back to the late '80's or the early '90's, those
4 were, as I recall, in the mid-'60's.

5 Now granted, some of the lower-performing plants
6 have been out of the mix, but the reality from my
7 perspective is that the open access transmission policies
8 that this Commission pushed long before we were here in
9 Order 888, and the consequent move towards more competitive
10 wholesale markets, basically forced the nuclear industry to
11 perform better, and I think they did an amazing job to get
12 those capacity factors up to 90 percent.

13 But they did it in response to competitive
14 pressures, while I would think the NRC would say that safety
15 actually improved--so again, highlighting the dependency or
16 the effects that this agency can have on the NRC and NRC
17 actions on FERC.

18 A question for Mr. Dorman: I like to think about
19 trends and anticipating challenges down the road. You've
20 obviously got a big one now related to the SONGS plant. But
21 if you were to say the top three or top two trends you see
22 as a professional going forward, that you're maybe not
23 concerned about but you would think we would find
24 interesting, I'd be interested in your answer.

25 MR. DORMAN: We have, as part of our reactor
26

1 oversight process, we have a routine process to evaluate
2 trends in industry performance and we recently completed
3 that periodic review and found no significant trend in
4 industry performance.

5 So from the standpoint of the availability and
6 reliability of the power produced from the nuclear sector, I
7 don't see any significant change in the operating fleet.
8 And we do have the power uprate program that I mentioned,
9 where we see several thousand megawatts being added over the
10 next five to six years to the grid, and then the addition of
11 the new reactors that have already been approved by the
12 Commission. And there are several still in the review
13 process.

14 So I think if I see a trend, it's in increasing
15 availability, in the few percent increase of the
16 availability of power from the nuclear sector in the coming
17 years.

18 FERC CHAIRMAN WELLINGHOFF: Cheryl.

19 FERC COMMISSIONER LaFLEUR: Thank you very much.
20 Very interesting presentation. I always observe that almost
21 all energy issues come down to trade-offs between
22 reliability and security, cost and environment and safety,
23 and that's true of almost everything we look at. And when I
24 look at the existing nuclear fleet, it's doing very well
25 across those dimensions.

26

1 You know, it's 20 percent of the energy. We
2 really miss it when it's not there, as in SONGS. It's
3 carbon-free and very low-cost, low marginal cost. So as has
4 been observed, the current fleet is doing very well in the
5 competitive markets and the open access transmission regime,
6 yet it's very, very, very difficult to build a new nuclear
7 plant in this country.

8 And as we look forward to the evolution of the
9 fleet, you can't keep operating the existing fleet forever.
10 At some point, we'll either we'll lose a lot of the existing
11 fleet. I know there's a lot of reasons for that, but are
12 there things within the design of the markets or the
13 policies under the control of this Commission that we can be
14 working on together, to look to the future of nuclear? Big
15 question but --

16 MR. DORMAN: Big question. I'll look to my
17 colleague for comment on the markets. That's not my area.
18 I think one of the significant challenges in putting new
19 nuclear and, to some degree, any new energy online is the
20 availability of capital to support the investment. We had a
21 period in the late '70's, '80's, into the early '90's in
22 licensing the existing fleet, where from the time of
23 application for a license to the issuance of the license was
24 measured almost in decades rather than years.

25 Our Commission made a great effort in the '90's
26

1 to look at our licensing process and the predictability of
2 our licensing process, and the Vogtle and Summer units were
3 the first tests of that process. But I think from a capital
4 standpoint, it's hard for the investment markets to look at
5 something that takes 20 years to start providing a return on
6 investment as a good investment.

7 So I think we've made progress on our end. I
8 think in terms of the market impacts on that, I'd defer to
9 my FERC colleague.

10 MR. SNOW: As Dan indicated, the major aspects on
11 new plants are will there be return on that investment?
12 It's the capital aspect or the market aspect. The
13 Commission has done a number of things in the capacity
14 market, forward capacity markets that gives some indication,
15 at least for the current fleet of gas-fired units that have
16 some certainty.

17 It might be appropriate to think about what would
18 be the appropriate time frame on a capacity market to match
19 some of the appropriate things or the time frames. 20
20 years? I think no one's quite that good figuring things
21 that far out, but a little further out might be something to
22 look at.

23 But just--my response is my personal response,
24 not an official--but the issue is, as Dan identified, his
25 critical issue is capital, can I finance these things, and
26

1 that really relates to do I have a revenue stream? What's
2 that stream look like?

3 A similar problem we've heard of and addressed in
4 the gas-fired fleet with multiple year-ahead capacity
5 markets, I don't think--the problem is the same. It's just
6 a different technology, but the problem is the same.

7 FERC COMMISSIONER LaFLEUR: I guess you can't--
8 three years of forward, a three years' forward look might
9 make sense for a gas plant. It isn't really obviously the
10 time frame of a nuclear. Thank you.

11 FERC CHAIRMAN WELLINGHOFF: Commissioner Magwood.

12 NRC COMMISSIONER MAGWOOD: Thank you for your
13 presentations.

14 Just one sort of comment and a question. You
15 know, as I've talked with nuclear operators over the years
16 and their decision-making processes when they consider
17 adding new units, one of the considerations that comes into
18 play is diversity, and some of them have expressed the
19 concern that as gas prices remain low, there's a tendency
20 for the utilities to add more gas capacity, and that over
21 time, that could tend to make them disproportionately, in
22 their view, relying on gas.

23 And if there is some spike in gas prices their
24 customers would be impacted, and that's what they've
25 expressed to be part of the rationale for considering
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1 nuclear power plants. Is that just the view of a few people
2 in the industry? Is that something that you think industry
3 and FERC view as a valuable part of the decision-making
4 process, or do you think the process really is simply driven
5 by what's the lowest price. If that's the case, what about
6 fuel diversity going forward?

7 MR. SNOW: Let me again preface this in my
8 opinion, just to -- my approach would be to identify what
9 your goals are going to be as far as reliability, loss of
10 load expectations--there are a bunch of ways of quantifying
11 that.

12 Single fuel, all your eggs in one basket, a
13 planner is never happy with that approach, be it a power
14 system planner, a transmission planner or a financial
15 planner, for that matter. So diversity is something you
16 would strive for. But that diversity can be across fuel, it
17 can be across geography and it can be across technologies
18 that are used.

19 So you have a bunch of diversities, and I don't
20 think we want to get, to narrow it down and say if it's gas,
21 it's bad. No. If there are approaches one can take to
22 limit the risk. The reliability standard approach was to
23 identify what you wanted to achieve, and let the very smart
24 people out there come up with varying ways.

25 Part of that discussion might be that you cover
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1 some of that variation, I was trying to make the point in my
2 presentation, of resources. There are two sides of the
3 equation. Generation is one; load is the other. Both of
4 them should be in play. Both of them should be
5 controllable. Dispatchable is the term I used a moment ago.
6 And that if you have a nuclear plant, certain
7 characteristics, that makes economic sense and is a good
8 business venture, it will almost always help the market, if
9 that responds to your question.

10 NRC COMMISSIONER MAGWOOD: Almost. Let me just
11 ask a follow-up then. Is it in--if you have the choice as
12 an operator to add, say, a nuclear capacity or some other
13 conventional capacity, or natural gas and you can do it for
14 roughly the same price, would you tend to just simply add
15 more gas if you could add more gas, or would you go to
16 another technology, wind or nuclear or something else if you
17 could do it for roughly the same price.

18 MR. SNOW: If I were the operator that had the
19 power to do those, I always would like to have diversity and
20 a number of options. So I have some amount of each of the
21 resources: a certain amount or renewables; a certain amount
22 of hydro which is another variety of renewables; some
23 baseload nuke; some plants that can vary or are very
24 flexible units that can ramp up/ramp down quickly, that give
25 me that capability.

26

1 I'd love to have all of those, if price was not
2 an object. As you kind of identified before, price is part
3 of that equation. So you need to kind of temper that. It
4 doesn't mean price is the only issue. It's reliable service
5 at the lowest cost. That doesn't mean zero or thereabout.
6 It's that good reliability, appropriate reliability at the
7 lowest cost involved.

8 FERC CHAIRMAN WELLINGHOFF: Thank you. Anybody
9 else, any questions anyone? Going, going, gone. Oh John.

10 FERC COMMISSIONER NORRIS: I'd like to share with
11 you a concern I have, and I think others have expressed here
12 as well that becoming over-dependent upon one fuel--well gas
13 is a tremendous asset for the generation industry and
14 industry all across the economic sectors. It's a concern we
15 have, and I have, of over-dependence on one fuel source, and
16 the fact that it's pushing out development of new nuclear,
17 renewables and a number of other technologies.

18 FERC CHAIRMAN WELLINGHOFF: Thank you, John.
19 Yes, George.

20 NRC COMMISSIONER APOSTOLAKIS: Yeah. The word
21 "reliability" and "reliable" performance has been used
22 several times. I know how the NRC defines that. How do you
23 define that concept?

24 MR. SNOW: I would kind of defer to the
25 Commission-approved standards on reliable operation, and in
26

1 the--fundamentally, it's the serving, I'm going to call it
2 the portfolio of generation is able to be delivered to the
3 portfolio of firm load, and with load being a variable and
4 generation being a variable. For all normal conditions, all
5 the expected things you would have, the hot days, the cold
6 days, the reasonable storm kind of things, and for any
7 credible contingency that would occur on the system, that
8 the customer, the end use customer, the wholesale customer,
9 doesn't know anything happened unless of course it was their
10 service connection that the tree came down on. Yes, they're
11 going to be out for that. I'd kind of describe that as one
12 aspect of reliable operation.

