

UNITED STATES OF AMERICA
U.S. NUCLEAR REGULATORY COMMISSION

BRIEFING ON NORTH ANNA

OCTOBER 21, 2011

9:00 A.M.

TRANSCRIPT OF PROCEEDINGS

Public Meeting

Before the U.S. Nuclear Regulatory Commission:

Gregory B. Jaczko, Chairman

Kristine L. Svinicki, Commissioner

George Apostolakis, Commissioner

William D. Magwood, IV, Commissioner

William C. Ostendorff, Commissioner

APPEARANCES

PARTICIPANTS:

Dominion Nuclear

David Heacock
President and Chief Nuclear Officer,
Dominion Nuclear

Gene Grecheck
Vice President of Nuclear Development,
Dominion Nuclear

NRC Staff:

Bill Borchardt
Executive Director for Operations

Victor McCree
Regional Administrator, Region II

Eric Leeds
Director, Office of Nuclear Reactor Regulation

1 PROCEEDINGS

2 CHAIRMAN JACZKO: Good morning, this morning the
3 Commission meets to discuss the restart readiness of the North Anna Nuclear
4 Power Plant. On August 23, the North Anna facility became the first operating
5 nuclear power plant in the United States to experience an earthquake beyond its
6 design-basis parameters, it was probably not the one we would have ever
7 picked, would have that experience.

8 Under our regulations the NRC will require a plant to shutdown if a
9 serious earthquake occurs and also requires that the licensee demonstrate that
10 the plant is in a condition to safely restart. The earthquake that affected the
11 North Anna site was beyond the minimum what would have required the plant to
12 shut down, and in fact, the earthquake was even beyond the plant's design
13 parameters. Because of these unprecedented circumstances the staff is
14 conducting a broader safety review than would typically be done. And while the
15 staff has done a great deal of work so far, the staff evaluation of whether the
16 North Anna plant is ready, from a safety perspective restart remains ongoing.

17 During today's briefing we will hear from Dominion regarding the
18 company's restart activities at North Anna and from the staff on the status of our
19 inspections and review. I would note that this is inherently a responsibility for
20 Eric Leeds to make the restart determination, but several of my colleagues on the
21 Commission, Commissioner Apostolakis and Commissioner Ostendorff had come
22 to me and were interested in having a meeting and I know my other colleagues
23 were as well, so we are having this meeting as an opportunity to hear from all of
24 you. The way I look at it is this is a chance to see if we have the right kind of
25 structure to address this kind of situation if it were to happen in the future and this

1 is a good opportunity for us to get some awareness and visibility on what's
2 happening, but this shouldn't be, I think, taken as a replacement for Eric's efforts
3 to make the determination, ultimately, about the readiness; that responsibility will
4 fall to him unless the Commission changes that, but as it stands right now that's
5 the way forward. So with that, would any of my colleagues like to make any
6 remarks? I guess we'll start with Dominion.

7 DAVID HEACOCK: Good morning, if I could make a couple
8 introductions, if I could. First, I'm Dave Heacock, the president and chief nuclear
9 officer with Dominion. To my left here is Gene Grecheck, he's the vice-president
10 of nuclear development. We have Larry Lane site vice-president; Eric
11 Hendrixson next to him, he's the director of nuclear engineering at North Anna,
12 Divakar Bhargava, the principle engineer and seismic expert with us and Dave
13 Sommers, supervisor of licensing. Good morning, we appreciate the opportunity
14 to be here today to discuss North Anna. Dominion and NRC share a common
15 goal here: the objective to make sure North Anna is safe, before it's allowed
16 restart. Public safety is always first in our minds. As you know, this is the first
17 time -- and you mentioned already Chairman -- that a plant has been shut down
18 as a result of the seismic event in excess of the design-basis earthquake. The
19 original design-basis earthquake spectrum was established with an 84 percent
20 confidence level, which means that some cases would exceed that, in fact, one in
21 six strong earthquakes could exceed the design-basis earthquake. We had that
22 earthquake at North Anna.

23 The plant did experience -- did not experience any significant
24 damage because there are substantial safety margins built into the design, in our
25 design process for the plant and the energy imparted on the plant was

1 significantly below that considered in the design.

2 The NRC has provided very specific guidance to return a power
3 plant to service that's been shut down as a result of a seismic event. The
4 guidance defines a protocol and we are following that protocol. The first step is
5 to determine the amount of energy that was imparted on the station. Gene will
6 describe how the accelerations were measured at the site and he will also
7 discuss how the accelerations when combined with the durations determines the
8 damage potential for any earthquake.

9 The best way to determine the effects of an earthquake is to
10 examine the components at the station. You look at the most susceptible
11 components first; these are called indicators. Components like unreinforced
12 block walls, un-anchored water tanks, ceramic components are the first things to
13 be damaged in an earthquake. Those indicators then establish the intensity
14 level, which then determines the scope of inspections and testing required for
15 that event.

16 Shortly after the August 23 event, Dominion began doing
17 inspections, examinations and testing. We did a number of areas, we did pump
18 testing, we verified the flow, pressure, vibrations, et cetera and assured they
19 didn't have a declining trend from previous inspections. We did weld inspections,
20 we did snubber, both visual inspections, over 700 of those. We did a number of
21 functional tests as well on snubbers -- these are the hydraulic devices that
22 dampen pipe movement in the event of an earthquake. We did steam generator
23 inspections on one steam generator on Unit 1, and two steam generators on Unit
24 2; over 10,000 tubes were inspected, did secondary side inspections on the
25 steam generators as well.

1 We also, on Unit 2, opened up the reactor vessel and inspected all
2 the fuel assemblies, did drag tests on the control rods, we inspected all the
3 reactor internals, we also excavated significant portion of our buried piping; about
4 10 percent of our piping that could contain reactor material was actually exposed
5 and inspected on the outside. We did pressure testing of a number of a
6 significant portion of the remainder of that piping as well. And we didn't find any
7 damage in any of the buried piping, we didn't find any damage in any of the
8 equipment. We found no damage whatsoever that could preclude operation of
9 the plant. No functional damage.

10 After nearly two months of comprehensive inspections over
11 100,000 person hours of activity, Dominion has concluded that consistent with
12 Part 100, Appendix A, there is no functional damage to any safety systems,
13 structures or components. I'm confident that the units have been thoroughly
14 inspected and tested and they pose no undue risk to health and safety. We have
15 demonstrated the units are ready to restart. Now Gene will walk through a
16 number of these areas I just talked about and give you more detail on each.

17 GENE GRECHECK: Thank you Dave and good morning. We'll go
18 to slide four please? I thought we would start out with looking at the actual data
19 that was recorded from the event, which actually created the conclusion that
20 North Anna had exceeded its design-basis on the basis of certain exceedances
21 of measured peak accelerations at various frequencies across the spectrum.
22 This graph is relatively complex, so let me just work through it for you just to
23 make sure we're all looking at the same data. The two curves that are at the
24 bottom of the graph, the ones that look like a small hill, there's a red line that
25 represents the operation basis earthquake; that represents the calculated

1 spectrum of accelerations versus frequencies for which the plant was licensed.
2 Above that, in purple, is the operational basis earthquake, or the safe shutdown
3 earthquake, basically the OBE, the operational basis earthquake is established at
4 50 percent of the design-basis earthquake.

5 You can see, in orange and blue are the measured horizontal
6 spectra that we experienced on August 23 and you can see that at certain
7 frequencies the measured accelerations do exceed the curves that were in the
8 licensing basis. It's also important to note the green line above. The green line
9 represents the spectrum that was used for the IPEEE A46 effort back during the
10 1990s. At that time the NRC and the industry did an overall evaluation of the
11 entire nuclear plant population to determine the ability of plants to successfully
12 shut down in the event of an event significantly above the design-basis. As you
13 can see, that green IPEEE curve does bound what we saw during the August
14 23rd event. So based on that evaluation, we would have expected, even without
15 doing any additional calculations, we would have expected that the plant would
16 have endured the August 23rd event without undue damage, since it had already
17 been evaluated to a spectrum that exceeded the measured values.

18 My next slide is the same data for the vertical component of the
19 three axes and, again, this is a similar situation here with the blue line that has
20 the various peaks in it at certain levels does exceed the accelerations that were
21 previously assumed. Next slide.

22 We've been looking at accelerations versus frequency; that's called
23 a seismic acceleration response spectrum. That spectrum is very valuable for
24 design. The designers take that information, they process it, creating a
25 composite seismic accelerations for the various components analyses and they

1 apply that for various time levels usually for -- in excess of fifteen seconds, if
2 you're doing a shaker table test it would be for even longer than that, typically
3 about 30 seconds. So the equipment and the analyses in the plant were
4 subjected to the maximum accelerations that you saw on that curve, but for an
5 extended period of time. That is what the designers use this curve for.

6 The curve, however, is a very, very poor predictor of plant damage.
7 If you actually have an actual event and you measure peak accelerations, since
8 that curve is in no way reflecting how long the accelerations or the strong motion
9 was actually present, it does not tell you anything at all about what damage to
10 expect or what damage you would predict that the plant would experience. But
11 what does do that is a value called the cumulative absolute velocity that has
12 been well-accepted in the industry with work done by EPRI and endorsed by the
13 Nuclear Regulatory Commission that takes both the duration and the
14 acceleration into account. It has been determined to be the best single indicator
15 of the actual energy imparted to the plant structures, and as a result it is the best
16 single indicator of what expected damage should be.

17 Before we get into the CAV calculation, I would like to show you
18 what actually was measured, in terms of the time history on August 23rd. The
19 three plots you see here, again, are the plots in the three directions that were
20 measured by the accelerometers. The top curve is the vibration in the east-west
21 direction, the vertical accelerations are in the middle and then the north-south is
22 on the bottom. Now a couple things jump out at you when you look at this.
23 Number one you can see that the vast majority of the strong motion occurred in a
24 very, very short time, at the very beginning of the event. As a matter of fact,
25 affective strong motion is defined when 70 percent of the total energy is imparted

1 to the structure, so range is between the point where five percent of the energy
2 has been imparted all the way up to 75 percent. So that calculation of 70 percent
3 of the total energy from the event was delivered to the plant in the times that you
4 see up on the graph. So for example in the north-south direction, the one at the
5 bottom, all of that energy was imparted to the plant in only one second.

6 Similarly, if you look up at the red line at the top, the east-west,
7 which also had some exceedances, that took longer and was 3.1 seconds. Now
8 there's an interesting inverse relationship that you can notice there; on the
9 bottom where you had what looks like larger accelerations, it was also over a
10 shorter period of time. In the east-west direction, you had less peak acceleration
11 but it took over a slightly longer period of time. It turns out that when you
12 integrate that the CAV values are not that different, although you'll see on the
13 next slide that there was a difference. But the fact is that for a given value of
14 energy that that event has, then you're going to see a trade-off between
15 acceleration and duration. If you have both high acceleration and long duration,
16 that is a much higher energy event, so for any given energy, one or the other is
17 going to be trading off.

18 So when you use that data and you compare it against the design,
19 the shaded portions on these graphs is the actual effective earthquake that the
20 plants have been analyzed or tested to. Superimposed on top of that is what we
21 actually measured. So what does that show you is that the total energy that was
22 assumed during the analysis, or during the testing, is substantially larger than the
23 total energy if you integrate over the very short duration peaks that we
24 experienced on August 23rd.

25 The other piece that's important to note when we look at measured

1 accelerations, is that these accelerations that are being quoted -- next slide --
2 occur at the containment base mat. The containment base mat is at the very
3 bottom of containment; it is founded on bedrock at the North Anna site and if you
4 calculate the postulated accelerations as you go up in a building, then you expect
5 to have amplified response as you go up higher. And indeed, we did have an
6 additional detector up at what we call the operating deck, the elevation 291 on
7 the graph there. So if you compare the calculated design-basis acceleration
8 which is in that upper graph you can see that there is a very, very large peak that
9 far exceeds the values that were actually measured at that elevation. Why is that
10 significant? It's because at the plant, when you are calculating the effects on
11 various components, all those components are distributed among various levels
12 within the containment; they're not all down at the containment base mat, as a
13 matter of fact there's not really all that much equipment at the containment base
14 mat.

15 So you actually have to look at each elevation within your buildings,
16 compared to either the calculated or measured accelerations at those levels,
17 against what was originally put into the design when the equipment was installed
18 at that level. And as you can see, what we saw in this event is that even though
19 we did have some frequency, or acceleration versus frequency exceedances at
20 the containment base mat, the design assumed -- at the operating deck, for
21 example -- significantly higher peak acceleration than what was actually
22 measured.

23 Let's talk a little bit more about cumulative absolute velocity and
24 we'll focus for a moment on the top row of this chart. The August 23rd event,
25 when you actually look at the effective strong motion that was experienced and

1 you do the CAV calculation you can see the numbers listed in the top row. In the
2 north-south direction, which turned out to be -- remember that was the bottom
3 trace on that previous graph, which had the highest peaks, we calculated a
4 cumulative absolute velocity of .17. In the other two directions, they are
5 substantially below .16.

6 What's the significance of .16? The Electric Power Research
7 Institute, EPRI, in the development of the guidance for seismic response, many
8 years ago had spent a long effort looking at hundreds of earthquakes around the
9 world and not on nuclear plants but on conventional engineered structures. They
10 attempted to -- what they were trying to is to find a correlation-- could you come
11 up with a correlation that says "If I measure certain values, can I predict what
12 kind of damage am I going to see?" And with looking at these hundreds of
13 various events, again, not on seismically designed buildings, but on conventional
14 structures, they determined that with a great deal of margin, if you established a
15 cut off value of .16, then you could predict with almost complete certainty that no
16 substantial functional damage would be experienced in an engineered structure.
17 Clearly, if you have a seismically designed structure, it's going to be significantly
18 above that, but purely as an ability to be able to do a quick calculation, do I have
19 something here that I should be concerned about, .16 was chosen as the value
20 that says, I know I don't have anything above that.

21 As you can see, in two of the directions we were substantially
22 below .16, in the third direction we were only 10 percent above it. So purely from
23 a number perspective, you can say I suspect, just based on this, that when I
24 actually go out and look at my plant, I'm not going to find any damage.

25 Just as a means of comparison, we also included here some

1 synthetic time histories that correspond to both the design-basis earthquake and
2 also to the reference level earthquake that was used for IPEEE. So the CAV
3 numbers that are calculated here is if you simulate a time history corresponding
4 to those larger events, what would the CAVs turn out to be for those? As you can
5 see, for the design-basis you're talking about numbers that are substantially
6 larger; about four times the magnitude of what we actually measured.

7 So again, when you start taking into account the energy imparted,
8 not just this single peak acceleration, but looking at the entire event, you can see
9 that the plant was designed for a cumulative absolute velocity that is on the order
10 of four times the event that was actually measured. And in terms of the IPEEE,
11 as you can see, it is almost an order of magnitude lower.

12 That same data is presented on Slide 11, this just made -- puts it in
13 pictorially. You can see again the .16 value that comes from the Reg Guide and
14 again you compare those three values and again you can see what we actually
15 measured at the site was just, either below or just barely above the .16 value as
16 compared to what had previously been analyzed for the plant.

17 In addition to the CAV calculation there are significant design
18 margins in the analysis that was used to design North Anna. There is substantial
19 conservatism in the analytical methods; there is the instructure response spectra
20 that we described before, the damping that is actually in present for equipment is
21 conservatively assumed. Using the calculational techniques that existed back
22 during the 1970s when this plant was designed and licensed, the calculational
23 techniques tended to be linear, they tended to be simplistic models and as a
24 result of that were much more conservative, simply as a reason -- as a basis that
25 there was not the detailed calculational techniques that became available later.

1 When we compare the limits, when we say we design a plant to a
2 particular limit, that is a limit based in the ASME code, the ASME code has
3 substantial conservatisms built into it again, between what is considered
4 allowable and where you actually expect to see equipment failure.

5 Another important fact is that when you calculate maximum
6 stresses in components, those stresses are calculated not for a typical static
7 condition with the units running at normal, 100 percent power, but they are
8 calculated for an accident condition. And in almost every case, the loads that are
9 created by an accident, whether it's a loss of coolant accident or a main steam
10 line break, are much greater than the loads that are created by an earthquake.

11 In addition, the maximum loads on a component include the dead
12 weight of the component itself, they include the pressure inside the component,
13 they include thermal effects, when the unit is hot. So when you combine all of
14 that, the seismic portion to the overall calculated maximum stress level on a
15 component is usually dominated by factors that are not seismic. So even if you
16 increase the seismic loading, that is usually a very small component of the
17 overall stress; and, therefore, you would not expect under a steady state
18 condition as we saw on August 23 that you would see a stress exceedance.

19 And again, the seismic test standards, when a component is tested
20 on a shaker table then it is not simply a single event. Usually, what the standard
21 requires is that the component is subjected to five consecutive OBE events,
22 followed by a DBE event. So the component has already been -- already
23 experienced substantially more shaking than what we would see during a single
24 event. And again, as we mentioned before, something between 15 and 30
25 seconds of strong motion as opposed to the one or three seconds we saw here.

1 One further comment on seismic margin, as I mentioned during the
2 1990s the plant did perform an IPEEE evaluation. We inspected around 1,800
3 safe shutdown components; these were components that were selected to be
4 important to the ability to safely shut down the unit in the event of a seismic
5 event. The reference peak acceleration that was chosen for that is .3g; that's the
6 value that is anchored at the 100 hertz level on the graph. And we demonstrated
7 that safe shutdown could be successfully accomplished at North Anna with an
8 event significantly higher than the design basis.

9 There are about 50 components in the plant; they were evaluated
10 to have high confidence levels slightly below .3. They ranged from .16, which
11 was a particular water storage tank, all the way up to values just below .3. In
12 many cases during the IPEEE effort modifications were made to the plant to
13 increase the capacities of those components, but we have a list of those and as
14 Dave mentioned at the beginning one of the ways you can quickly determine the
15 effect of an earthquake on your plant is to look at the components that are known
16 to have the smallest seismic margins. These components were clearly identified
17 during the IPEEE analysis as being more susceptible to seismic damage than
18 perhaps others and they were one of the first areas to look at during our
19 inspection. We looked at all of those and found no seismic damage.

20 Ultimately, on Slide 14 the plant tells the story. We've shown that
21 analytically, when you do the calculations you would predict that there would be
22 no damage to safety related structures, so with that analytical background we
23 can now go into the plant and say, do our actual observations confirm what our
24 analysis tells us.

25 So I'm going to show you a few pictures of damage at the plant.

1 This first picture is taken in the Unit 2 turbine building. The Unit 2 turbine building
2 is a non-seismic structure; this is up on the operating deck of the turbine building
3 so it is quite high up in the air, again, it will be experienced to seismic
4 acceleration. And you can see a series of tanks there; these are vertical filtration
5 – condensate polishing tanks -- filled with water, so you have a large lump mass
6 on the highest level of the turbine building. If you look very carefully at those
7 pictures, you'll see that the tanks are supported with four relatively small vertical
8 angle type supports; those supports are bolted down to concrete base plates that
9 are on the floor.

10 If you go to the next slide, you can see an example of damage, as a
11 matter of fact, this picture represents the most substantial recorded damage to
12 any structure that we saw at North Anna power station following the event.
13 Again, it did not affect the functionality of this support but we did have some
14 concrete spalling on that corner, so this picture here represents the most notable
15 damage that was observed. Again, it clearly did not affect the function of this
16 support, but it is visually, the worst damage we saw.

17 Another indicator, as we described before is what is the effect of the
18 event on unreinforced concrete block walls. Here is a concrete block wall in the
19 turbine building, again, this is not a seismically designed structure and you can
20 see what is a classic, seismically induced crack in this wall, that's the stair step
21 that you can see in the grout as you go down the wall. So, probably, this crack
22 did result from the seismic event but it, again, did not affect the functionality of
23 this wall. This wall is not displaced; it is still structurally sound; it does not require
24 repair; it is simply an example, again, of how small the event actually occurred
25 within the plant.

1 And finally, and we observed a horizontal crack on an interior wall in
2 the Unit 1 containment. If you look very carefully at that, at the very top of that
3 picture you can see a horizontal crack that seems to run through that wall. Upon
4 investigation of this what we discovered is that during construction of this wall, in
5 containment, many, many years ago what you had was a concrete pour, which
6 stopped at the level of that crack, that was allowed to cure and then a second
7 pour was done above that. The joint was then covered with mortar in order to
8 make a smooth surface which then could be painted; that wall there was painted
9 so in order to make a nice smooth surface to paint, you had a mortar joint there,
10 similar to what you would do in your home if you had two slabs of sheetrock and
11 you used the paste to cover over the crack. The crack is only in that mortar joint;
12 it is not in the concrete structure at all. So once again this is a cosmetic defect,
13 this is not a structural defect. North Anna does have a dry cask used fuel storage
14 facility. That pad that you see there is seismically designed. It has 27 vertical
15 casks on it, each containing spent fuel assemblies. When we examine this pad
16 in detail, we did note that 25 of the 27 casks did move slightly from their original
17 position. In the worst case, it was about a 4 and a half inch movement.

18 If you go to the next slide, you can see the ring on the concrete pad
19 where the cask had originally been and you can see that it moved over slightly. It
20 is important to note that these casks are not bolted down to the pad in any way,
21 they are free to move, they are obviously very heavy but they simply sit on the
22 pad and simply friction between the concrete pad and the bottom of -- the smooth
23 bottom of this cask gives the only restraining force that it has on that.

24 We did do extensive review of the condition of the ISFSI; we
25 measured to radiation levels before and after the event, each one of these has a

1 pressure monitoring system in it to verify that the seals are intact. That pressure
2 monitoring system stayed in operation throughout the event and showed no
3 change; so therefore, we know there's no leaks or any changes in the pressure
4 integrity of the vessel. So the cask did move, but their existing position is
5 acceptable and again, no damage was observed.

6 So you have a sense there of what we actually saw, so the next
7 step was to determine what steps did we need to take in order to demonstrate to
8 the staff's satisfaction that the plants were acceptable to restart. The regulatory
9 guidance comes from 10 CFR 100, Appendix A, this is Slide 22. And in the
10 regulation it says, "Prior to resuming operations the licensee will be required to
11 demonstrate to the Commission that no functional damage has occurred to those
12 features necessary for continued operation without undue risk of the health and
13 safety of the public."

14 If you go onto the next slide, during the 1990s EPRI did extensive
15 work on developing guidance, which I'll show you on the next slide. But the NRC
16 -- if you go back one, the NRC did endorse the EPRI guidance, in two Reg
17 Guides, 1.166 and 1.167. As a matter of fact, the title of Reg Guide 1.167 is
18 particularly appropriate; it's entitled, "Restart of a Nuclear Power Plant Shut
19 Down by a Seismic Event."

20 So the guidance has been in place for many, many years. This
21 guidance was developed during a period not in the heat of battle, not at a time
22 when a plant needed it, so it had a lot of time for consultation between the
23 industry and the NRC staff. Essentially, what the guidance tells you, in the Reg
24 Guide is follow the protocol that is in the EPRI document.

25 The EPRI document, as you go to the next page, is EPRI NP 6695,

1 you'll hear lots of references to that in both our presentation today and also I
2 believe the staff will refer to it. Again, it's guidelines for a nuclear plant response
3 to an earthquake, this is about 100 pages long, it is extremely detailed, it
4 provides detail on how to do the damage evaluation, what to look at, how to
5 categorize it, what kind of inspection process you should use and even discusses
6 after the plant has restarted what kinds of actions should take place. We have
7 used this as our guidance throughout the investigation of the event.

8 One of the words that pops up in many of the guidance is the
9 definition of functional damage. I've already mentioned that a few times, in terms
10 of cosmetic damage is not functional damage. This is the definition in the EPRI
11 guidance, it says, "That in order to be functional, it has to be significant damage,
12 either physical or other that impairs the operability or reliability of the item to
13 perform it's intended function. Minor damage, such as slight or hairline cracking
14 of concrete elements is not functional damage."

15 And again, the comment in the Reg Guide, or in the EPRI guidance
16 was that the plant itself and not any information that you may gather from nearby
17 communities, or any recorded motion that may have been measured somewhere
18 else other than at the power station, the best indicator is what actually happened
19 at the plant and not what may have happened at some other location.