13 The other aspect is that you're going to do this
14 over time. You know, there are going to be some things that
15 will occur. You know, Murphy's alive and well and certainly
16 existing out there and certain things will occur. So that
17 the kind of the loss of load expectation, the probability, I
18 think, in the nuclear industry--my resume doesn't show me,
19 but I started in the nuclear industry many, many years ago
20 in plant design--so I have some idea, at least a dated idea
21 of probabilities used to look at core damage.

22 I kind of think that concept but in service,
23 keeping that value at a reasonably low number. And as we
24 become more and more dependent on or use the systems more
25 and more, electricity becomes not a commodity but a
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1 necessity, So making sure it's reliable in a kind of
2 deterministic point of view, but also look at the
3 probabilities of what's going to happen of all of the
4 events, and keep that probability also low. That would be
5 my definition of that.

6 FERC CHAIRMAN WELLINGHOFF: Anyone else have
7 anything?

8 (No response.)

9 FERC CHAIRMAN WELLINGHOFF: Okay. Well thank you
10 both. Bob, I don't think you ever knew we were going to
11 make you into a markets expert, but you did a good job.
12 Thank you. Both of you did a great job. If we can have our
13 second panel please, Mr. Dapas from the NRC and Mr. Franks
14 from FERC. Mr. Dapas, did I pronounce your name correctly?

15 MR. DAPAS: Da-Pas.

16 FERC CHAIRMAN WELLINGHOFF: Dapas, sorry. Mr.
17 Dapas. If you can start please.

18 MR. DAPAS: If I could have the first slide
19 please. Good morning Chairman Jaczko, Chairman Wellinghoff
20 and other Commissioners. I'm Marc Dapas, and I'm the Deputy
21 Office Director in our Office of Nuclear Security and
22 Incident Response, and as such, that office has program
23 oversight responsibility for the NRC's cybersecurity
24 program.

25 I appreciate the opportunity to share with you a
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1 perspective on some of the activities that we have
2 undergoing in the area of cybersecurity. Let me start out
3 by providing a summary of the regulatory history, framework
4 and associated guidance in this area.

5 Next slide, please. In March 2009, the NRC
6 issued 10 C.F.R. Part 73.54, known as the cybersecurity
7 rule, which requires each nuclear power plant licensee to
8 provide high assurance that digital assets are adequately
9 protected against cyber attacks. The scope of the
10 cybersecurity rule includes systems associated or considered
11 safety-related, important to safety, have a security
12 interface, or affect the emergency preparedness function.

13 It also includes offsite communications as well
14 as associated support systems. In connection with the rule,
15 we issued Regulatory Guide 5.71, which provides a framework
16 for identifying those digital assets that must be protected
17 from cyber attacks, referred to as critical digital assets
18 or CDAs. The framework also includes a set of security
19 controls that's based on standards that were provided by the
20 National Institute of Standards and Technology or NIST.

21 Those NIST standards are based on well-understood
22 cyber threats, risks and vulnerabilities, as well as
23 countermeasures and protective techniques. Before the NRC
24 issued its cybersecurity rule, FERC issued an order, No.
25 706, which specified critical infrastructure protection or
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1 CIP reliability standards to safeguard critical cyber
2 assets. That FERC order specifically exempted facilities
3 regulated by the NRC from those requirements.

4 Initially, the NRC staff interpreted that
5 cybersecurity rule to require the -- or our cybersecurity
6 rule, I should say, to require the protection of critical
7 digital assets that if compromised, could directly or
8 indirectly result in radiological sabotage. It's in this
9 interpretive context that the NRC staff initially did not
10 consider many of the balance of plant or BOP systems to be
11 within the scope of the rule, but rather considered these
12 BOP systems to fall within the scope of the FERC CIP
13 standards.

14 To address this gap in cyber protection for BOP
15 systems, FERC issued another order as you know, 706(b), and
16 that order removed the nuclear power plant exemption clause
17 and clarified that BOP systems that are not within the scope
18 of Part 73.54 are subject to compliance with the CIP
19 standards. The order further indicated that nuclear power
20 plant owners could seek exceptions from the CIP standards on
21 a case-by-case basis, for those digital assets that were
22 subject to the NRC cybersecurity requirements.

23 In December 2009, the NERC and the North American
24 Electric Reliability Corporation or NERC entered into a
25 Memorandum of Understanding which included the mutual
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1 commitment to cooperate in considering those specific
2 exception requests. And as mentioned by Chairman
3 Wellinghoff in his opening remarks, the NRC and FERC signed
4 a Memorandum of Understanding to facilitate interactions
5 between the two agencies, and that included coordination of
6 activities related to cybersecurity.

7 So to inform the decision on where the
8 jurisdictional line between FERC and NERC should be drawn
9 with respect to BOP systems, NERC sent a survey to all
10 nuclear power plant owners known as the Bright Line Survey.
11 That survey asked licensees to identify which BOP systems
12 are within the scope of the FERC CIP standards, and which
13 ones are subject to NRC's cybersecurity regulations.

14 So in response to that Bright Line Survey, all
15 nuclear power plant licensees stated that BOP systems, if
16 compromised, affect reactivity and then as such they're
17 considered important to safety and fall under the scope of
18 the NRC cybersecurity rule. Then to further clarify the
19 jurisdictional issue, in October 2010 the NRC Commission
20 stated that as a matter of policy the NRC cybersecurity rule
21 at 10 C.F.R. Part 73.54, should be interpreted to include
22 structure, systems, and components in the balance of plant
23 that have a nexus to radiological health and safety.

24 The staff then determined, in looking at what
25 systems have a nexus to radiological health and safety, it's
26

1 those BOP systems that could directly or indirectly affect
2 reactivity at a nuclear power plant, and that as such, are
3 considered important to safety and fall under our
4 cybersecurity rule. I would like to point out that in the
5 many activities and interactions to determine the respective
6 jurisdictional responsibilities, FERC, NERC and the NRC have
7 worked together in a highly collaborative manner.

8 Then the last activity that I'd like to mention
9 in the context of a guidance development pertains to the
10 Nuclear Energy Institute or NEI 1004, which was developed by
11 the industry to provide additional guidance with respect to
12 the identification of those critical digital assets that are
13 subject to the requirements of our rule.

14 We recently provided NEI with what we expect to
15 be the last round of staff comments before NEI submits the
16 document for a formal NRC endorsement.

17 Next slide, please. With respect to program
18 implementation, the NRC cybersecurity rule requires each
19 licensee to submit a proposed implementation schedule for
20 its cybersecurity plan. Those plans and schedules have been
21 reviewed and approved by the NRC and then incorporated into
22 each nuclear power plant license through license conditions.

23 Unlike other aspects of our security regulations,
24 the cybersecurity rule did not mandate one specific date for
25 full compliance for all operating reactors. This is because
26

1 the staff recognized that each site is different, and
2 factors such as outages, hiring qualified personnel with a
3 cybersecurity skill set, and the interdependencies with
4 other programs would impact implementation.

5 So to provide an appropriate degree of
6 flexibility, while also ensuring that key threat vectors are
7 addressed in a timely manner, and that activities which
8 provide a high degree of protection against radiological
9 sabotage are accomplished first, the staff endorsed a graded
10 approach that consisted of eight key milestones, and as
11 indicated on the slide, Milestones 1 through 7 are required
12 to be complete in six months or by December 31st, 2012.

13 These milestones focus on activities that provide
14 higher degrees of protection. But with respect to BOP
15 systems, which I know is an area of interest with FERC, when
16 you look at Milestone 2, that requires all CDAs in the BOP
17 be identified and Milestone 5 would require that those CDAs
18 as well as others be looked at for obvious signs of
19 tampering when you're doing your insider mitigation rounds.

20 With the implementation of Milestone 6, all CDAs
21 and the balance of plant systems associated with target sets
22 will have security controls applied. Additionally, if there
23 are any portable or mobile devices that interface with any
24 BOP CDA such as through routine maintenance, reprogramming
25 of software patching activities, that those devices must be
26

1 protected against the propagation of any malware.

2 While the completion of Milestones 1 through 7
3 provide for key threat vectors and activities being
4 addressed in the nearer term, it's with the completion of
5 Milestone 8 that additional security controls will be
6 applied to every CDA, to meet the full requirements of our
7 rule.

8 Next slide, please. With respect to oversight
9 activities, in terms of our inspection program we've been
10 working collaboratively with our internal and external
11 stakeholders. That includes FERC, the Department of
12 Homeland Security and NIST, to develop an inspection
13 procedure of what we call a Temporary Instruction.

14 In the fall, we're planning to conduct a workshop
15 with the industry to discuss that temporary instruction. We
16 also will be training our inspectors, another critical
17 element of our oversight program, and in July 2011, we
18 conducted our first cybersecurity course for inspectors at
19 the Idaho National Laboratory. We intend to conduct the
20 second course in October of this year.

21 Regarding development of our Significance
22 Determination Process, and that's a tool that we use to
23 determine, as the name implies, the significance of any
24 findings that would derive from our inspection activities,
25 we have drafted an initial SDP framework. We plan to meet
26

1 with industry and our interagency partners in late August,
2 to obtain any insights they may have, and then in October we
3 will conduct a table top pilot, and we use various findings
4 scenarios, with the goal of issuing that final Significance
5 Determination Process or SDP, before we start our
6 inspections in January of 2013.

7 Consistent with how we have developed other
8 inspection elements associated with the reactor oversight
9 process, we will be piloting that cybersecurity inspection
10 process. We've already conducted one pilot evaluation at
11 Watts Bar Unit 2, and we're looking at conducting a second
12 pilot at Clinton in August.