20 Very quickly, just run -- this is Slide 27 -- as I said there is some
21 very detailed guidance in the EPRI document, I'll just run through a couple of
22 these flow charts just to show you how this process works. In this first one, it
23 talks about short term actions, in terms of what do the operators do immediately
24 after a seismic event. So you feel the earthquake, the operators at North Anna
25 definitely did feel the earthquake at the time it happened, and of course one of

1 the first decision points is did the plant trip or did it not? In North Anna's case,
2 both units did trip. So the operators have their procedures, which they run
3 through in order to safely verify that the plant has shut down.

4 There are some immediate near-term operator walk downs that are
5 performed that the operators will immediately, after the plant is stable, they will go
6 out and look in the plant just to verify at a very, very high level that there is no
7 damage that they need to be aware of. And in parallel with that, the effort to
8 determine the extent of ground motion begins. That is not something the
9 operators can do, that is something that you need engineering support in order to
10 perform that and a lot of that is dependent on the instrumentation that you have
11 available.

12 So you have at the very early stage of the event, two parallel paths,
13 the operators are making sure that they don't see anything that they need to
14 respond to, on the other hand the engineering folks begin to do the analysis.

15 One of the first decisions that needs to be made is have you
16 exceeded the operational basis earthquake or not. In North Anna's case we
17 made that determination and we reported it to the staff.

18 So if you go to the next slide, at this point you've determined the
19 fact that you've exceeded the OBE so what you now have to do is determine, on
20 a plant basis, not on analytical basis, what kind of damage are you observing.
21 EPRI provides guidance for four damage intensity levels, ranging from 0 to 3,
22 that range from essentially no damage at all to relatively significant damage at
23 level 3. We were able to determine that North Anna experienced level 2 damage
24 intensity. We brought in external experts to independently verify our
25 assessments and in all cases they agreed with us, that what we saw at North

1 Anna was a level 0. And if you follow this chart, if you have a level 0 event then
2 essentially what it suggests is that you need to do a set of surveillance tests to
3 verify that your equipment is in good shape. Clearly, you would need NRC
4 approval to restart, but from a physical standpoint there are no other actions
5 required.

6 We chose, conservatively, to apply the situation that we had a level
7 1 intensity. Again, there was no question, there was no debate about whether
8 there was a level 0 or level 1 but we chose, conservatively, to just assume for the
9 sake of plant response that we did have a level 1. The major difference between
10 level 0 and level 1 is the yellow box at the very top that talks about expanded
11 inspections. This -- at this point drives you into a more extensive inspection,
12 detailed inspection, of the plant beyond what was done immediately after the
13 event.

14 And on the next slide I give you some examples of what expanded
15 inspections included. This included structural inspections, it included inspections
16 of these the low HCLPF items on there as a reference to that list of components
17 in the IPEEE that we knew had lower seismic margins. We look at electrical
18 components, we consider hidden damage. One of the lessons that the industry
19 has learned from some of the events in Japan, including the Kashiwazaki-Kariwa
20 event from several years ago is what kinds of things should you look at in order
21 to determine if there is hidden damage. Clearly, the experts will tell us that
22 visually you're able to tell a lot, because you're able to determine whether the
23 component is moved. That's relatively easy typically because you have paint on
24 a support or paint on a component. That paint will typically break and you'll see a
25 crack in the paint, and even if there was no structural damage, you can tell that

1 some movement occurred. The question is, even if movement did not occur, or
2 you don't see any potential damage, how do you know that something did not
3 potentially happen in a weld or a component? A lot of the information was
4 gathered from the Kashiwazaki event, in terms of what kinds of things to look at,
5 what things do seem to be susceptible, and what are not. And we use that to
6 guide our selection of, for example, weld inspections that we did in the plant, and
7 I'll talk about that shortly.

8 We looked at our main dam for the plant. The main dam at North
9 Anna is not seismic, it is not safety-related. The cooling water lake is not
10 required; it is not part of the ultimate heat sink for the plant. But clearly it is an
11 important feature of the plant and was inspected. We do have a service water
12 reservoir, which is the ultimate heat sink that again is a impoundment that was
13 inspected in detail. We did many system inspections, a great deal of surveillance
14 and functional testing. We looked at the fuel, we looked at the vessel internals,
15 and we also, as I mentioned, looked at the spent fuel storage.

16 We put all that together into a demonstration plan, which we
17 presented to the staff in this room back on September 8th. We put -- listed the
18 process that we would go through to inspect and test the plant, all based on the
19 fact that, again, we have determined that we had an EPRI damage intensity zero
20 event, but we chose to apply the guidance from a level 1. In the two months that
21 have gone by, almost two months, since that we have had extensive interactions
22 with the NRC staff. The staff here at headquarters has been sending us
23 extensive RAIs. We're up to over 130 already, which we have answered. As a
24 matter of fact, last night, we answered the last of the short-term questions that
25 were outstanding. So, the staff now has all of the information that they have

1 asked for.

2 On site, we had both an augmented inspection team, and a restart
3 readiness inspection team come in and look at many of the inspections that we
4 had performed. And the staff will report the results of those. And we also
5 completed the root cause evaluation of what actually caused the reactor trip.
6 Overall, once we had completed the demonstration plan, which we described for
7 you, we evaluated everything in the corrective action system that was identified
8 during the last several months that could be associated with the earthquake, and
9 made sure that we had this position on all of those. And finally, our facility safety
10 review committee, this is the on-site safety review committee, reviews all of that
11 information, all the evaluations, the engineering evaluations that were performed,
12 and makes a determination or a recommendation to the plant management that
13 the plan indeed is ready for restart. This review has been completed for Unit 1,
14 and will be completed for Unit 2 in the next several days.

15 Next slide on Page 32, what did we actually inspect and test? Go
16 to Page 33. This shows you person hours that were expended as of October 9th.
17 These are direct Dominion hours, it does not -- the numbers do not include the
18 contractor resources that were used. And as Mr. Heacock mentioned a few
19 moments ago, we're estimating that about 100,000 person hours have been
20 expended over the last two months in the effort to inspect, evaluate, and
21 determine the acceptability of the power station. This is, obviously, a very
22 extensive effort. It represents a huge amount of documentation; and so between
23 the hours that have been spent in the plant, and the hours that have been spent
24 answering the staff's questions, we believe that we've performed a very thorough
25 review of the plant condition. Matter of fact, this binder I have next to me

1 represents the submittals that we've made to the staff over the last several
2 months, and as you can see, it's a substantial amount of information in there.
3 We also used multiple external consultants. These are the people that, you
4 know, the leaders in the industries and seismic experts. People who are -- have
5 developed much of the theory and methodology around calculating effects of --
6 seismic effects on buildings.

7 Let me show you a couple of pictures of some of the things we
8 looked at during the inspection effort. This is the chemical addition tank. This
9 turns out to be one of the items on that low seismic margin list. And interestingly,
10 this particular component was calculated to have a susceptibility to tip-over, and
11 not at the point where you would expect. If you look at that and you see those
12 anchor bolts that anchor the tank down to the concrete pad, you would expect
13 that the vulnerability there would be in those anchor bolts. It turns out it's actually
14 the pad itself that is the weak link here. So the calculated effect here is that this
15 tank would tip over and take the pad with it. As you can -- we did inspect that
16 pad in detail, found no cracks, no evidence of any seismic distress to it. So this
17 again is one of the lowest margin components in the plant and did not experience
18 any damage.

19 Another example of that is the boric acid tank. You can see a
20 seismic support there. Again, that seismic support was calculated to have a
21 relatively low margin. And you can see again there was no damage there.

22 The next example is actually an opportunity. This is the inside of
23 the circulation water discharge tunnel on Unit 2. Normally this tunnel is full of
24 water. This is the water that is being pumped from the lake through the
25 condenser, and then back into the discharge. So normally this tunnel is full of

1 water. What makes this tunnel interesting is that it is a square tunnel, and it is
2 underground, and therefore it could be susceptible to a seismic event. But again,
3 it's a concrete structure so if you have some sort of excessive shaking, you'd
4 expect to find some cracking, or distress in that. Again, this was inspected in
5 detail. As you can see, we strung lights up, we had people in there looking at the
6 structure in great detail, and again found no seismically induced damage to the
7 tunnel.

8 A great deal of pump inspections. Again, we've listed some of the
9 examples, we've looked at all of our safety-related pumps, performed the
10 surveillance testing on them, measured current and vibration and flow and
11 discharge pressure. And again not simply to verify that they were acceptable,
12 but to compare those values against the recorded values for these components
13 prior to the event to show that there was no degradation. So it's not simply to say
14 I ran it and said it's okay -- I'm comparing it to what the component did before,
15 and show that there was no change in the characteristics.

16 As Mr. Heacock mentioned, we did do extensive snubber testing.
17 We have here about 700 visual inspections of snubbers throughout the plant. A
18 great deal of functional testing again verified that there was no damage as a
19 result of the event. We did look at the nuclear fuel. As you know, on Unit 2 --
20 Unit 2 was scheduled to go into a refueling outage within several weeks after the
21 event. We decided to enter that refueling outage as part of the restart. And so
22 therefore we had opportunities to inspect all of the fuel on Unit 2. As part of the
23 evolution, we defueled the unit, put all the fuel in the spent fuel pool, had the
24 opportunity to perform visual inspections, control rod drag testing. All of those
25 inspections were satisfactory.

1 In addition, new fuel had been delivered to the station in
2 anticipation of the Unit 2 refueling. That new fuel was in dry storage; that's new
3 fuel storage racks. We examined that fuel, made sure again that there was no
4 observed damage there, measured the control rod insertion force into those
5 assemblies as well, looked in the spent fuel pool, examined fuel that was both
6 from the previous cycle, and is scheduled to go into the new cycle. Again,
7 observed no damage.

8 Buried piping: There is a significant amount of interest as to what
9 potentially could have occurred for piping that is buried in the earth. There are
10 about 1,100 feet of piping at North Anna that either contains or potentially contain
11 radioactive fluid. That 1,100 feet is split up about 700 feet or so of that normally
12 has water in it. The other 400 feet is drain piping that, you know, may drain water
13 from the floor of the building that could have radioactive fluid in it but is not
14 normally wet.

15 So, 400 feet of piping normally has radioactive fluid in it. What? You
16 said something – 700? What is particularly significant from a buried piping
17 standpoint is where piping travels between one building and another because the
18 buildings may be moving independently in a seismic event and, if you had piping
19 that bridges from one building to the other, again, that would be a postulated
20 place to look for possible damage.

21 The left-hand picture on Slide 41 represents one of those cases.
22 This is the, this is an area right next to the refueling water storage tank on Unit 1
23 where it moves into the safeguards area. You can see a lot of piping that's
24 labeled there. You can see some safety injection piping. You can see some
25 containment spray piping, high head safety injection. This is a relatively critical

1 area and, as you can see also, that there's a relatively small area between the
2 two buildings. This could be, potentially, a high stress area if indeed these
3 buildings had been moving.

4 So, we exposed this piping, completely dug the dirt out, went down
5 there, and looked at the piping, and, again, observed no damage to this piping. In
6 total, we looked at about 100 feet of safety-related buried pipe, both visually
7 inspected it and used ultrasonics in cases to verify wall thickness and, again,
8 confirmed that no damage was found.

9 Next slide shows you a fire protection pipe. Fire protection pipe is
10 particularly susceptible to seismic shaking. It is typically cast iron. It is not,
11 doesn't have quite the same resilience, for example, as stainless steel safety-
12 related piping. We exposed about 50 feet of fire protection piping, looked at it.
13 We also pressure-tested this system. The fire protection system is a system that
14 has an automatic pumping pressure control process in it and verified again that
15 there was no leaking or no new leakage being identified in this system beyond
16 what had been seen before.

17 Steam generator inspections, as mentioned before, we did three
18 steam generators between the two units, one on Unit 1 and 2 on Unit 2. Over
19 10,000 tubes were inspected using eddy current. We also used video
20 examination of the channel heads to verify that we saw no damage in there. The
21 eddy current of over 10,000 tubes did not identify any new flaws or indications
22 that we had not seen before. Also did extensive inspections of the secondary, the
23 steam drum, feedring, J tubes, upper support blades. No evidence of
24 degradation was found.

25 And, finally, a great deal of NDE inspections and testing on welds.

1 You can see the numbers on the charts between the liquid penetrant tests and
2 ultrasonics and visual testing, we did an extensive sample. And this was not just
3 random sampling of welds. What we did is we looked at, again, what would be
4 calculated to be high-stress areas, and also areas where indications had been
5 previously seen and evaluated as being acceptable. We went back and looked at
6 those same locations to verify that those indications that had been previously
7 detected before the event had not changed. Again, no seismic damage.