13 Then upon successful completion of the pilot
14 process, we're looking to begin our inspections of
15 Milestones 1 through 7, as I mentioned earlier, in January
16 of 2013, and inspections of the full program implementation,
17 which is reflected in Milestone 8, will begin in late 2014.

18 That start date coincides with when the first set
19 of licensees are required to have fully implemented their
20 programs. Similar to the comment that I made regarding the
21 collaborative manner in which we've worked with FERC and
22 NERC with respect to guidance development, we've seen the
23 same degree of collaboration and information-sharing in
24 working with those agencies as we develop our oversight
25 program. Those interactions have been excellent. That
26

1 concludes my remarks. Thank you.

2 FERC CHAIRMAN WELLINGHOFF: Thank you, Mr. Dapas.
3 Mr. Franks.

4 MR. FRANKS: Good morning Chairman and
5 Commissioners. My name is Ted Franks, and I am with the
6 Office of Electric Reliability at FERC. Since the last
7 joint Commission meeting, NERC's Critical Infrastructure
8 Protection or CIP standards have been evolving. Today, I
9 would like to give you an update on the standards
10 development and the path forward, as the industry continues
11 to address the directives issued by the Commission in Order
12 706 and subsequent orders.

13 Next slide. The standard disclaimer. These
14 opinions expressed in the presentation are mine, and do not
15 necessarily reflect the Commission or any individual
16 commissioner.

17 Next slide, please. First, I would like to
18 present a brief synopsis of NERC's development of the CIP
19 standards. In January 2008, the Commission issued Order
20 706, which approved Version 1 of the CIP standards. In
21 approving the standards, the Commission also identified
22 numerous areas of needed improvement, and directed NERC to
23 revise the standards to address these concerns.

24 Subsequent versions of the CIP standards address
25 directives associated with the removal of terms "reasonable
26

1 business judgment" and "acceptance of risk from the
2 standards." NERC also addressed requirements associated
3 with senior management sign-off, training, personnel risk
4 assessments, implementation time tables and technical
5 feasibility exceptions.

6 Versions 2 and 3 of the CIP standards, along with
7 various compliance filings, address some of the Commission
8 directives. However, additional modifications to the
9 standards are still being developed, such as defense in
10 depth, access control, patch management and traffic
11 monitoring. As Marc has already referenced in his
12 presentation, Order 706(b) was also issued to address this
13 regulatory--to address a regulatory gap.

14 I think this is a good example of the two
15 agencies working with NERC and the industry to ensure the
16 proper regulatory framework was put in place to address this
17 issue. This collaborative effort continues today as we
18 regularly meet with the NRC to communicate cybersecurity
19 issues that could potentially impact the security of the
20 nuclear power plants and bulk power system.

21 Next slide, please. In April 2012, the
22 Commission issued Order No. 761, which approved Version 4 of
23 the CIP standards. The major change proposed in Version 4
24 was the method for identifying critical assets. Version 4
25 applies a Bright Line criteria on the elements associated
26

1 with transmission generation and control centers. For
2 instance, black start resources and associated cranking
3 paths, which are used to provide offsite power to the
4 nuclear stations after a disturbance, are identified as
5 critical assets.

6 This method of identifying critical assets
7 replaces the use of a risk-based assessment methodology used
8 by individual entities. The Commission found that the
9 Bright Line would add consistency and clarity in the
10 identification of critical assets. Similar to Versions 1, 2
11 and 3, the critical cyber assets will be identified as a
12 subset of the critical assets.

13 These critical assets will then be afforded the
14 protections and controls of CIP 003 through CIP 009.
15 Critical cyber asset identification and the protection and
16 controls of CIP 3 through 9, remain relatively unchanged
17 from Version 3.

18 Next slide, please. In Order 761, the Commission
19 also provided some guidance on some of the remaining
20 directives from Order 706. This guidance focused on three
21 primary areas. Connectivity, the National Institute of
22 Standards and Technology or NIST standards, and regional
23 perspective.

24 For guidance on how connectivity should be
25 considered in the course of determining appropriate
26

1 cybersecurity protections, the Commission stated its support
2 of NERC's intentions to apply electronic security perimeter
3 protections of some form to all bulk electric cyber systems.
4 This guidance is consistent with the language in Order 706,
5 that states "the cyberconnectivity of the bulk power system
6 assets increases the risk of multiple asset cyber attack,
7 and the CIP standards should reflect this.

8 In Order 761, the Commission reiterated its
9 encouragement to NERC and the industry to include relevant
10 aspects of the NIST framework and standards into subsequent
11 versions of the CIP standards, to better protect the bulk
12 power system with regard to both identification of elements
13 to be protected, and the design of the appropriate
14 protections.

15 Also in Order 761, the Commission highlighted its
16 Order 706 directive for NERC to develop a process of
17 external review and approval, based on regional perspective,
18 emphasizing the need to avoid any reliability gaps. On this
19 regional perspective issue, the Commission determined that
20 even with the adoption of clear and objectionable criteria,
21 there remains a need for an entity with a regional
22 perspective, presumably the ERO or a regional entity to have
23 the opportunity to identify or adjust the characterization
24 of cyber assets in some circumstances.

25 In other words, Bright Lines are useful for the
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1 identification of assets and systems, but there could be
2 circumstances such as technological development or
3 reliability gaps revealed by events, where assets or systems
4 fall out of a Bright Line, that should be afforded the
5 appropriate levels of protection based on their unique
6 characteristics or role in maintaining grid reliability.

7 Order 761 also issued a deadline for NERC to
8 submit Version 5 of the CIP standards to the Commission by
9 March 31st of 2013. NERC has indicated that it anticipates
10 responding to all of the remaining Order 706 directives in
11 Version 5 of the CIP standards. In the draft currently
12 under development, Version 5 takes a tiered approach and
13 applies various levels of controls for each category of
14 cyber systems associated with the bulk electric system.

15 This approach will afford some level of
16 protection for all cyber systems associated with the BES.
17 Two ballots have been conducted, one in January, in which
18 the standards received an average approval of 29 percent.
19 Another ballot was recently completed in May, in which an
20 average of 52 percent approval was achieved. However, the
21 standards need a two-thirds majority approval prior to being
22 sent to the NERC BOT for approval.

23 FERC staff continues to monitor the standards
24 drafting team progress, and we look to their filing on March
25 31st or sooner. This concludes my presentation, and I look
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1 forward to answering any questions.

2 FERC CHAIRMAN WELLINGHOFF: Thank you, Tim. I
3 appreciate it. So we're trying to move along on the NERC
4 side with CIP standards. As you can see, it's sometimes a
5 long and torturous process to get there.

6 My question actually would be on the other side
7 of things for Mr. Dapas, something that we don't have a lot
8 of ability to move forward on, and little statutory
9 authority, and that's in the area of known threats and
10 vulnerabilities, and I'll give you an example.

11 I guess one would be the Aurora effect. Are you
12 familiar with the Aurora effect?

13 MR. DAPAS: Yes.

14 FERC CHAIRMAN WELLINGHOFF: So what authority and
15 what abilities does the NRC have to deal with known threats
16 and vulnerabilities that you would determine on your side of
17 the Bright Line?

18 MR. DAPAS: We have a process that we go through,
19 and it's called a threat assessment. We have an office or
20 branch that's called our Intelligence Liaison and Threat
21 Assessment Branch, and they engage with the interagency to
22 identify any threats.

23 And then we work with the Department of Homeland
24 Security in an organization called ICS-CIRT to evaluate the
25 significance of any threat, and then we would determine if
26

1 we need to issue advisories to licensees communicating that
2 threat, and then we would expect licensees to take action,
3 just like similar to an operating experience program that's
4 in effect within the safety arena.

5 But we do evaluate those to determine the
6 significance. We learn from the perspective of the other
7 agencies and depending on the significance, if we needed to
8 take more significant action, we could direct licensees to
9 take action. But right now, the current process is we
10 expect licensees to evaluate the significance with the
11 benefits of the insights that we were provided in those
12 advisories, and then take appropriate action.

13 FERC CHAIRMAN WELLINGHOFF: Can you make those
14 advisories classified?

15 MR. DAPAS: Some are -- yes. It depends on
16 obviously the content of the threat and we certainly don't
17 want to share information with those who don't have a need
18 to know. We also have a mechanism called the protected web
19 server, which does provide--different licensees that have a
20 need to know do have access to that server and are able to
21 acquire information.

22 But the salient point I want to make is that we
23 would evaluate the significance of the threat, and then
24 determine what's the appropriate follow-up action and would
25 communicate that to licensees. Then, as appropriate, we
26

1 would follow-up to ensure licensees have taken action to
2 protect against those threats. And I think we did that in
3 the case with the Aurora example that you mentioned.

4 FERC CHAIRMAN WELLINGHOFF: Because you had the
5 ability to do it immediately, in essence, and do it in a
6 classified manner as well.

7 MR. DAPAS: Again, I would offer like if there
8 were a safety issue. It's the same concept there, that we
9 would evaluate what action we need to take to ensure that a
10 facility's security posture is not being compromised due to
11 that threat.

12 FERC CHAIRMAN WELLINGHOFF: Thank you. Greg.

13 NRC CHAIRMAN JACZKO: Thanks, Jon. One of the
14 issues that we've been dealing with over the last several
15 years has to do with new nuclear generation and
16 transitioning from an infrastructure control and an
17 instrumentation and control infrastructure that has largely
18 been non-digitally based.

19 So as we have gone through the process of looking
20 at new reactors, we've generally been dealing with systems
21 that are digitally-based, and as we've gone through that
22 process, and particularly when it comes to reliability and
23 security concerns with the digital instrumentation and
24 control systems, we've generally gotten very--well, we've
25 gotten a little bit mired in the issues of design of these
26

1 systems, and how much detail do we need to know about the
2 design in order to ensure that the architecture is secure or
3 reliable or whatever the specific outcome may be.

4 When I look at the nuclear infrastructure, that
5 is a fairly narrowly defined set of infrastructure with a
6 utility, or a sector-specific regulator, the NRC, so we have
7 some measure of ability to heavily influence that
8 architecture in its development so that we can begin to
9 deploy a generation of instrumentation and control systems
10 that should have in theory better cyber protections built
11 into the design process to the extent that we can.

12 I'm not sure that we've succeeded in that, but at
13 least we have the ability to do that. When I look at the
14 bulk power system, the limited things I know about the bulk
15 power system tell me that that is a very diverse system,
16 with a large number of control systems, a large number of
17 utility entities involved in that entire system.

18 So do you see right now the ability to properly
19 influence the addition of new control systems, of new
20 transmission, whatever the systems may be, to ensure that as
21 those new resources are brought on board, that they are
22 building in the kind of appropriate thinking about
23 cybersecurity from the beginning, or will this need to be
24 added on later? How do you see that?

25 MR. FRANKS: Well I guess that is one of the
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1 issues that they're running into now, is that the original
2 industrial control systems weren't really designed with
3 security in mind. So now they're in, you know, the bolted-
4 on stage. But going forward, yes, we would very much like
5 to see vendors working with customers, the ability to bake
6 in the security, so you don't have to add it later on, and
7 we are seeing some progress in that area.

8 Of course a lot of attention has been given to
9 vulnerabilities that exist in the current systems that are
10 in place right now, and they're using that as say leverage
11 and learning experiences on how to move forward to secure
12 the future of control systems. But I think the progress is
13 being made in that direction.

14 NRC CHAIRMAN JACZKO: So if I could just do a
15 brief follow-up, so who has the authority in that area? Is
16 that -- I mean does someone have authority over all those
17 systems? Is it FERC, is it NERC or do some of those systems
18 fall outside of the authority of any entity?

19 MR. FRANKS: The simple answer is no. Right now,
20 we don't have that authority to oversee, or anyone that I
21 know of has the authority to oversee the design of a control
22 system. Right now, it's between the vendor and the customer
23 on how secure the system is going to be.

24 NRC CHAIRMAN JACZKO: Thank you.

25 FERC CHAIRMAN WELLINGHOFF: Anyone else? Yes.

26

1 NRC COMMISSIONER OSTENDORFF: Thank you, Mr.
2 Chairman.

3 I have a question for both -- two questions, one
4 for both of you and then one for Ted. The question for both
5 of you, I'm going back to Ted's comment about the Bright
6 Line approach, adding consistency to identifying which SSCs
7 fall in the balance of plant.

8 I want to ask both of you to comment on any
9 challenges that you've seen to date, on what you anticipate
10 going forward with the Bright Line approach for the nuclear
11 power plants.

12 MR. DAPAS: I guess the perspective I would
13 offer, Commissioner, really independent of the BOP systems.
14 I think one of the challenges is licensees looking at the
15 148 controls associated with the NIST standards, and trying
16 to determine which controls needs to be applied to each
17 system or critical digital asset, whether that be BOP or
18 whether those be those critical digital assets that are
19 specific to the target sets.

20 But I do think, you know, we're doing what we can
21 to provide guidance there to assist the licensees in looking
22 at how to provide appropriate protections for the BOP
23 systems. Our whole approach with Milestones 1 through 7,
24 you know, it's graded based on those systems that would have
25 the highest degree of impact on any potential radiological
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1 sabotage.

2 So as you look at it with that graded approach,
3 the licensees have to determine to what extent do they need
4 to implement controls with the various critical digital
5 assets. Some require, I would offer, more controls to be in
6 place than the others, because of the significance of the
7 system in terms of preventing radiological sabotage. Like
8 when you look at power conversion systems, which is a BOP
9 system, that may need to have greater controls than another
10 BOP system that isn't subjected to potentially the same
11 vulnerabilities through a cyber intrusion.

12 But I do think the Bright Line Survey clearly has
13 delineated, you know, what is the responsibility under NRC
14 jurisdiction and what is the responsibility with FERC? You
15 know, we establish it by going out to the first intertie
16 breaker in the electrical distribution system. That clearly
17 has provided clarity that both the Commission's direction
18 back in October 2010 and the Bright Line Survey results are
19 consistent, and I think that has been significant--so that
20 there's not that uncertainty that exists on which systems
21 need to have controls applied.

22 NRC COMMISSIONER OSTENDORFF: Ted, did you have
23 anything you wanted to comment on?

24 MR. FRANKS: Sure. I just want make sure I
25 clarify. So there was a Bright Line that was ordered
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1 through or discussed in 706(b). The Bright Line in my
2 presentation was how they are identifying critical assets.
3 I just wanted to make that clarification. It's not uncommon
4 to use the same word for it.

5 NRC COMMISSIONER OSTENDORFF: I understand.

6 MR. FRANKS: But your question about, you know,
7 are there any concerns about a Bright Line or limitations.
8 I think a Bright Line is a good start, but there does need
9 to remain somewhat a flexibility, because it's hard to say a
10 one-size-fits-all for everyone. I think it's a good start
11 as far as identifying critical assets.

12 But there could be circumstances where more
13 protections need to be afforded to certain assets than
14 others, and you may need to make that switch, moving it from
15 one category to another. So that would be my concern, is
16 that just the ability to have a little bit of flexibility to
17 address the assets that need additional protection.

18 NRC COMMISSIONER OSTENDORFF: So this is kind of
19 really the second question I wanted to ask you specifically
20 on your FERC hat. Look at the non-nuclear generating
21 sources you deal with, whether it be gas, coal, whatever it
22 may be. I think your flexibility response answer to my
23 question, is that from a policy and from a technical and a
24 security standpoint, you're comfortable with there being
25 somewhat different approaches based on the type of
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1 generating source?

2 I don't want put words in your mouth. I just
3 want to understand. I was going to ask, are there any
4 concerns about an approach the NRC is taking that might be
5 philosophically or fundamentally at odds with other non-
6 nuclear generating source of supplies?

7 MR. FRANKS: No, they should be similar. Again,
8 the goal is to protect the control systems. So not that a
9 one-size-fits-all, but the protection of the, we'll say non-
10 nuclear generation is also critical for the bulk power
11 system. So yes, those same types of protections should be
12 afforded to those as well.

13 NRC COMMISSIONER OSTENDORFF: Thank you.

14 FERC CHAIRMAN WELLINGHOFF: Yes. Commissioner
15 Magwood.

16 NRC COMMISSIONER MAGWOOD: Thank you for your
17 presentations. First, a comment for my FERC colleagues, and
18 I'm sure you've heard something about these events, small
19 modular reactors that the industry is developing. On a
20 visit not long ago, one of the vendors who's developing a
21 small modular reactor informed me that they have decided to
22 not incorporate digital systems in their reactor. Rather,
23 they're going to go completely analog.

24 The reason for doing that is cyber security.
25 They just simply decided it's just too difficult to keep up
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1 with things. So in that respect, I have a question for both
2 of you. You know, we are in NRC accustomed to establishing,
3 you know, a design-based threat or establishing a level of
4 safety that we require, and our licensees are used to
5 working to achieve that level or whatever the issue is.

6 It seems to me cybersecurity is a constantly-
7 evolving threat, that it doesn't just evolve in terms of the
8 sophistication of the attacks, but really the nature. We
9 find that they come at this situation from different
10 directions. As we go through this process, and let's say by
11 the end of this process you think that we are secure. Are
12 we secure five years later? And how do we assure that
13 we're secure five years later?

14 Do we have to continue--do we have to give orders
15 on a continuing basis from here on out? Or does this
16 establish a methodology where our various licensees will be
17 able to deal with these evolving threats on their own? I'd
18 like to hear both an NRC and FERC perspective on that.

19 MR. DAPAS: I guess my perspective would be,
20 drawing an analogy in the safety arena, you have controls in
21 place and when you have new information, you have to assess
22 to what degree are your existing controls sufficient to
23 provide protection.

24 As you indicated, cyber is a very dynamic and
25 evolving area, and I would offer the expectation going
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1 forward would be that as we provide information to licensees
2 they'd have to look at, do they provide an appropriate level
3 of protection with their critical digital assets?

4 And that may necessitate a change to their
5 cybersecurity plan, and if such, that would be submitted to
6 be reviewed and approved by the NRC. A licensee can't make
7 a change to their plan without NRC review and approval.

8 And I'll offer, just like currently under our
9 inspection process and other cornerstones with the reactor
10 oversight process, when we have new information there can be
11 times where we initiate an inspection activity to determine,
12 you know, to what degree do the vulnerabilities exist? So I
13 would offer we do have tools in place that we could
14 leverage, to ensure that licensees are implementing
15 appropriate controls as that cybersecurity dynamic or threat
16 would continue to evolve.

17 And of course, we haven't established, you know,
18 the full operating experience program. I can see it will be
19 structured similarly to how we approached that in the safety
20 arena. But I would offer that we do--we'll be able to
21 ensure that an appropriate degree of cyber protection is
22 provided for with the flexibility that exists to use those
23 tools.

24 MR. FRANKS: And maybe taking it to a little bit
25 higher level for your question, I don't think you'll ever
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1 hear a cybersecurity expert say like 100 percent security is
2 achievable. They describe it more in terms of it's a
3 journey, not a destination; and that there always seems to
4 be instances where the bad guys are maybe just a little bit
5 ahead of the good guys.