8 So, in summary, on Slide 45, we completed 134 system
9 inspections. These are detailed, walk-down inspections of systems, reviewed 141
10 structures, looked at 46 low-margin components, and have completed 445
11 surveillance tests per unit. These are the tests that can be performed in cold
12 shutdown mode, Mode 5, where the units are presently at. Each unit has about
13 29 additional tests that we will perform during the heat up process that's, once
14 the determination is made, that it is acceptable for us to start heating up the
15 plants. We have additional testing in our program that will be performed as the
16 units get warmer. For example, we will do hot rod drop testing when the units are
17 at temperature to verify that the control rods are free to move and are within their
18 proper timing.

19 All the inspections confirm the EPRI damage intensity of zero. So,
20 going forward, we've made a number of modifications to the plant as a result of
21 the event. One of the first is that we have installed a temporary, free-field seismic
22 monitor at the site location. As I've mentioned before, the seismic monitors that
23 we had at North Anna were located inside the containment. Some questions
24 have been asked about whether measurements that we take down on the
25 containment basement -- again, the containment basement is founded on rock,

1 and it is widely, it is believed to be very, very close to the free field -- but in order
2 to address the question about, you know, is this exactly the best measurement
3 you can do, we have installed a temporary free-field monitor in an area clear of
4 all the buildings that we will, in the future, will be able to use.

5 What makes this particularly interesting is that this temporary
6 monitor has the capability to plug a laptop into it and very, very quickly after an
7 event, create the seismic spectra curves that we saw before, and, also, the CAV
8 calculation can now be performed very, very quickly after an event as opposed to
9 taking the many days that it took us to use the existing instrumentation.

10 One of the incidents that occurred during the event is that the
11 alarms that the operators have available to them for the seismic event are
12 powered from our emergency buses -- this is emergency AC power. As you
13 know, we did lose off-site AC power for several seconds following the reactor
14 trips, and in the eight seconds or so that it took for the diesels to start and load
15 on the buses and restore that power, the alarm processes were not available. So,
16 in the immediate post-recovery from the event, the operators did not have any
17 alarms locked in that said that they indeed had a seismic event, and that did, in
18 some ways, complicate the review initially in the first few hours. We have now
19 installed a qualified, uninterruptible power supply to that panel, so that alarm
20 function now will be able to tolerate a loss of AC power.

21 We haven't had an existing station procedure, abnormal procedure
22 36, that provided guidance for what to do post a seismic event. We've extensively
23 revised that procedure to provide additional guidance to the operators, and also
24 to reference the use of the new free-field monitor that, again, the engineering
25 people can get out to that monitor within a very short time after the event and

1 evaluate any future events. And, clearly, we need to complete the start-up
2 surveillances.

3 In the longer term, we are reviewing what the permanent free-field
4 seismic instrumentation should look like. There may be additional locations that
5 could use a monitor. We are investigating what it would take to have those
6 instruments read out into the control room. Right now, those are local. That
7 instrument we installed is a local instrument, and we need to go out and look at it.
8 We're looking at what it would take to bring that into the control room. We are
9 continuing to reevaluate the low margin components from the IPEEE list. One of
10 the things our consultants told us is that they believe that in many cases either
11 the evaluation was excessively conservative, that established that below .3 level,
12 and that they thought that it, with very, very small modifications, we would be
13 able to increase the seismic capacity of those complements. So, we are
14 evaluating the entire list of IPEEE low margin components to see if it is possible
15 to increase their seismic capacity.

16 And, finally, the Reg Guide guidance, in 1.166 and 167 is currently
17 not referenced in our license base. Those Reg Guides were produced
18 substantially after the licensing of these plants, and we think there is some very
19 useful information in those that probably would be useful in a future event, and
20 we are evaluating, incorporating those into the licensing bases for the plant.

21 On an analysis standpoint, the EPRI guidance, EPRI NP 6695,
22 does have guidance in there about after the plant is restarted, after we have
23 demonstrated that there is no functional damage, and that the plant is ready for
24 restart, to do some seismic evaluations to evaluate the overall analytical impact
25 on the plant. What it suggests to do, and this is what we are going to do, is to

1 develop floor spectra -- these, again, are, at the various elevations of the plant,
2 you're going to have calculated responses different than what would be expected
3 at the containment base mat -- will develop those floor response spectra at
4 various building levels based on the actual recorded motion that we observed.
5 We will assess that those new calculated floor spectra against the design basis
6 spectra, and, if exceedances are found, then we'll evaluate equipment at those
7 levels, at those particular floor levels, for any possible effect on the analysis.
8 Typically, what happens is is that equipment at that level will have a particular
9 resonant frequency that will be affected by the event only at those frequencies,
10 so we'll, once we identify if there is a spectrum exceedance, we'll then examine
11 what equipment is at that level and evaluate any potential issues there.

12 Typically, what the guidance tells you is that if you identify an
13 exceedance, then go inspect it in more detail. I think that we performed that
14 inspection in great detail, so we really do not expect that we will have any issues
15 there. But, we will follow up on any exceedances we find.

16 And, finally, we will revise our UFSAR to document the fact that this
17 recorded event did occur, what the results of the seismic analysis were, and,
18 also, we are putting into effect design controls that will ensure that the margin
19 that clearly this plant has demonstrated that it does have, that that margin is not
20 degraded by any potential or future modifications. The plant demonstrated it for
21 the event that occurred. Obviously, substantial margin existed between the
22 calculated design basis and what was actually occurring. So, we will put
23 measures in place to evaluate that for any modifications made in the future, that
24 we will take into account both the design basis, which is what the, is in the FSAR,
25 and also the actual recorded event. And, as I mentioned, we'll evaluate the, we'll

1 put in a commitment to using these Reg Guides. In the longer time frame, as the
2 NRC determines the path forward on GI-199, then we will obviously participate in
3 that as well.

4 So, quick summary, we do know that OBE and DBE acceleration
5 criteria were exceeded in certain directions and for certain frequencies by a very
6 short duration event. However, the CAV calculations indicate that unequivocally
7 no significant damage should have been expected, and the review of effective
8 strong motion also tells us that no damage should have been expected, and that,
9 indeed, was confirmed. We had a level zero event.

10 The IPEEE and A46 evaluations during the 1990's demonstrated,
11 even before the event, that the safe shutdown SSC's were capable of peak
12 accelerations in excess of the design basis. No safety related SSC's have been
13 identified that required any repair as a result of the earthquake. And, so, the
14 expanded inspections and the expanded testing, which we endeavor to perform,
15 have confirmed the expectations that the analysis tells us.

16 DAVID HEACOCK: All right. Thank you, Gene. You know, many
17 times, with a natural event, there are precursors. You have warning that a
18 tornado or hurricane is coming to the plant. With a seismic event, there's no such
19 warning. It happens without any warning. I have to comment that the station's
20 staff responded quite well to a dual unit trip, responded promptly, no issues were
21 identified. And then, many support people showed up. there were no lights on in
22 the plant anywhere, so there's no place to be except for where there was light
23 either outside or in the control room of one of the other facilities. So, the
24 emergency responders did quite well as well. The local, state, and NRC
25 responders performed flawlessly. My boss gave me the strongest compliment

1 possible. He said, "It sounds just like a drill." So, it worked just like it was
2 supposed to in all respects.

3 In summary, if I can say, the original design requirements
4 contemplated that some earthquakes could exceed the design basis. This was
5 just such an earthquake. As Gene pointed out, some of the spectra were
6 exceeded at some frequency. But, overall, the energy in part of the station was
7 well below that the station was designed for. The plant has substantial design
8 margins above those required by the original design, and, the bottom line is the
9 plant tells the story. We have gone over North Anna very systematically. Every
10 safety system, structure, and component, and found only cosmetic damage. The
11 seismic, thermal, and mechanical stress margins designed in all of our safety
12 system piping, equipment, and structures, made it more than able to withstand
13 this earthquake.

14 Dominion is confident that we have demonstrated that the units are
15 safe to restart. We have established an enhanced process to provide additional
16 testing and oversight during power ascension once restart is authorized. As part
17 of our long-term actions, as Gene just delineated, we'll do a seismic analysis of
18 the plant based on the actual seismic floor spectra in accordance with the NRC
19 protocol. We'll revise our safety analysis report to incorporate and document the
20 new analysis and the modification process will be revised to make sure we've
21 maintained existing margins. Mr. Chairman, that concludes our remarks.

22 CHAIRMAN JACZKO: Well, thank you very much for very
23 interesting and detailed presentation. Over to staff.

24 BILL BORCHARDT: Thank you. Good morning. When the
25 earthquake occurred on August 23rd, the NRC staffed our operations center to

1 monitor the activities at all the plants that were potentially affected by this
2 earthquake. The automatic reactor shutdown of both units at North Anna was
3 the only shutdown, automatic shutdown as a result of this event. North Anna also
4 declared an alert based upon the activities at North Anna. In addition to the alert,
5 there were 12 reactors, operating reactors, that declared an unusual event, and
6 two research test reactors that declared an unusual event. However, North Anna
7 was the only plant to experience any actual impact from the earthquake.

8 Since the earthquake, the NRC's conducted a number of
9 inspections and has ongoing technical reviews and inspections underway. The
10 initial inspection had to do with the licensee's immediate response to the event,
11 and the ongoing technical reviews will form the basis for any decision regarding
12 restart. That, in coordination with the special inspections being conducted by
13 regional and headquarter staff.

14 The bottom line is that the NRC will not authorize restart until we
15 are satisfied that the plant can be operated while protecting public health and
16 safety. So, with that, I will turn the presentation over to Vic.

17 VICTOR MCCREE: Thanks, Bill. Morning, Mr. Chairman,
18 Commissioners. When the earthquake occurred on the afternoon of August 23rd
19 the senior resident inspector for North Anna was in the control room, observing
20 activities there. So, he was strategically positioned to observe the plant and
21 operator response to the earthquake. Another NRC inspector who specialized in
22 emergency preparedness was also on site at the time of the earthquake and
23 assisted in the response. When the agency entered monitoring mode shortly
24 after the event, the resident inspectors were key to the effectiveness of
25 communications, when the Region II incident response center as well as the

1 headquarters operations center were staffed. Later, on August the 23rd, Region
2 II dispatched an additional inspector to the site to assist the inspections being
3 conducted by the residents. Also, seismologists and structural experts from the
4 Offices of Nuclear Reactor Regulation and the Office of New Reactors were also
5 directed to the site within days of the event.

6 Immediately following the event, it was uncertain whether the
7 ground motion from the earthquake had exceeded the plant's design. However,
8 the U.S. Geological Survey data, based upon that, we determined that the best
9 estimate of the peak ground acceleration at North Anna may have exceeded the
10 safe shutdown earthquake ground motion design limits of 0.12g for structure
11 system and components. SSCs located on top of rock, and 0.12g for SSCs
12 located on top of soil. As a result of that and because of the heightened risk
13 associated with the loss of off-site power and the malfunctioning of one of the
14 sites, one of the four emergency diesel generators, an augmented inspection
15 team was formed and dispatched to the site to better understand the
16 circumstances of the earthquake and Dominion's response. The AIT team was
17 led by an experienced region supervisor who is here today, Mark Franke, and
18 included four inspectors from Region II and three experts from NRR and NRO.
19 The team possessed significant technical expertise, covering seismology,
20 structural engineering, operations, as well as electrical engineering.

21 AIT was tasked to collect facts related to a number of areas,
22 including human and plant performance in response to the event, ground motion
23 strength experienced at the site, the condition of the plant following the
24 earthquake, and any safety or generic issues. The team's findings were
25 communicated to the licensee during a public meeting on October 3rd near the

1 site. During the meeting, we informed Dominion as well as members of the public
2 who were there of the results of the inspection. In the area of human and plant
3 performance, when the earthquake occurred, the plant's systems responded
4 automatically to shut down both units and all safety systems functioned as
5 designed. All four emergency diesel generators did start as required and
6 powered emergency buses when off-site power was lost. A fifth backup diesel
7 also automatically started in the standby mode. When the two hotel, one of the
8 emergency diesel generators experienced a cooling jacket, water leak plant
9 operators shut it down, and aligned the standby diesel to power the associated
10 emergency safety bus.