6 Not to sound too negative here, but I think what
7 the standards can do is provide like a discipline, like just
8 an overall culture in the organizations where there's a
9 discipline, so in the event that there is some type of
10 intrusion or attack, that it can be isolated and removed,
11 and then resume operations again.

12 I think that's what the standards can offer, is
13 that just getting that discipline in place because it's
14 inevitable that you're going to be attacked and possibly
15 even penetrated.

16 MR. DAPAS: Could I offer one additional
17 perspective, Commissioner? I think how we are approaching
18 cybersecurity requirements associated with new construction
19 where there's been discussion should that be included in the
20 initial design and submitted to the NRC for review, there is
21 a school of thought which is reflected in the staff position
22 that with the evolving nature of cybersecurity and the long
23 lead time between when we receive the submittal and when we
24 would actually issue the combined operating license, that
25 threat can evolve.

26

1 And so we wanted licensees to have the ability to
2 take full advantage of the state of the art protections to
3 address those threats. And that's why the staff position
4 going forward is that licensees would subsequently submit a
5 separate licensing document to address their cybersecurity
6 program.

7 So I'd offer that, you know, in the context of
8 addressing your question about the evolving nature, and do
9 we have a means in place to address that.

10 FERC CHAIRMAN WELLINGHOFF: Marc, Ted, thank you.

11

12 If we could begin our next panel please, the
13 third panel. Mr. Lauby from NERC, Mr. Dorman from NRC, and
14 Mr. Binder from FERC.

15 Mark, do you want to kick it off?

16 MR. LAUBY: Thank you and good morning to the
17 Chairman and Commissioners. My name is Mark Lauby. I'm the
18 Vice President of Reliability Assessments and Performance
19 Analysis at the North American Electric Reliability
20 Corporation or NERC.

21 I think most people here know what NERC is, and
22 so I thought I would just jump to Slide 4, and just mention
23 that NERC's mission is to ensure the reliability of the bulk
24 power system. We develop and enforce reliability standards,
25 analyze system events and risks to reliability, and are

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1 accountable as the electric reliability organization to FERC
2 here in the United States and the provincial governments in
3 Canada.

4 Next slide, please. I wanted to chat real
5 briefly about risk to reliability and how NERC looks at
6 risk. It's beyond just the standards themselves, but also
7 the frequency and severity of risks. And this has been kind
8 of--well, I think they've actually jumped a slide on me, but
9 that's okay. We're way over. We've got a different set
10 here.

11 Okay. Yes. Well, I'm going to just chat about
12 what I want to chat about.

13 (Laughter.)

14 MR. LAUBY: So we talk a little bit about
15 severity of risk itself and the frequency of risk, and how
16 we really, you know, look at beyond just the standards
17 themselves but rather also, you know, things like, you know,
18 clusters of risks around areas where we want to learn and
19 reduce risk, and then areas around high impact low
20 frequency, and that would be where we put geomagnetic
21 disturbances, for example.

22 We focus on prioritizing those risks and define
23 the problems and the metrics for success. We apply a
24 disciplined approach to that, so that we can really measure
25 where we are today and where we're going, and we want to
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1 avoid missteps such as making unknowingly mistakes on
2 complex problems and making matters perhaps worse. So we
3 want to tailor solutions whenever possible.

4 The geomagnetic disturbance itself, the way we
5 approached this area was initially working with the
6 Department of Energy. We developed a list of different
7 types of high impact, low frequency risks such as pandemics
8 and coordinated attacks. There was a workshop held here in
9 Washington, along with geomagnetic disturbances and
10 electromagnetic pulses.

11 We mobilized, you know, the industry itself, the
12 executives of the Electricity Subsector Coordinating
13 Council, NERC's board, to address certain key areas, and the
14 geomagnetic disturbance area was one area that we focused
15 on, and a task force was launched with industry experts in
16 September of 2010. You know, we look at this particular
17 risk as important to industry, and there's extraordinary
18 uncertainty around it.

19 We issued a report, internal report, at the end
20 of February of this year, and we had three key findings.

21 One of course was that the most likely impact
22 from a severe geomagnetic disturbance would be an elevated
23 risk to voltage instability or collapse. This is really a
24 serious issue from NERC's perspective. You look at what
25 happened in HydroQuebec. That was a voltage collapse;

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1 portions of what happened in 2003 was a voltage collapse.
2 This is a serious issue and something that we definitely
3 want to dig into more deeply.

4 The second was that system operators and planners
5 needed the analytical tools, and information-sharing, to
6 understand the impacts and develop mitigation strategies.

7 The third conclusion was that some transformers
8 may be damaged or experience reduced life, depending on
9 design and current health.

10 So we then developed a plan forward. We had over
11 20 recommendations of action, and we've kind of laid them
12 out over a time period. The first kind of near-term actions
13 that industry can take is to identify facilities which
14 perhaps are at risk from severe geomagnetic disturbances,
15 and really want to see how we can assess those risks and
16 mitigate them.

17 So conducting a wide area view by collecting the
18 right kind of information from industry around their
19 transformers and the transformer health, and assess those
20 risks based on certain design parameters and age will be an
21 important step; also, working with the planning authorities
22 and planning coordinators to actually do some of the study
23 work that's going to be needed here.

24 Also identifying spare equipment, exactly what
25 transformers, for example, that we have and what, you know,
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1 what are their voltages and designs is also an important
2 component. We've just recently launched the spare equipment
3 database. Enhancing equipment specifications is going to be
4 important as well. We're working with IEEE and IEC as a
5 starting point, to ensure that we have the right kinds of
6 information there being developed. And of course enhanced
7 training.

8 From a mid-level perspective, also refining the
9 probabilistic storms themselves: What does a 1-in-100 year
10 storm look like? What's the wave front look like? Working
11 with NASA and the Canadian science agency, we're going to be
12 addressing that and a comprehensive set of tests for
13 transformers themselves, so we understand what are the
14 withstands capabilities there.

15 For a mid-term set of actions, increasing the
16 number of locations and where we monitor geomagnetic-induced
17 occurrence is important, and also bringing and centralizing
18 that information so that we can do the research and
19 development required, as well as enhancing the forecasting
20 capabilities is an action item.

21 We also are working with industry to develop
22 open-sourced analytical tools that then can be incorporated
23 into many of the commercial tools that industry uses to
24 simulate impacts is also important so that folks can then
25 know how it works and incorporate, start incorporating it
26

1 into their usual planning processes.

2 We are also working with the U.S. Geological
3 Survey and Natural Resources of Canada to develop ground
4 impedance maps, because the whole idea here is the currents
5 follow Ohm's law, and in some places, the same storm will
6 create no impacts and other places it could have impacts.
7 So we need to understand was the resistivity of the soil is.

8 Long term we're working with NOAA to increase the
9 granularity of forecasts. Right now we get information like
10 it's going to be a K-9. That's a global number. It doesn't
11 mean a lot from an action perspective. Obviously industry
12 does take action, but sometimes then those actions are not
13 required. So getting better and more informed information
14 from forecasting will be important.

15 Then also then developing, you know, GMD as part
16 of the normal planning process, perhaps in the planning
17 standards, and this is kind of a mid- to long-term two to
18 four years, is going to be very important. And then also
19 looking at our spare equipment and getting a kind of a
20 strategy as an industry, exactly what, you know, what kind
21 of policy should be available, and finalize the IEEE and IEC
22 standards.

23 For example, I know in Sweden they already
24 specify transformers that have to have, I believe, 200 amps
25 for ten minutes. That's a specification for Swedish
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1 transformers. They happen to be a certain variety of
2 transformer.

3 Then finally, of course, from a regulatory
4 perspective, you know, obviously a no-regrets' approach is
5 really going to be needed here. It's an area that has great
6 uncertainty, and we want to make sure first and foremost
7 that we do no harm.

8 We believe that developing a plan of action which
9 is what we've started to lay out here, and provide oversight
10 of that plan, and ensure that progress reporting continues
11 to happen to the regulators, so they know the progress of
12 the activity is important, because this is something that
13 will take some time and continue to engage global expertise.

14

15 We're not the only ones that experienced this.
16 You know, the Norwegians, the Swedes, the United Kingdom,
17 there are other countries as well, but certainly those are
18 most advanced in reviewing and taking action on geomagnetic
19 disturbances. You know, continuing to engage global
20 expertise, I think, will be important to reaching across the
21 pond, as they say.

22 Work with industry to introduce and adjust risk
23 controls. I think regulators can help us with that, as well
24 as, you know, so that we can address complex problems like
25 this. There are others as well. And of course, then,

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1 continue to monitor and ensure that we refine solutions and
2 get to a final no regret solution. So with that, I wanted
3 to thank the Commissioners and the Chairman for their kind
4 attention.

5 FERC CHAIRMAN WELLINGHOFF: Thank you, Mark.
6 Dan?

7 MR. DORMAN: Thank you. In this portion of the
8 presentation, I want to tee up two topics. One is our
9 station blackout rulemaking in the context of our lessons
10 from the Fukushima accident, and the second is our work in
11 the area of geomagnetic disturbances and long-term coping
12 for power.

13 If I could get my third, I think it's my third
14 slide, lessons learned from Fukushima, there's a lot of
15 topics on this slide. I'm not going to go into all of them.
16 I put those up there to give the Commissioners the
17 perspective of areas that the NRC staff is working to
18 enhance the protection of nuclear power plants, in light of
19 the accident at Fukushima.