11 North Anna operators responded to the event in accordance with
12 established procedures, and in a manner that protected public health and safety.
13 As for the ground motion at the site, based on the seismic ground motion
14 monitoring equipment at North Anna, the ground motion, as you heard from Mr.
15 Grecheck and Mr. Heacock did exceed the licensing design basis at some
16 frequencies

17 Following the earthquake, as, also as Mr. Heacock and Mr.
18 Grecheck mentioned, Dominion walked down and conducted inspections of plant
19 structures and systems and performed functional tests in accordance with the
20 EPRI guidelines. The AIT observed some of Dominion's inspections and
21 conducted a number of independent walk-downs of the plant. That team also
22 reviewed Dominion's tests and evaluations of important equipment and, based
23 on those walk-downs and reviews, significant damage to plant equipment was
24 not apparent.

25 Some equipment issues were revealed as a result of the event, as,

1 again, Mr. Grecheck described. I won't go into those details again, but there were
2 some minimal damage to several, non safety-related structures. The seismic
3 ground motion caused movement of spent fuel storage casts as was noted. The
4 team also identified two potential generic issues that are being evaluated for
5 generic applicability The first has to do with the location of monitoring equipment.
6 The instruments are located in plant buildings as opposed to being directly in the
7 ground, free-field detectors. So, the earthquake motion experienced in the
8 building may be different than what's experienced on the ground because the
9 plant design is based on certain ground motion locating instruments in a building
10 may not provide the best indication of whether actual ground motion exceeded
11 design.

12 Secondly, the team noted that some functions of an important
13 earthquake monitoring panel failed during the event, and Mr. Grecheck
14 mentioned that-- the kinematic system. The panel's power supply did not
15 maintain power at the panel alarms during the event. Also, some performance
16 issues were noted with the Ingdal scratchplate recording system. At this point, I'll
17 turn it over to Eric Leeds.

18 ERIC LEEDS: Thank you, Vic. Good morning. The regulatory
19 requirements governing this event are delineated in 10 CFR Part 100, Appendix
20 A, as we heard previously from the licensee. It states that vibratory ground
21 motion exceeds that of the operating basis earthquake, shutdown of the nuclear
22 power plant is required. Obviously, that occurred. The operating basis
23 earthquake is approximately half of that of the safe shutdown or design basis
24 earthquake. The regulations also state that prior to resuming operations, the
25 licensee is required to demonstrate to the NRC that no functional damages

1 occurred to those features necessary for continued operation without undue risk
2 of health and safety of the public. And, as the Chairman noted at the beginning,
3 the regulatory decision to approve restart rests with me, the Director of the Office
4 of Nuclear Reactor Regulation. Next slide, please.

5 As you can see from the licensee's presentation, the regulatory
6 review guidance that the staff is following was actually established in the late
7 1990's. That was Reg Guide 1.167, Restart of a Nuclear Power Plant Shut Down
8 by a Seismic Event, which endorses the EPRI guidance that has been referred
9 to, Guidelines for nuclear plant response to an earthquake. The EPRI document
10 also provides guidance on what to do if the plant exceeds its design basis
11 earthquake.

12 In addition to this guidance, staff is also incorporating operating
13 experience that have occurred since this guidance was published. The July 2007
14 earthquake at the Kashiwazaki-Kariwa Nuclear Power Plant in Japan, that plant
15 actually experienced a 6.6 magnitude earthquake, which was beyond that plant's
16 design basis. And the lessons learned from that event were published in an
17 International Atomic Energy Agency Safety Report Number 66.

18 In addition to using operating experiences, staff is also utilizing its
19 experience on changes that have been made to these plants since the time
20 frame that we established this guidance; a notable issue has to do with fuel
21 design. There have been changes in fuel design, and that's one of the things that
22 the staff asked the licensee to review, and that's why we've done a very thorough
23 audit of the fuel in the Unit 2 reactor at North Anna.

24 As you heard from Vic and you've heard from the licensees,
25 significant level of staff effort is being placed on this initiative. Almost every

1 technical branch in the Office of Nuclear Reactor Regulation is involved in the
2 review with coordination from the other offices, such as Region II, the Office of
3 Research, and the Office of New Reactors. The reviews are in progress;
4 however, to date, the staff has not identified any significant issues. Key technical
5 areas of the review have included the reactor vessels and internals, the reactor
6 fuel, instrumentation, off-site power, piping, and associated support, such as
7 snubbers and hangers, pumps and valves, and steam generators.

8 The overall review and evaluation will assess the scope and
9 adequacy of the licensee's inspections, walk-downs, surveillance testing, and
10 evaluations. The reviews are also being informed by the results of the
11 inspections that Vic's folks are doing down at the plant. Next slide, please.

12 The inspection is still in progress. Region II is leading that
13 inspection with support from NRR, from Research, and from New Reactors.
14 NRR staff is providing feedback to the region, and the inspectors, regarding the
15 confirmatory walk-downs, in order to obtain reasonable assurance that the
16 structure systems and components are functional. The inspection team is
17 focusing on corrective action follow-up, the licensee's evaluation of the current
18 plant condition, and review of actions required to support the start-up

19 As discussed by Dominion, the EPRI guidance identified pre-
20 startup short-term and post-startup longer term activities, based on the overall
21 EPRI damage intensity observed at the plant. The licensee indicated that North
22 Anna experienced a damage state intensity of zero, but they are taking a more
23 conservative tack in implementing actions for damage state one. In evaluating
24 the licensee short-term actions to date, the NRC inspections team has not
25 identified any damage that would indicate a higher damage state. The inspection

1 has not been completed, however, and there are several outstanding issues that
2 the staff is continuing to evaluate

3 The NRC's restart readiness inspection team has identified a
4 number of valuated issues. Just a couple of examples for the Commission, one
5 of those is inspections of the reactor vessel's supports were not originally
6 conducted by the licensee, neither for the event or the in-service inspection
7 requirements of the ASME code, so the licensee is going back and conducting
8 those. Based on, also, based on a large number of the observations by the
9 inspectors, the licensee is assessing the need to re-perform certain portions of
10 inspections at walk-downs that have been completed.

11 Now, going to the next slide, a moment on our path forward, as you
12 just heard, the staff is conducting our safety review in accordance with
13 established acceptance criteria. The review is ongoing. The technical review will
14 confirm that the restart decision is in accordance with Appendix A to Part 100
15 requirements. The staff plans to issue a safety evaluation that will
16 comprehensively address all the staff review activities.

17 The restart decision will include the staff assessment of reasonable
18 assurance for the structure systems and components functionality and the
19 licensee's commitments to perform walk-downs and analyses during the heatup
20 and power assentions to ensure the functionality of those structure systems and
21 components.

22 The public has expressed a great interest in this event. We had
23 significant public attendance at our September 8th meeting here in White Flint,
24 and at the augmented inspection team exit at the site on October 3rd. That
25 meeting was held about in the afternoon in the middle of the week, and

1 approximately 200 people attended that meeting. Both Vic and I were in
2 attendance at that public meeting. Because of the public interest in the event, we
3 plan to hold another public meeting in the vicinity of this site to discuss the status
4 of the review and the status of our work to date. That public meeting is currently
5 scheduled for November 1st. Next slide, please.

6 Should the results of our review determine that the plant may be
7 restarted safely, the staff will perform enhanced inspections during start-up and
8 after start-up. These inspections will assess the licensee's operations, additional
9 surveillance testing, and other activities. As you heard previously, the licensee is
10 committed to performing the long-term evaluations in accordance with the EPRI
11 guidelines. We will review and follow up on those evaluations. And, also, as you
12 heard previously, the licensee has committed to updating its final safety analysis
13 report to include the new seismic response spectra reflected in the Mineral,
14 Virginia earthquake.

15 And, with that, that concludes my portion of this presentation.

16 BILL BORCHARDT: Staff's presentation is complete

17 CHAIRMAN JACZKO: Okay. We'll start with Commissioner
18 Apostolakis.

19 COMMISSIONER APOSTOLAKIS: Thank you, Mr. Chairman. The
20 licensee made a strong argument that the safe shutdown earthquake by itself is
21 not a good measure of the plant's ability to absorb an earthquake, and that this
22 new measure -- I don't know how new it is, but -- the cumulative absolute
23 velocity, which takes into account the duration of the event, is better. So, I'm
24 wondering why we're still using the safe shutdown earthquake idea in the
25 regulations when it creates such a big problem with perceptions. I mean, you

1 know, you read in the papers and so on that the nuclear plant, the design basis
2 was exceeded, and people get scared when, apparently, the experts feel that the
3 plant was safe.

4 So, let's not forget that the, you know, perceptions are very
5 important. I mean, we have a situation here like Caesar's wife. She has to be not
6 only honest but also be perceived as honest. So, here, we don't really have to be
7 safe. We have to be perceived as safe. So, is there any move to change the SSC
8 concept and move to something more realistic, perhaps?

9 ERIC LEEDS: Commissioner, if I can, I heard two different issues
10 that you raised there, and very good issues, but let me address both of them.
11 The first one is the challenge of communicating with the public on this type of an
12 issue, and we've experienced that for years here at the NRC. The public
13 understand the Richter scale, the magnitude of the earthquake. It's a 6.6, it's a
14 7.3, it's a 5.8, and then they ask the question, is the plant designed to withstand
15 that? Well, engineers and scientists, the Richter scale provides a magnitude of
16 energy. It doesn't provide the engineering or the science behind how you design
17 that plant. Engineers will take that information, and we translate it into something
18 that we can use -- horizontal and vertical ground motion. But, to express that to
19 the layman is very, very difficult. How do you understand? So, we're constantly
20 having to make that translation from that safe shutdown earthquake versus what
21 was actually felt at the site, what was experienced at the site, and so that's a
22 challenge that we have going forward. It's been there, and I think we're getting
23 better at it as it goes along, but it's tough for the public to understand. The
24 problem with public communication is a challenge for us.

25 The second issue that you talked about, are we using the right

1 parameters? Should we be talking about safe shutdown earthquakes? Should we
2 be talking about cumulative, absolute velocity? But one of the things that I, that
3 we wanted to get out, the staff wanted to get out of this and, you know, very
4 important to us is that, in light of the recent task force report on Fukushima, the
5 information that we're gaining from this event and the learnings that we're gaining
6 from that will hopefully help focus our review and inform us going forward in
7 responding to the issue of earthquakes that was identified by the near-term task
8 force in the Fukushima report. These learnings will inform us going forward, and
9 evolve our thinking about how to best make sure that these plants are protected
10 from earthquakes. So, I'm answering your question, but we need to evaluate that.

11 COMMISSIONER APOSTOLAKIS: I understand that, but I'm not
12 sure that the Fukushima recommendations dealt with the change in the SSC, the
13 concept, and use something else. I mean, they talked about design basis and
14 walk-downs and so on, but there may be some opportunity there to do that. But,
15 it seems to me that based on what I heard, the safe shutdown earthquake is only
16 part of the story. There is more to it.

17 Now, turning to you, Mr. Grecheck, on slide 10, I must say it
18 confuses me a little bit. This is where you have the CAV comparisons. So, the
19 first role is the actual calculated cumulative absolute velocity. Is that correct?

20 GENE GRECHECK: That is correct.

21 COMMISSIONER APOSTOLAKIS: Correct. Then you said that
22 EPRI did this work reviewing many, many earthquakes, and they concluded that
23 if you are below 16 percent of g you don't expect to see anything, and you
24 argued that the .172 was a little bit higher. What confuses me is the other two
25 rows. If we look at the design basis earthquake, and you say .588, is that a

1 calculated value? Does it play the role of .16g? What is it? Is it a limit?

2 GENE GRECHECK: It is not a limit. It is a synthetic time history
3 that is created by assuming that you had an event at the DBE, with the
4 accelerations that were assumed for the DBE curve, over the entire design
5 period. And, so, you create a synthetic time history, and you say if we had this
6 postulated synthetic event and calculated the CAV for that postulated event,
7 these are the numbers that would be representative of such an earthquake.