20 But for this purpose, I'll focus your attention
21 on the third and fourth sub-bullets, and I'll start with the
22 fourth one, mitigating strategies for beyond design basis
23 events. In response to the terrorist attacks of 9/11, the
24 Commission required licensees to enhance capabilities to
25 mitigate events that involved the loss of a large area of
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1 the plant due to fires and explosions.

2 In response to the event at Fukushima, we
3 examined the availability and reliability of those systems
4 at nuclear power plants, and found that those systems were
5 generally sound and available, but they were designed to
6 accommodate a localized impact on one unit at a multi-unit
7 site. So we have required our licensees to procure
8 additional equipment, and also to look at those from the
9 standpoint of impacts on reactors and spent fuel pools on
10 multiple units at one site as a result of a large-scale
11 natural event such as we saw at Fukushima. So those orders
12 were issued on March 12th of this year, and the licensees
13 are in the process of implementing those.

14 In parallel, we've initiated -- we've issued an
15 Advance Notice of Proposed Rulemaking with a number of
16 questions. We had, the comment period is closed and our
17 staff are evaluating the comments. In the Fukushima event,
18 the operators made heroic efforts in the early hours of the
19 event, scouring neighborhoods for car batteries and anything
20 that they could cobble together to provide power to the
21 plants, to provide cooling to the reactors.

22 The purpose of both our mitigating strategies and
23 ultimately the station blackout rulemaking is that our
24 operators would have the capability to provide the cooling
25 using initially installed equipment at the plant to give
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1 them time to bring to bear the mitigating strategies, which
2 would be pre-staged onsite, which would buy time to bring in
3 industry resources from offsite to support sustained
4 operation without reliance on external government resources-
5 -which one of the factors in Fukushima was the significant
6 focus of the Japanese local and national governments was on
7 other effects of the earthquake and tsunami that impacted
8 them.

9 So briefly, those are the things that we have
10 underway in that area.

11 If we can go to the next slide, please, in the
12 area of geomagnetic effects NRC staff has been participating
13 with other agencies in evaluating the effects of geomagnetic
14 disturbances. We will be evaluating the NERC Task Force
15 Report for any applicability of those recommendations to the
16 nuclear power plants.

17 If I can go to the next slide, we have been
18 looking at geomagnetic effects for many years. We have no
19 specific regulatory requirements restricting plant
20 operations during geomagnetic disturbances. But the NERC-
21 mandated requirements provide assurance that the
22 transmission system operators provide reliability off-site
23 power sources for the nuclear power plants.

24 However, in the event of a loss of power in the
25 vicinity of the nuclear plant, the existing agreements
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1 between the nuclear plant operators and the grid operators
2 require a high priority for the restoration of the offsite
3 power to the nuclear power plant.

4 Some plants do have procedures to reduce power
5 output in the event of a solar storm warning of significant
6 severity, and in the event of the loss of the transmission
7 system, the nuclear power plants have redundant onsite
8 emergency diesel generators to provide adequate power to
9 assure core cooling.

10 The NRC has been looking at the potential
11 significance of electromagnetic pulse to the critical
12 infrastructure. We've reviewed the 2004 report of the
13 Commission to assess the threat to the United States of
14 electromagnetic pulse attack. And going back into the 70's,
15 we undertook a research program to study the effects of a
16 high altitude man-caused electromagnetic pulse on the safe
17 shutdown systems at nuclear power plants.

18 We've continued that work over the years. The
19 most recent report was issued in 2010, and continues to
20 sustain the conclusion that the reactors can achieve safe
21 shutdown following a man-made electromagnetic pulse event,
22 or a solar or geomagnetically-induced current event of
23 similar magnitude.

24 The actions that we're taking to address the
25 station blackout rule will provide further capacity to
26

1 ensure the ability to maintain the cooling of reactors and
2 spent fuel pools in the event of a significant geomagnetic-
3 induced event. That completes my presentation.

4 FERC CHAIRMAN WELLINGHOFF: Thank you, Dan.
5 Regis.

6 MR. BINDER: Good morning, thank you. Good
7 morning Chairman and Commissioners. My name is Regis
8 Binder. I'm with the Office of Electric Reliability at
9 FERC. This presentation is intended to give some insights
10 into the complex subject of geomagnetic disturbances. I
11 want to do so by discussing some areas on which there is
12 general agreement, and to discuss some possibilities for
13 moving forward.

14 In doing so, I'll mention some technical studies
15 and a recent FERC staff technical conference on geomagnetic
16 disturbances. Second slide, please. The disclaimer is that
17 the content here does not necessarily represent the opinions
18 of the Federal Energy Regulatory Commission or any
19 individual Commissioners.

20 Geomagnetic disturbances: I want to leave you
21 with a few impressions about geomagnetic disturbances that
22 will help understand some of the issues I'm going to go into
23 later in the presentation. There are three basic components
24 of the geomagnetic disturbance. First, the sun creates a
25 coronal mass ejection, which is a gust of ionized particles
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1 into space. Now those particles reach Earth sometimes, and
2 when they do, they cause varying magnetic fields on the
3 Earth's surface.

4 Now those magnetic fields induce voltages and
5 cause a flow of DC-like current, which I'll call GIC for
6 brevity, standing for geomagnetically-induced currents. Now
7 some of the things I want to mention to you are that the
8 CMEs, coronal mass ejections, are not always pointed at
9 earth. Sometimes you hear about them in the news and they
10 never really have a drastic effect on the earth. They may
11 not actually be pointed towards the Earth.

12 They can have a wide range of energy, and
13 depending on the energy, they can take different amounts of
14 time to reach the Earth, typically two to three days to
15 reach the Earth. Another aspect of them, of the CMEs that's
16 important is the polarity, and that has a drastic effect on
17 how much impact the event has on the Earth's magnetic
18 fields.

19 Unfortunately, we don't really know the polarity
20 of the CME until it almost reaches the Earth. So there's
21 very little advance warning of the polarity. Also, it's
22 important to remember that the grid has grown significantly,
23 and therefore we have put more antennae up in the air to
24 capture these magnetic fields, and to be influenced by them,
25 and for the GIC to flow on.

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1 There's about eight times as many extra high
2 voltage lines or HV lines today as there were in 1960. So
3 there's a lot more opportunity for the impact. In addition,
4 there are huge improvements and capacity expansions that are
5 expected on the transmission grid in the next 20-30 years.

6 Some of the threats from geomagnetic
7 disturbances: They can create damage or actually destroy
8 equipment, including large power transformers, generators,
9 breakers if they try to uprate during the event, capacitors.
10 They also cause an increased consumption by the transformers
11 of reactive power or VARs. Ultimately, that can lead to
12 system voltage instability and blackouts.

13 Also, the GIC when it's flowing through the
14 transformers causes the creation of harmonics on the bulk
15 power system, which you can think of as noise, in addition
16 to the regular sinusoidal voltage and current shapes that
17 are typically found on the bulk power system.

18 Now all of these effects are caused by the GIC or
19 the induced currents, and they basically cause the
20 transformers to operate in a mode and in a region of their
21 design that they're not intended to.

22 Next slide, please. There have been some
23 conflicting results in studies and reports recently. The
24 Oak Ridge National Laboratory study predicted that well over
25 300 EHV transformers would be at risk for failure or

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1 permanent damage. The Oak Ridge study was published in
2 2010. The conclusion regarding the transformers at risk was
3 calculated in the study that used a 1-in-100 year event.
4 That's the strength of the storm.

5 The study was jointly funded by FERC, DOE and
6 DHS, and there have been other reports, most notably by the
7 Congressional EMP Commission, that have also warned about
8 widespread transformer damage.

9 Another report that just came out in February of
10 2012 was the NERC interim report, which Mark has spoken of.
11 The point I want to make here to compare to the Oak Ridge
12 study is the NERC report indicated that the most likely
13 worst case system impacts of the severe EMD event and the
14 corresponding GIC flow was voltage instability.

15 Next slide, please. Mitigating steps: There are
16 hardware solutions and operational solutions. On the
17 hardware side, capacitors can be put in series with the
18 transmission lines, and that actually blocks the GIC,
19 because since the GIC is like DC current, to a DC current a
20 capacitor is like an open circuit. So basically it stops
21 the GIC from flowing.

22 However, you have to be very careful when you're
23 installing capacitors on the bulk power system, because you
24 have to be careful about the interaction with the rest of
25 the system. You can get into resonance problems very
26

1 quickly. So each installation needs to be looked at
2 carefully.

3 Neutral devices: Devices can be put into the
4 neutrals of the transformers to reduce or block the GIC from
5 flowing in the transformers. The important thing here is to
6 realize for resisters, you're not eliminating the GIC;
7 you're just reducing it. But then that raises the question
8 how much do you need to reduce it and how big of a storm do
9 you need to size the resistor for?

10 It can increase the withstand capability, and
11 Mark mentioned, I think it was in Sweden, that they do this.
12 You can actually -- the transformer can be designed and
13 built to withstand the GIC flow without significant damage,
14 and there are operational solutions, such as reducing load
15 and load-shedding, and increased reactive generation
16 reserve.

17 These operating solutions are intended to protect
18 equipment from damage, and to improve the grid's ability to
19 survive a CME, but not necessarily to prevent the creation
20 or the flow of the GIC.

21 Next slide, please. On April 30th, 2012, we held
22 a GMD staff technical conference here in this very room. As
23 you can see, we had a pretty diverse representation of
24 speakers, including a representative from the NRC, which we
25 were grateful for. Written comments were accepted through
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1 May 21st, and we got a variety of comments from a variety of
2 interested parties, and it significantly helped us to
3 understand all the expert opinions that exist on the
4 subjects.