8 COMMISSIONER APOSTOLAKIS: And I'm supposed to compare
9 this .588 to what?

10 GENE GRECHECK: To the calculated numbers that occurred on
11 August 23rd, which is the top row.

12 COMMISSIONER APOSTOLAKIS: Which is which number? .17 --

13 GENE GRECHECK: .172, 125, and 112 --

14 COMMISSIONER APOSTOLAKIS: Okay. What does this tell me
15 now? That .58 is much bigger?

16 GENE GRECHECK: Yes.

17 COMMISSIONER APOSTOLAKIS: So --

18 GENE GRECHECK: So, it says that a representative calculation
19 for the actual design basis would result in a CAV that is represented on that
20 second row, and that number roughly is something on the order of four, five times
21 the CAV that we showed for the August 23rd event.

22 COMMISSIONER APOSTOLAKIS: So, therefore, I shouldn't
23 expect to see any damage.

24 GENE GRECHECK: Well, we shouldn't, you shouldn't expect to

1 see any damage because what we saw was below or very close to .16. so, the
2 .16 is this theoretical number that says that we know based on inspections of
3 many, many events that if you calculate a CAV from an actual event that is .16 or
4 below, you're not going to see any damage. That's not to say that you're going to
5 see damage at some higher number, but with a very high level of assurance, you
6 know that if it's at .16, then you know that --

7 COMMISSIONER APOSTOLAKIS: I understand the .16. It's the
8 .588 --

9 GENE GRECHECK: All right. That is typically a representative
10 value for a time history based on the design basis accelerations over the entire
11 period of the event, not just this very short --

12 COMMISSIONER APOSTOLAKIS: So, as long as my actual value
13 is smaller than this, then I shouldn't --

14 GENE GRECHECK: Then you should feel that you have met the
15 design basis requirements.

16 COMMISSIONER APOSTOLAKIS: But, this .58 does not, is not
17 based on actual earthquakes, like the .16?

18 GENE GRECHECK: That is correct.

19 COMMISSIONER APOSTOLAKIS: Okay. One broader question,
20 and, in fact, in some of the slides, I mean, slide 25, for example, quoting from the
21 EPRI guidance, significant damage to plant systems components, either physical
22 or other, which impairs the operability or reliability of the damaged item. I wonder
23 how one can conclude that the reliability has not been impaired, I mean, that's a
24 probability. So, how does one conclude that? I mean, or, a broader question, is
25 there margin that we had before the earthquake the same now, or has there

1 been some permanent, maybe minor, but still permanent damage, some crack
2 grew some place a little bit, and then, of course, it didn't shrink. Do we know
3 anything about it? I mean, can we say something about it?

4 GENE GRECHECK: We can say something, because as I noted in
5 the presentation, we did look for places where we had noted previous indications.
6 For example, we had welds where we had previously seen an indication that was
7 evaluated as acceptable. We went back and looked at those locations again after
8 this event, and demonstrated that there was no change in those conditions.

9 COMMISSIONER APOSTOLAKIS: Now, you use the word look,
10 and one thing that, as I was looking at the slides and the documents, you did
11 visual inspections, that's for sure.

12 GENE GRECHECK: Yes.

13 COMMISSIONER APOSTOLAKIS: But, the visual inspection has
14 limitations, especially if you have an earthquake and so on. So, what else did you
15 do to make sure that there was no damage that was not visible?

16 GENE GRECHECK: Well, in the case of the welds, we did both
17 liquid penetration inspections and ultrasonic. And, as I mentioned, in terms of the
18 functional testing of pumps and valves, we performed extensive reviews of the
19 parameters of those components and compared them to the performance of
20 those same components prior to the event. So, if we had a recorded vibration
21 level or we had a recorded pump curve, we compared that data post-event to
22 prior to the event to show that there was no degradation in the performance of
23 the component. It may have still been acceptable, but beyond just demonstrating
24 acceptability, one wanted to show that there was no degrading trend in that
25 performance.

1 So, systematically, in many of the examples, it was a comparison of
2 pre event to post event recorded data. And, in the case of the steam generator
3 tubes or welds, we examined known prior indications and compared those to
4 verify that there had been no change.

5 COMMISSIONER APOSTOLAKIS: One last question. This is to
6 Eric. On slide, well, eight, we all agreed that it's within your authority to authorize
7 restart, does the Commission get involved at all in that decision, or, and the
8 second is, the second part is, on slide nine, there is all of a sudden this 10 CFR
9 50.59 that is mentioned. Can you elaborate a little bit on it?

10 ERIC LEEDS: With regard to authority to grant the restart, that,
11 according to regulations, rests with me. The Commission, whenever the
12 Commission believes that there is a policy issue, the Commission can make that
13 decision and take the issue up to them, up to yourselves, to make that decision.
14 So, otherwise, in absence of the Commission weighing in, it's my decision.

15 COMMISSIONER APOSTOLAKIS: Now, I'm about to make this
16 decision. Is that how it works? How would I know that you're about to do that?

17 BILL BORCHARDT: Yeah. The normal practice is we would inform
18 you, that --

19 COMMISSIONER APOSTOLAKIS: Okay.

20 BILL BORCHARDT: -- about ready to --

21 COMMISSIONER APOSTOLAKIS: Fine.

22 BILL BORCHARDT: -- inform the licensee

23 COMMISSIONER APOSTOLAKIS: So, how about this 50.59
24 business? That's part of the notes, at slide nine. I mean, it seems to me this is
25 pretty --

1 ERIC LEEDS: Well, let me respond to it anyway. It's not in my
2 notes, and I didn't mention it, but that's all right, Commissioner. When the
3 licensee mentioned that we've been in discussion, how do we go forward from
4 here? You experienced an earthquake which was in excess to the design basis
5 earthquake for that plant. And when you go forward from that, what our concern
6 is is when you make changes to the plant, what are you going to analyze those
7 changes to? You know, you change pumps, valves, piping, whatever. Well, what
8 the staff is looking for is that the licensee updates their final safety analysis report
9 such that it reflects this new earthquake, but the new earthquake exceeded the
10 design basis earthquake at high frequencies, not at low frequencies. So, the
11 design basis earthquake for low frequencies, needs to remain. For high
12 frequencies, we want the licensee to evaluate against these new values from this
13 earthquake that actually occurred.

14 And, in my conversations with the licensee, there's an agreement, a
15 conceptual agreement. Now, how do you make that change? Well, 50.59 is one
16 process that the licensee may use to make changes and update their final safety
17 analysis report. When you go through that process, and that's something the
18 licensee has to do, it tells them whether they can make that change without
19 coming to the regulator or whether they need to come to the regulator for
20 approval. If they need to come to us, they would submit a license amendment
21 request, and we would process it.

22 COMMISSIONER APOSTOLAKIS: I find it a bit strange, but --
23 Thank you, Mr. Chairman.

24 CHAIRMAN JACZKO: Commissioner Magwood?

25 COMMISSIONER MAGWOOD: Good morning, and thank you for

1 your presentations this morning, I particularly appreciate Mr. Grecheck's very
2 comprehensive and detailed tutorial on the matter. I appreciate you going
3 through all that for us.

4 Let me pick up on a couple of issues Commissioner Apostolakis
5 raised. One, I am, I'm a bit unsure about what exactly the licensee is proposing
6 to do regarding the FSAR. On Dominion's slide 50, they've listed that they intend
7 to revise the UFSAR to document the recorded event, the seismic analysis of the
8 recorded event, design controls on seismic margin, and commitment to the reg
9 guides. And, in the staff presentation, the staff says something a bit more, what
10 sounded to me to be a little bit different, that they were going to make, adjust the
11 licensing basis effect to reflect the new spectra, and that's what I thought I heard.
12 Can you reconcile those two for me? Did I hear correctly as to what Dominion,
13 what you think Dominion is going to do?

14 ERIC LEEDS: Well, Commissioner, I liked what I heard from
15 Dominion this morning about what they plan to do, and I think conceptually that
16 we're in agreement with what they need to do. But, until, you know, you see the
17 paperwork and you see what the commitment actually is, the devil's always in the
18 details. But, what basically, what I think is important for the public to understand
19 is that when this plant going forward, when this plant makes a change or
20 modification to its site, it's going to analyze it to make sure that it addresses this
21 actual earthquake that occurred and that this plant can operate safely going
22 forward.

23 COMMISSIONER MAGWOOD: And is that, when you say that, I
24 want to make sure I understand what you, what that means when you say that.
25 Does that require a full reanalysis of the design basis to make that change to this

1 order, or is it simply incorporating the fact that this earthquake took place? I
2 mean, what are we actually saying?

3 ERIC LEEDS: It's not a backwards look. We're not requiring that
4 they go through and take a look at every seismic calculation that was ever done
5 on this plant previously. What the EPRI guidance acknowledges is that, based on
6 the damage, there's margin, so we know that those system structures and
7 components have margin and can withstand this new earthquake, this actual
8 earthquake that occurred.

9 Now, there are long-term evaluations that the EPRI guidance
10 requires, so there's two parts of it. They're going to longer-term evaluations to
11 make sure that the reliability of the equipment that went through this experience,
12 this earthquake, will be able to perform their function going forward for the
13 whatever the life of the equipment itself. There's that part of it. And then,
14 combined with that, you have this idea of any new modifications would need to
15 be analyzed to a different spectrum that had previously been done. Did that
16 answer the question?

17 BILL BORCHARDT: Yeah. As a non-seismic expert, let me tell
18 you, it's, the plant demonstrated that there is margin beyond the established
19 design basis because it withstood this seismic event. We want to make sure that
20 any changes made to the facility that don't require NRC approval through the
21 50.59 criteria be used as the basis for that, the seismic event that just happened,
22 so that we don't erode the margin that existed on August 23rd, down to what the
23 licensing design basis would have been.

24 COMMISSIONER MAGWOOD: All right. Okay. Mr. Hancock, or
25 Mr. Grecheck any comment?

1 DAVID HEACOCK: I think that was said exactly right. That's what
2 we intend to do to ensure that we maintained existing ordinances in the plant
3 going forward.

4 COMMISSIONER MAGWOOD: Let me also pick up a bit on the, I
5 think Mr. Heacock mentioned during his presentation that the design basis
6 earthquake was anticipated to be exceeded, and I think he used a number like 84
7 percent confidence level. I just wanted to say, does that comport with the staff's
8 understanding of design basis earthquake?

9 ERIC LEEDS: Well, if you don't mind, I'm going to bring one of our
10 seismic experts up to the -- or, one of our -- [laughter]

11 PAT HILAND: Hi. Pat Hiland, the director of engineering in the
12 office of NRR. Yes. That's correct. The original safe shutdown earthquake or
13 design basis earthquake is a 84th percentile level.

14 COMMISSIONER MAGWOOD: So, does that, when I heard
15 Dominion say that therefore it was expected that this might be exceeded at some
16 point, and that --

17 PAT HILAND: Well, I'm not sure I would use the word expected,
18 but there certainly was a -- I'm using the word probability loosely. There was a
19 probability that there was some percentage if they had an earthquake in this
20 area, that there was a chance that it could exceed and, as we saw, in certain
21 frequencies, the design basis. That's correct.

22 COMMISSIONER MAGWOOD: So, this gets to the first question, I
23 think, Commissioner Apostolakis asked. It makes, really, I think it raises the
24 question, when we say the design we are referring to the design basis of the
25 plant. Most people in hearing that think that if you go beyond a design basis you

1 either have to fix the plant or change the design basis. You can't have the design
2 basis stay in place and have it exceeded. So, in this case, is there some gray
3 area in this particular case of a design basis where, well, yes, we've exceeded it,
4 but it's okay because we have all this margin so we can continue to operate? I
5 mean, that's effectively what we're saying. I'm trying to understand from a
6 regulatory standpoint, what all this means. Something that I've been worrying
7 about for this whole episode.

8 PAT HILAND: Well I think the-- again, Pat Hiland, director of
9 engineering in NRR. I think that the discussion on the cumulative acceleration
10 velocity, the CAV, and the work that had been done in the past and our
11 assessment of that, which was published in a reg guide, which endorsed this
12 effort, is a measure that would tell you, for this event, what was the integrated
13 impact, or deposition of energy on the plant. I would look at that first, to answer
14 your question, is there something in between a design-basis earthquake and a
15 no damaging seismic event and I think I would look there because of the short
16 durations of those peaks. The total deposition on the plant is relatively small
17 compared to the CAV.