5 Next slide, please. In general, what came out of
6 that conference were some issues that there was pretty
7 widespread, I'll say general agreement. By general, I mean
8 unanimous or near-unanimous agreement. One is that there's
9 definitely an opportunity to improve the knowledge about the
10 GMD issues and the solutions, as urgent actions are taken.

11 Standards are necessary to protect the grid from
12 GMDs, but when I say standards here, that could either be
13 mandatory reliability standards or industry standards like
14 IEEE standards. There's general agreement that grid
15 collapse due to a CME was not acceptable, and significant
16 effort is needed to prevent it.

17 And also there's agreement that GMD must be
18 addressed regionally, because what one company does to
19 mitigate GIC can influence its neighbors, and sometimes in a
20 detrimental way. And of course, the last item is the
21 vulnerable and critical assets should be examined and
22 protected.

23 Next slide, please. At a general high level, the
24 potential approaches for GMD are, number one, to encourage
25 voluntary action by industry.

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1 The second option is for industry to develop
2 standards, and again, remember I'm talking about potentially
3 industry standards in addition or perhaps including some
4 reliability standards.

5 Or there to be a FERC order to develop
6 reliability standards, or there can be some combination of
7 any of those. That concludes my remarks and I look forward
8 to taking questions.

9 FERC CHAIRMAN WELLINGHOFF: Regis, thank you very
10 much. I have to admit, I didn't attend our staff technical
11 conference on GMD and didn't have an opportunity to read the
12 conclusions. So maybe I can get a quick synopsis here.
13 Mark, could you reconcile for me the Oak Ridge study and the
14 NERC study?

15 MR. LAUBY: Yes. In the NERC study, we brought
16 together industry experts, you know, both industry
17 stakeholders as well as vendors, manufacturers, and we
18 reviewed the problem in quite a bit of detail. Really what
19 it comes down to is that when the, you know, when you start
20 getting the geomagnetic-induced currents, you have a volts
21 per kilometer. It gets to some level, five volts, six
22 volts, seven volts, and that induces the current.

23 What we find is the voltage collapse, which
24 because transformers are absorbing so much reactive power
25 when they saturate, you know when a transformer saturates
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1 it's like a towel. It has a certain amount of water in it
2 and then after a while the water starts coming out. The
3 magnetics start coming out. It starts absorbing a lot of
4 reactive power, and that happens in a matter of seconds.

5 While with the thermal impacts, those happen in a
6 longer time frame. And so that's why our view was
7 initially, and in our interim report that voltage collapse
8 is the most likely result, not damage to-- widespread damage
9 to equipment.

10 Now we know, we recognize that other studies have
11 come up with other results, but our study pretty much lays
12 out what our view is.

13 FERC CHAIRMAN WELLINGHOFF: So why did Oak Ridge
14 come out with a different result? What was different about
15 Oak Ridge's that was distinct from yours? I haven't read
16 either report and again, like I said, I didn't even go to
17 the staff technical conference. Either you or Regis can
18 tell me the --

19 MR. LAUBY: Our report looks at what the, how the
20 system responds to transformers absorbing a great deal of
21 reactive power, transformers emitting harmonics. We didn't
22 just go to a certain level of geomagnetic-induced currents
23 and say that at let's say 90 amps, transformers fail per
24 phase. So once you put that piece into the puzzle, then you
25 start seeing what the impacts are.

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1 FERC CHAIRMAN WELLINGHOFF: So I guess the bottom
2 line, is NERC recommending to us that we should protect
3 these transformers or not?

4 MR. LAUBY: Well, NERC's recommending a plan that
5 I laid out here to address this. Do a high level risk
6 assessment of where the transformer fleet is today, because
7 some transformers are vulnerable here, especially if their
8 health is, you know, they're near the end of their life or
9 there are certain kinds of designs.

10 In addition, you know, to actually do the study
11 work on individual transformers in a regional way, and take
12 a look at what the impacts are from voltage collapse, as
13 well as for potential --

14 FERC CHAIRMAN WELLINGHOFF: Would that include
15 assessing ground resistance near individual transformers as
16 well?

17 MR. LAUBY: That's right.

18 FERC CHAIRMAN WELLINGHOFF: So in other words,
19 some transformers should be protected and some may not need
20 to be, depending upon how--.

21 MR. LAUBY: That's right. There's no single
22 solution here. You're absolutely right.

23 FERC CHAIRMAN WELLINGHOFF: So how long does it
24 take us to figure out which ones we protect and which ones
25 we don't protect, I guess is the other question?

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1 MR. LAUBY: Well, we think really --

2 FERC CHAIRMAN WELLINGHOFF: Will it take us a
3 year or five years or ten years or what?

4 MR. LAUBY: Well, doing the study work as we
5 designed--suggested here, assessing the risk, I think we're
6 looking at between two to four years or two to five years.

7 FERC CHAIRMAN WELLINGHOFF: All right, thank you.
8 Greg.

9 NRC CHAIRMAN JACZKO: Well, maybe following up a
10 little bit on that issue of equipment damage, there's been
11 an effort in the nuclear industry to see transformers as
12 vital equipment, with long lead time for transformer
13 replacements, to try and make an effort to ensure there's a
14 sufficient supply of backups in the event of failures,
15 whether it be from I guess there's some outstanding
16 technical question of whether transformers themselves would
17 be impacted by this type of event, but by other events.

18 So I mean from your sense, what is the impact if
19 some of these transformers that are vulnerable are not
20 protected, and you were to have a geomagnetic disturbance
21 that would impact a large number of transformers? I mean
22 how long are we talking to be able to get replacement
23 transformers and be able to restore some of those systems?
24 Anyone?

25 MR. LAUBY: Well, it's major "what if," and I
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1 think the spare equipment database is going to help us
2 understand exactly where we stand. That's one of the
3 reasons why we developed that system. Folks are starting to
4 provide us the information, so we'll understand where we
5 stand as far as the inventory goes.

6 NRC CHAIRMAN JACZKO: Do you think that there's,
7 I mean just your guess right now, is there sufficient
8 inventory?

9 MR. LAUBY: I couldn't hazard a guess. I don't
10 have the information.

11 MR. BINDER: Chairman, if I might offer, it
12 depends somewhat too on what type of transformer, for
13 example, is damaged. If--thinking strictly of a nuclear
14 station--if the grid has a problem, so one of the grid
15 transformers is damaged, there's probably a higher
16 probability that there would be a spare that could be
17 inserted in place. If it's a generator step-up
18 unit, they're much more specific and almost uniquely
19 designed, you know, to the station. So that might be more
20 of a problem.

21 NRC CHAIRMAN JACZKO: Thank you. Thanks.

22 FERC CHAIRMAN WELLINGHOFF: Thank you, Greg.
23 Kristine.

24 NRC COMMISSIONER SVINICKI: My thanks to each of
25 you for your presentations. I will confess that this is a
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1 topic on which I was not as well-read, and as a function of
2 having this on our agenda today and the reports and studies
3 that you cited, I have significantly expanded my background
4 reading on this particular topic. So I had a very basic
5 question.

6 In terms of the phenomena of the coronal mass
7 ejections, and I think there was in some of the studies the
8 term "space weather" and a state of knowledge or detection
9 and measurement of that, so advance warning of what
10 direction these are headed in coming to the Earth, what is
11 the state of knowledge there? Is it something that we have
12 a good sense of the frequency? And again I ask this
13 because, post-Fukushima, NRC is of course looking more
14 closely at these low probability, high consequence events.

15 And as I read about this particular phenomena, it
16 occurred to me that this is another one of those. Maybe
17 lower probability, but potentially very high consequence
18 events. Is there a good sense of, you know, 1 in a 100
19 years' storm of a certain severity? What is the state of
20 our knowledge and prediction capability?

21 MR. LAUBY: That's a very good question and, you
22 know, we're working with NASA who monitors this kind of
23 thing, to develop what are the wave fronts and what are, you
24 know, what are the 1-in-100 year. What you find here is
25 that it depends on where you are what a 1-in-100 year is as
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1 well as, for that matter, your geology.

2 So there's a geomagnetic latitude here, not
3 exactly the same as latitude. So the further north you get,
4 what the severity and the peak condition and the -- not so
5 much the duration but the peak will be different than if you
6 are let's say in Florida. So what we're trying to develop
7 is a series of wave fronts, so that we understand, for
8 example, what a 1-in-100 year might look like in
9 Pennsylvania, compared to let's say in Florida.

10 Second of all, what's the worse case? Now based
11 on the statistics we have so far, you know, NASA is, you
12 know, pretty confident they can come up with a 1-in-100
13 year. It gets a little bit messier when you get to 1-in-
14 1,000 and a 1-in-1,000,000. So the idea is to get that 1-
15 in-100 and then get the worse case potential, based on our
16 probabilities and statistics, and use that as a way to kind
17 of develop a sensitivity.

18 MR. BINDER: Commissioner, let me just add a
19 couple of things. There is, I guess what I'd call perhaps a
20 weak spot in determining the storm that's going to actually
21 hit the Earth, and that is the satellite that's used to
22 determine the polarity that I mentioned, which gives us
23 minutes of warning, that's beyond its useful life, design
24 life right now.

25 Now there is a replacement that's expected to be
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1 launched, I think it was in 2014. But even then, it will
2 still be a single satellite up there. It's not duplicate
3 satellite to measure --

4 NRC COMMISSIONER SVINICKI: Well and let me
5 guess, budget cuts, right?

6 MR. BINDER: Well, I think perhaps that has
7 influenced why it hasn't been launched yet. But even with
8 the existing or the anticipated cuts, they expect it to be
9 launched in 2014. But you know, Mark was absolutely correct
10 in mentioning that there's different impacts, depending on
11 locations. The latitude is a big impact and earth
12 connectivity has a big impact.