18 COMMISSIONER MAGWOOD: Let me say, I think that Mr.
19 Grecheck's presentation was very thorough and I've talked with the staff about
20 this and there seems to be a great deal of confidence that there was no
21 significant damage to the plant and that this plant, certainly is safe to operate on
22 the same basis it operated at before. The question is, whether we have such a--
23 we have a design-basis issue. I think the question isn't a question of physical
24 condition of the plant, it's a question of what the design-basis is and what our
25 regulatory posture is regarding this plant. I'm still struggling with where are we

1 now? If we know the design-basis has been exceeded, how do you continue to
2 operate unless you make that change in the design-basis?

3 NILESH CHOKSHI: Nilesh Chokshi, Office of New Reactors. I
4 think this concept of design-basis, let me just give a little bit of background --
5 ground motion -- type of time history in order to do a design, so the design-basis
6 should be at ground motion. If you go to the revision of the Appendix A of Part
7 100, the new definition which we are using in New Reactors, is safe shutdown
8 ground motion. It takes a -- earthquake, because people then associate a certain
9 magnitude and those sort of things. I think the communication difficulty Eric
10 described, because a magnitude 5 point at the source, it's the--

11 COMMISSIONER MAGWOOD: That's a different issue.

12 NILESH CHOKSHI: So what you need for design is the ground
13 motion and the way THE design-basis on one of the previous presentation slide
14 the spectra, the design spectra and the spectra from the earthquake. If you look
15 at that design spectra, it's really broad band. It's not a real earthquake, the
16 spectra itself, because they're not using the 36 western time actual earthquake
17 records in 1970s. And 84 percentile comes from accidents of that, when you to
18 the response vector from reaching the real time history that 84 percent which is
19 referred to is 84 percentile of that statistic, so I would say that you would expect
20 the ground motion to exceed, but that's how the design-basis was drawn up and
21 because of that broad frequency content, that's why you see a lot of energy in
22 that time history, that designed time history.

23 COMMISSIONER MAGWOOD: Let me cut you off and ask-- I
24 appreciate your input, that's a sort of a different question, this-- the dam on Lake
25 Anna, can you tell me a little more about that, I don't know very much about the

1 situation with that. What kind of hazard does that present to the plant? Is that
2 something that-- I know the licensee did mention it was-- they looked at it but
3 what can you tell us about that?

4 ERIC LEEDS: George Wilson, he's our dam safety officer.

5 COMMISSIONER MAGWOOD: He's our dam guy? Okay.

6 [laughter]

7 GEORGE WILSON: Actually, the main dam at North Anna is
8 regulated by the Federal Energy Regulatory Commission. The dam that we
9 regulate is actually the ultimate heat sink dam, so the dam, the main dam that
10 they're talking about is actually regulated by FERC and they actually do
11 inspections of it, so the licensee and you can correct me if I'm wrong, does have
12 to evaluate that in their abnormal operating procedures, but that is not something
13 we regulate, for the licensee.

14 COMMISSIONER MAGWOOD: Does the dam-- if the dam were to
15 fail, would that present a hazard to the facility other than the loss of the heat
16 sink?

17 GEORGE WILSON: No, the ultimate heat sink is the dam, that's
18 the little reservoir that is a different body of water. The main dam is that's a hydro
19 dam, it's regulated by FERC. So the ultimate heat sink would provide the
20 cooling, that's the one that we look at.

21 COMMISSIONER MAGWOOD: I see, thank you. Appreciate it.

22 CHAIRMAN JACZKO: Commissioner Ostendorff.

23 COMMISSIONER OSTENDORFF: Thank you Mr. Chairman, I'd
24 like to add my thanks to Commissioner Magwood's to the licensee for doing a
25 very nice job of explaining a fairly complex topic in step-wise fashion, so thank

1 you for that session. I just want to start out with the licensee with a couple
2 questions here, specifically on inspections and I want to kind of follow up on
3 where Commissioner Magwood was headed, I think. Can you talk a little more
4 about the dam inspection, do you use divers, do you look for visual cracks? I'm
5 curious as to how that inspection was done.

6 GENE GRECHECK: Eric, do you want to address that? This is
7 Eric Hendrixson, he's the director of engineering at North Anna.

8 ERIC HENDRIXSON: The dam, for the most part, is an earthen
9 dam. In the center of the dam there is a concrete structure. You do visual
10 inspections of the downside of the dam and then there are certain inspections,
11 you check groundwater internal to the dam structure itself. Those inspections
12 were performed and we saw no changes from the normal operation of the dam.
13 You really can't put any divers in front of the dam because it's an earthen
14 structure.

15 COMMISSIONER OSTENDORFF: You may want to stay at the
16 podium. Two more inspection questions. Can you talk about how you did your
17 electrical inspections, specifically circuit breakers and instrumentation?

18 GENE GRECHECK: Go ahead.

19 ERIC HENDRIXSON: Two different ways. The electrical
20 components were de-energized, you go in, open up the breakers, do a visual
21 exam, check for tightness and bolt checks, that kind of thing. Typically, check
22 resistance, checks between bolted connections, then as we put the equipment
23 back together, perform the normal functional test verified breakers close, contacts
24 made up.

25 COMMISSIONER OSTENDORFF: You do that under voltage, trip

1 tests?

2 ERIC HENDRIXSON: Every single test, yes.

3 COMMISSIONER OSTENDORFF: Same question for the reactor
4 vessel internals, what are you looking at there?

5 ERIC HENDRIXSON: The vessel internals, on Unit 2, we defueled
6 Unit 2, then opened it up and did a visual exam with cameras and submarines,
7 looking at the upper internals as well as the internals to the reactor vessel. The
8 visual exam was with submarine and cameras.

9 COMMISSIONER OSTENDORFF: Do I understand you didn't find
10 anything there?

11 ERIC HENDRIXSON: That is correct, we found no damage.

12 COMMISSIONER OSTENDORFF: Last inspection question, how
13 about your emergency diesels?

14 ERIC HENDRIXSON: Same thing with emergency diesels besides
15 the obvious visuals, we performed the various, what we refer to as blackout tests,
16 where we de-energize the emergency bus, watch the diesel come up, take the
17 loads and then there are other surveillances you do to verify the various functions
18 to the diesel generators, including 24 hour diesel runs.

19 COMMISSIONER OSTENDORFF: Thank you. Let me go back to
20 the licensee with a separate question, getting back into the cumulative absolute
21 velocity and I was not familiar with that phrase until this event occurred, I learned
22 a lot more about it the last couple of months. I want to get a better understanding
23 from the licensee, then I want to get a question from the staff on the same topic,
24 as to what experience is out there in the civil engineering community, the seismic
25 community, in using CAV outside of the application for a nuclear power plant, for

1 bridge assessments, for stadiums, et cetera. Can you talk about that, or can
2 somebody in your group discuss that aspect?

3 GENE GRECHECK: I can give you a little background. As we did
4 research on this concept, because again, I'm sure the seismic experts were very
5 familiar with this before, but the rest of us were not. You can see there are even
6 commercial vendors that sell devices that are used for commercial buildings
7 because this evaluation of the .16 and knowing that in a commercial building that
8 if you have CAV rate at below the .16 you would not expect to find any damage.
9 That is apparently available commercially for normal office buildings to have--
10 they suggest that you have that in your office building, that you can quickly
11 calculate following a seismic event as whether you should be concerned about
12 your structure or not. So this is well-known out in the seismic community as a
13 way of rapidly evaluating the potential for damage in your structure.

14 COMMISSIONER OSTENDORFF: So let me ask you a very pointed
15 question. So I'm in the state of California and I'm a bridge inspector and you
16 have an earthquake out-- you know you had one 20 some years ago in Oakland,
17 that damaged the Oakland bridge. Is this CAV concept being actually applied by
18 civil engineers and bridge inspectors to apply that after an event to assess
19 usability or functionality?

20 GENE GRECHECK: That I don't know.

21 COMMISSIONER OSTENDORFF: Does anybody know about
22 that?

23 GENE GRECHECK: I don't know.

24 COMMISSIONER OSTENDORFF: I'd appreciate some follow up
25 on that, I'm just curious as to how-- I mean, we're getting mired down in the

1 nuclear applications here I think it would be helpful for us to know where else in
2 the civilian engineering community or other disciplines is CAV being applied as a
3 concept to evaluate post earthquake functionality and useability of structures.

4 DAVID HEACOCK: Mr. Bhargava might be able to answer a part of
5 this question.

6 COMMISSIONER OSTENDORFF: If you want to talk about this.

7 DIVAKAR BHARGAVA: Very quickly, I'm Divakar Bhargava. The
8 only other application that I'm familiar with the use the CAV is the 2007
9 Kashiwazaki-Kariwa earthquake and they calculated CAV from the recorded
10 motions to determine what kind of damage, and hidden damage and their CAVs
11 were actually about five to six times higher than the North Anna event, so that is
12 one application where they have developed CAV to determine what sort of
13 inspections and what kind of damage they might have expected. That's the only
14 example I know.

15 COMMISSIONER OSTENDORFF: That's very helpful. Let me stay
16 in this topic of CAV and shift over to the staff and I'll ask Eric, Bill and Vic. Eric I'll
17 start with you. Prior to this event, has the staff had any experience in using CAV
18 to assess something like this?

19 ERIC LEEDS: Commissioner, let's get Nilesh up here.

20 COMMISSIONER OSTENDORFF: Sure.

21 NILESH CHOKSHI: I think yes, we have used the CAV, it's an
22 empirical measure, it teaches, similar to modified -- intensity, there are many
23 measures civil engineers use. Areas intensity and if you're reading that research
24 you'll see that. This is a similar and empirical measure of assessing damage and
25 that the scale was established by looking at the actual events and observing the

1 damage. And then correlating, calculating CAV and defining threshold, that's
2 how we came up with the .16 threshold which is for basically a non-engineered
3 structure. It was defined – the cut off was much more conservatively, so that's
4 the CAV. Now the CAV is being used for several other applications, primarily in
5 nuclear. IAEA has also adopted a CAV and it's in their safety guides and many
6 other countries are using that. We also used CAV for the new reactor siting in
7 the probabilistic hazard analysis to filter the non-damaging earthquakes. One of
8 the things that you have to be careful of with small magnitude earthquakes, you
9 can predict hazard if you do it systematically. So we use CAV concept in that
10 filtering. The concept is now widely used both in the geosciences field and
11 engineering field. Still, to my knowledge, it's still primarily in the nuclear industry.

12 COMMISSIONER OSTENDORFF: Let me follow that up, stay on
13 the podium. You can, Eric, I'll ask you and feel free to use your podium expert
14 here. I know he said the devils in the details and the analysis by the licensee is
15 still ongoing and so forth. To date, as far as the general approach, the
16 assumptions being used by the licensee to evaluate the cumulative absolute
17 velocity, is the staff in general in alignment with the approach the licensee has
18 taken to document the CAV and its application here?

19 ERIC LEEDS: Yes. The short answer is yes, the staff is in
20 alignment, the staff has reviewed what the licensee has done and so far we
21 haven't seen significant areas of disagreement. Now, the licensee has just
22 responded to a number of our last requests for additional information that came
23 yesterday, so the staff has more work to do but thus far I don't have any
24 significant disagreements between where the staff is and the licensee.

25 COMMISSIONER OSTENDORFF: Okay, follow up question, with

1 respect to reg guide 1.167 I know that this is something that's not used on a
2 regular basis and sometimes we get into using something after an event occurs
3 when there's not been a lot of experience with using that particular document.
4 You learn there may be some gaps, maybe some inconsistencies. Are there any
5 significant issues that you or your team have discovered in trying to apply 1.167
6 to this event?

7 ERIC LEEDS: Nothing significant to report at this time. There are
8 a couple areas that we may want to go back and revisit, one I mentioned before
9 was fuels. Between the reg guide and the EPRI guidance it's silent on fuels and
10 fuel design has changed, the current fuel that they're using at North Anna has
11 swirl veins that we were concerned about. Now, the licensee examined those
12 and they turned out to be fine but certainly there will be lessons learned from this
13 that we may want to go back and reexamine that EPRI guidance. Nilesch was
14 actually one of the NRC folks that were instrumental in us endorsing that
15 guidance.

16 COMMISSIONER OSTENDORFF: Thank you. Vic, I'm going to
17 ask you a question here in the few seconds remaining. What's been the hardest
18 communications challenge you've seen between your team and the public with
19 respect to the meetings that have been held to date.