13 But it's such a dynamic -- storms are such, these
14 storms are such a dynamic event. Minute to minute the
15 strength is changing, the location is changing, and it's
16 actually the rate of change of the magnetic fields that
17 causes the current.

18 If the storm just came and stayed at a constant
19 level and didn't change, there actually wouldn't be any
20 induced currents. So it's actually the dynamic flowing of
21 the magnetic field that causes the problems.

22 NRC COMMISSIONER SVINICKI: Thank you.

23 FERC CHAIRMAN WELLINGHOFF: Thank you. Cheryl.

24 FERC COMMISSIONER LaFLEUR: Well thank you all.
25 Reliability and grid security has been one of my top
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1 priorities, and I've been involved in this issue, and I
2 really appreciate the Chairman giving it the visibility of
3 putting it on the agenda, and I thought your presentations
4 were very thoughtful. And we're weighing right now, you
5 know, what the right balance is between continuing to do
6 more analysis and getting started on some solutions,
7 particularly with new infrastructure to get it built right.

8 I think Regis had the chart where we're looking,
9 you said it's a jumping off point to a question. We're
10 looking at different options, including mandating a standard
11 versus letting these things perc up, and let industry work
12 with transition manufacturers, transformer manufacturers on
13 their own, et cetera.

14 I don't think I've been to a NERC or a
15 reliability meeting in the last two years, but that someone
16 hasn't mentioned the INPO model, and what the nuclear
17 industry has done together to improve nuclear safety over
18 the last 20 or 25 years, as a model for reliability
19 development.

20 Yet it's obvious, just from this morning, that
21 that's within -- and from my past, that's within the context
22 of a very mandated command and control NRC requirement
23 environment. So it's, you know, both the requirements and
24 the industry involvement. And I'm very interested from Mr.
25 Dorman or our fellow Commissioners, how, you know, what the
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1 relationship is between the voluntary work of the industry
2 in developing standards in nuclear, and then the work of the
3 Commission, and if there are things we can learn from.

4 MR. DORMAN: I think you made a very important
5 point on the complementary relationship, and NRC and INPO
6 obviously have very different focuses and missions in terms
7 of our charter is adequate protection of public health and
8 safety. So we're setting a minimum bar and ensuring that
9 all of our licensees meet that bar.

10 INPO developed out of the Three Mile Island
11 experience, and said we, the industry, need to set a higher
12 bar for ourselves. We need to set an excellence standard
13 and hold each other accountable to achieve that standard,
14 because the unacceptable performance of one has such an
15 impact on everybody. I think Chairman Wellinghoff noted the
16 experience in Japan, where one site had an accident and all
17 of the plants are down right now.

18 And so that was an industry-driven by almost a
19 mutual survivability. We need to hold ourselves to a high
20 standard. But I think that is a model that we hold out to
21 our counterparts in other countries, as well as to other
22 industries, as an effective model.

23 FERC COMMISSIONER LaFLEUR: Thank you.

24 FERC CHAIRMAN WELLINGHOFF: Yes.

25 NRC COMMISSIONER MAGWOOD: Thank you. Thank you

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1 for your presentations today. I wanted to, and this is
2 actually somewhat of a follow-up on Commissioner Svinicki's
3 line of questioning. But your Slide 5, you mentioned the
4 NERC interim report made reference to a worst case system
5 impact from a severe GMD event. What--can you describe that
6 event for us? I mean what kind of geomagnetic disturbance
7 was this? Was the 100-year storm that we've been talking
8 about, or was this something more severe?

9 MR. BINDER: Subject to check by Mark who had a
10 lot to do with the report, my understanding was that it was
11 based on not necessarily the strength of the storm, but a
12 certain voltage per kilometer that would be induced in the
13 earth. I believe it was 20 volts per kilometer.

14 MR. LAUBY: It can go upwards to a total of 20.
15 People allege that it can go upwards to 20, though we find
16 that in most cases if you get to the voltages of six to
17 eight volts per kilometer, that that induces enough current
18 in the transformers that they'll probably saturate and start
19 absorbing reactive power, and then you'll have a voltage
20 collapse.

21 So it was based on some studies especially done
22 in Canada, in Quebec and Ontario, because they're actively
23 doing this now, putting operating procedures in place now.

24 NRC COMMISSIONER MAGWOOD: And that was
25 considered to be a worst case scenario?

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1 MR. LAUBY: Well, you know, we haven't gotten all
2 the information yet from NASA exactly what their view is of
3 the worst case. There are people that have chatted about
4 potential worst case scenarios, based on morphology and
5 other scientific calculations. But we're waiting to hear
6 from NASA statistically what's the worst case.

7 But realize that once you've gotten the voltage
8 collapse, which is not an acceptable result--again, NERC's
9 all about not having any uncontrolled cascading the bulk
10 power system--but then those transformers are no longer at
11 risk. So we need to really look at what is the worst case
12 once we get the, you know, the statistical information from
13 NASA and Space Canada.

14 NRC COMMISSIONER MAGWOOD: Let me sort of -- this
15 is sort of Dan for you, both maybe a question and a comment.
16 You know, in looking at the post-Fukushima environment, and
17 I think the Fukushima earthquake, as I recall, was something
18 like a once in 10,000 year event, something on that order as
19 I recall, and we've looked at seismic events recently, some
20 VAR studies that were once in 60,000 years, and I can't help
21 but wonder if there's a once-in-60,000 year GMD that is
22 just, it's kind of a game-changing event? And I'm wonder if
23 that's something that since we're looking at the once-in-
24 60,000 year earthquakes, why aren't we looking at once-in-
25 60,000 year GMDs? And I'll just pass it and see if you have

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1 a comment on that.

2 MR. DORMAN: I think the challenge is we have a
3 lot of data in paleoseismic research that gives us insights
4 of what's happened in the earth over tens of thousands of
5 years. Historically, we've licensed nuclear power plants
6 based on hundred year floods, 500-year floods. We're now
7 looking in probable maximums, we're talking probable maximum
8 floods and we look more at the hydrology of what could
9 happen, and the capacity of the system to absorb water and
10 the availability of water to the system.

11 As we go beyond the seismic and flooding that
12 we're currently working on with the industry, and look at
13 the mandate that we have to look at other external hazards,
14 as we get out into some of those other hazards, defining
15 those probabilistically, going out into more of the tails of
16 the curve, if you will, becomes more challenging in terms of
17 the confidence in data that's available.

18 I think this is probably one of those cases where
19 if you go back into the 1800's and look at some of the GMD
20 events and the impacts on the telegraph system, is kind of
21 some of the earliest data that we have on GMD. So the kind
22 of paleohistorical data is going to be more challenging to
23 define. Where is the tail of the curve?

24 So if we're talking six to eight, but we see the
25 possibility of 20, assigning where is that 20, is that 1-in-

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1 1,000 years? 10,000 years? 100,000 years? That I'm not
2 sure we have the information to define that.

3 NRC COMMISSIONER MAGWOOD: Yeah, I appreciate
4 that. I wonder, and this is a closing comment, I wonder if
5 doing a worst case assessment of the plant systems, to see
6 if there's something there that we just simply hadn't looked
7 at before, a triggering event that would lead to an
8 initiating core damage is probably something we should look
9 at, because again as Commissioner Svinicki has indicated,
10 this isn't something we've looked at much in our world, but
11 maybe we should.

12 MR. DORMAN: One other note I would make on that
13 is the several decades of research that we have in this area
14 has been focused on the operability of the installed safety
15 systems. As we go forward with the station blackout
16 rulemaking and the implementation of the mitigation of
17 strategies orders, those stand-alone pre-staged equipment, I
18 would expect, would also be even less vulnerable to this
19 kind of effect.

20 So we are in the process of instituting, from the
21 safety of the nuclear plant perspective, further enhanced
22 capabilities that I think will give us confidence in this
23 area as well.

24 NRC COMMISSIONER MAGWOOD: Thank you very much.
25 Thank you.

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1 FERC CHAIRMAN WELLINGHOFF: Thank you.

2 Questions? We're out of questions. Thank you.

3 I thank the panelists. Appreciate it. That ends
4 our panels, which for me were very informative this morning.
5 I'm really very glad we did this. Great topics, great
6 panelists. I want to thank all the panelists for all the
7 information that you provided us this morning. I don't have
8 any formal closing remarks. Greg, do you have any?

9 NRC CHAIRMAN JACZKO: Well no. I would just
10 thank you again for hosting us, and I thank everyone for the
11 presentations. I think it was a very interesting
12 presentation, and I think it highlights the
13 interdependencies that we have. So much of what we do
14 impacts what you all do, and so much of what you all do
15 impacts what we do.

16 So I think, as I said at the beginning, these I
17 think discussions are a good way to share information, and
18 make sure we're all working together.

19 FERC CHAIRMAN WELLINGHOFF: I agree, and it is
20 one whole system. So we have to look at each component part
21 and how it's into the system, and hopefully make it work as
22 efficiently as possible. Anybody else have any closing
23 comments? Colleagues, anyone?

24 (No response.)

25 FERC CHAIRMAN WELLINGHOFF: If not, this meeting
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1 is adjourned.

2 (Whereupon, at 11:51 a.m., Friday, June 15, 2012,
3 the Joint Meeting of the Federal Energy Regulatory
4 Commission Commissioners and the Nuclear Regulatory
5 Commission Commissioner was adjourned.)

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