20 VICTOR MCCREE: Thank you for your question. As Eric
21 indicated, we've held one public meeting at North Anna, that was the AIT exit.
22 The greatest challenge, I think, was what Eric alluded to and that is the 5.8
23 magnitude on the Richter scale earthquake occurred, what does it mean? It is
24 beyond the design-basis, the licensing basis of the plant, why is it safe for that
25 plant to operate? Developing terminology, developing a layman's, laypersons

1 terminology of what the actual energy deposition, what the impact on the plant
2 was, has been and is an extraordinary challenge.

3 COMMISSIONER OSTENDORFF: Have the public understood the
4 CAV concept?

5 VICTOR MCCREE: I don't believe we have shared that with them.
6 Have they derived meaning from it to the point that they understand it, I don't
7 believe we're there yet. We'll have another opportunity next Tuesday. Eric and I
8 and the staff, we're going to try again to communicate it in terms they can better
9 understand.

10

11 COMMISSIONER OSTENDORFF: Thank you. Thank you Mr.
12 Chairman.

13 CHAIRMAN JACZKO: Commissioner Svinicki.

14 COMMISSIONER SVINICKI: Thank you all for your presentations.
15 I begin with a question for Dominion. Did both units safely shut down as
16 designed and were there any complications with the unit trips?

17 DAVID HEACOCK: Yes, both units shut down as designed, now
18 you know there's no seismic trip directly, so they shut down for other reasons but
19 they shut down as intended and there was no complications with the reactor
20 shutdown. The reactor shut down as it did. Victor mentioned the only issue that
21 we had about 50 minutes into the event, one of the diesel generators failed.

22 COMMISSIONER SVINICKI: Victor or Eric, I believe that you
23 mentioned that just coincidentally, we had either the resident inspector, the senior
24 resident, in the control room in one of the units at the time of the event?

25 VICTOR MCCREE: Yes ma'am. The senior resident inspector was

1 Greg Kolcum, was in the control room when the earthquake occurred and we had
2 another inspector, an emergency preparedness inspector that was on site. He
3 also assisted. I would mention that the two hotel emergency diesel generator,
4 which did fail, failed because of a gasket leak and the operator shut the diesel
5 down. At this point, based on the information we have seen, that the licensee
6 has inspected, evaluated that gasket failure was not due to the seismic event, but
7 due to an installation error, if you would.

8 COMMISSIONER SVINICKI: I had heard that it was perhaps
9 improperly seated, in some prior maintenance --

10 VICTOR MCCREE: That's correct.

11 COMMISSIONER SVINICKI: -- evolutions of some kind. Okay,
12 thank you. Mr. Grecheck, you had explained, at least partially, how in terms of
13 buried piping, how did you go about selecting, for your enhanced inspections
14 areas of buried pipe, I think you indicated piping runs between structures is
15 something that would be probably useful in terms of selecting that as part of a
16 sample to inspect. But could you elaborate a bit in terms of, you showed us
17 pictures, you had excavated and there was inspection of various types but other
18 than runs between buildings, how or even of the piping runs between buildings
19 how did you go about targeting and selecting piping, buried piping to inspect?

20 GENE GRECHECK: Well, again the primary selection was where
21 can you do an excavation and in an area of high interest and also see many
22 different examples of piping in a small area. Excavation, as I'm sure you can
23 appreciate, is not an easy thing to do and so therefore you want to find a location
24 where you can see the many different piping systems in a relatively small area
25 and that was for example that picture that we showed you. It is important to note

1 that in addition to the visual inspections that we performed we did pressure
2 testing on as many piping systems as we were capable of doing then. Then we
3 verified that once these pipes were pressurized that we saw no pressure
4 decreases or leakage in the piping. So we have a very high level of confidence
5 that even if we did not visually look at a pipe, that that piping system is intact.

6 COMMISSIONER SVINICKI: Okay, thank you for that elaboration.
7 For the NRC staff, Eric I was listening to your presentation and of course
8 Dominion has presented that even though they assessed an EPRI damage state
9 or damage level of zero they elected to perform enhanced inspections to a EPRI
10 damaged state of one and when I was listening to you present the staff's
11 assessment you said NRC has not observed indication of a higher damage state
12 and you ended your sentence there. I assume you mean NRC has not observed
13 indications of a higher damaged state than zero. Is that correct?

14 ERIC LEEDS: That's correct, Commissioner.

15 COMMISSIONER SVINICKI: Thank you. And there has been
16 some discussion, Eric, about the delegation that the restart authorization resides
17 with the director of NRR, and there's been a lot of discussion of other issues, but
18 I would -- I guess I'd ask you very simply that this isn't an event where we've had
19 to go in and invoke and exercise our regulatory framework for this type of event.
20 So, when this occurred, and you had to go and basically assess what our
21 regulations require, the guidance that's invoked, and, in this case, there's an
22 endorsement of an EPRI document that's embedded in that framework -- do you
23 assess in looking at the regulations, the guidance, and other technical
24 documents that are endorsed or invoked as part of this process, do you find that
25 to be a complete framework? Is it thorough? Have you identified anything that

1 you feel are areas of gaps in that framework in terms of invoking this rather
2 unique and novel regulatory process for an authorization for restart after this type
3 of seismic event, having gone through this at least to this level, you haven't
4 gotten to a restart authorization step yet, but, to date, have you or members of
5 your staff identified that there's anything incomplete about what we're doing?

6 ERIC LEEDS: Commissioner, so far, the guidance has served us
7 extremely well. In fact, I applaud the people who developed this guidance so long
8 ago and the foresight that they had, because it has directed the staff on a
9 complete path. I think that there are a couple of things that we may need to
10 update on the guidance, and I think that Commissioner Apostolakis makes an
11 interesting point, and I want my folks to go back and take a look at the cumulative
12 absolute velocity and see if that -- if there's something there. Certainly, the
13 lessons learned from the Kincaid Nuclear Power Plant event, I want to take a
14 look at that. Also, the fuels issue. But those, you know, those are -- would be
15 enhancements going forward. The process that we have in place I think has
16 served us very well.

17 COMMISSIONER SVINICKI: Can you help me in light of that
18 understand why, what is the nature of the 130 requests for additional information
19 that the staff has generated? I think you also responded that the last batch of
20 responses from Dominion for those 130 requests for additional information were
21 received very recently, perhaps as recently as yesterday, and are there
22 responses to those requests for additional information necessary in order to
23 complete a restart inspection? Do you need to have those answers in hand and
24 evaluated before -- because I'm interested, I think you testified that the staff's
25 restart readiness inspection began on October 5th, so we didn't have all the

1 responses to the RAIs in hand. Help me understand the sequence of events
2 there.

3 ERIC LEEDS: Well, I'm hearing two different questions,
4 Commissioner, and I'll try to get to both of them. The first one, the amount of
5 questions, this event was unprecedented here in the United States for an
6 operating nuclear power plant to experience an earthquake beyond its design
7 basis. The staff's doing a very deliberate, thorough review. We don't have
8 practice at this. This hasn't occurred before. So, the staff is being very thorough
9 in its review. And when you've got a lot of smart people looking at something,
10 that's where you get at the thoughts of, "Well, wait a minute, why isn't the fuels
11 discussed here?" Or, "What's changed since 1997 when that guidance has come
12 out, and should we look at that?" And that generates those types of questions,
13 and you want the staff to have that questioning type attitude. And, frankly, the
14 licensee has been very responsive, and, you know, I think there's been a number
15 of "ah ha" moments on both sides. Yes, it's a good idea. We better go take a look
16 at the fuels. We better go look at the reactor vessel supports and things like that.

17 COMMISSIONER SVINICKI: And that part of the question was
18 meant to get to, you said that the process established by others in the past, there
19 was a lot of foresight there and it served us well. So, what I'm trying to say is do
20 the 130 RAI's somehow indicate that there were gaps, or we had an incomplete
21 framework for moving forward?

22 ERIC LEEDS: Oh, I don't think so.

23 COMMISSIONER SVINICKI: I hear you saying that that's not the
24 case.

25 ERIC LEEDS: I don't think so. I think that that's just the staff being

1 deliberate and thorough and going through and making sure that we have
2 answers to each one of these issues as we follow the EPRI guidance. I believe
3 the licensee is doing the same thing.

4 COMMISSIONER SVINICKI: Okay. And the second part of the
5 question was how do you start the restart readiness inspection without having all
6 of the responses to the RAI's in hand? Do the, are the issues not coupled?

7 VICTOR MCCREE: Well, they are coupled, Commissioner, and
8 very well integrated. In fact, as a result of the augmented inspection team, there
9 were some open items, if you would, and the restart readiness team picked up
10 from those open items to continue that review. For example, it wasn't known
11 when we exited the AIT on October 3rd the reason for the reactor trip, which
12 turned out to be a negative flux rate trip, but those kinds of issues were, have
13 been followed up on by the restart readiness team, again, which is still ongoing.
14 And, again, it does complement the questions that have been asked because
15 there is a need for independent verification of the information that was provided.
16 That team is continuing the walk-downs, observations, that Dominion has done
17 and has conducted some independent walk-downs as well. But the focus, unlike
18 the augmented inspection, is on the readiness for the plant to restart, integrated
19 with the questions that are being asked by NRR.

20 COMMISSIONER SVINICKI: Okay. Thank you. Eric and Bill, did
21 you want to add something with that?

22 ERIC LEEDS: Yes. To start with Bill, and one of the things, the
23 response that the licensees provide us help the staff write our safety evaluation
24 for the public so they can understand how we got from one place to the final
25 determination.

1 COMMISSIONER SVINICKI: Okay. Thank you. That's helpful.

2 Thank you, Mr. Chairman.

3 CHAIRMAN JACZKO: Well, a couple questions, Dave, for you.

4 The first one, the staff indicated that you did not initially look at the reactor vessel
5 supports. Can you just give me a kind of a quick answer on why that was not
6 considered?

7 DAVID HEACOCK: Yes. For the intensity level zero, they would
8 not -- you would not normally look at the reactor vessel supports. As I
9 mentioned earlier, you look for indicators first, things that would be damaged that
10 were not seismic, not structurally sound, and we saw very few of those. And as
11 we moved into the more structural almost we saw none in that category. So, the
12 reactor vessel's obviously a class one very strong vessel. You heard it mentioned
13 there's really two reasons. One's for the seismic event, and one was an ISI
14 question. So, ultimately, we looked at it. Be sure we satisfied both of those at the
15 same time.

16 CHAIRMAN JACZKO: So, you are doing it?

17 DAVID HEACOCK: Yes, sir. We have all 12 of them already.

18 CHAIRMAN JACZKO: Okay. Thank you. The -- you also indicated,
19 and I think as I -- and I may have misunderstood this -- there is -- the
20 scratchplates do have some indications in the control room or the back panel
21 somewhere where they do indicate if you exceed at the various frequencies of
22 design basis earthquake. I think what I understand is because of the power loss,
23 those indicators never illuminated. Is that correct, or is that --

24 DAVID HEACOCK: That's correct. One of the scratchplate devices
25 also has remote indication in the control room for each of the three planes and 12

1 frequencies in each plane, and that's the Ingdal device that lost power for 8.1
2 seconds. It would have alarmed in each individual frequency in the base mat of
3 Unit 1 containment had it had power.

4 CHAIRMAN JACZKO: Okay. So, it didn't get an alarm. And, as
5 you said, I mean --

6 DAVID HEACOCK: It did not receive alarm because it lost power
7 during the effect of strong motion duration.

8 CHAIRMAN JACZKO: Okay. And you indicated that, I mean,
9 nonetheless, there's not a trip signal on that particular, or there's not a trip tied to
10 that particular signal, but, is there -- or let me ask you, I mean, should there be or
11 at least a procedural or manual pursuit, because I think, again, there wouldn't
12 have been a manual trip if even the operators had seen indications of that from a
13 procedural standpoint? Is that correct, or --

14 DAVID HEACOCK: It wouldn't, and, in fact, in this case, there was
15 almost a manual trip anyway.

16 CHAIRMAN JACZKO: Right.

17 DAVID HEACOCK: The manual trip was within a second or so of
18 the automatic trip that occurred, so the strong motion was sensed in the control
19 room sufficiently to cause the operators to decide to trip the unit at that point.

20 CHAIRMAN JACZKO: Okay. And, I guess what I'm trying to get at,
21 is that proceduralized, that if you do -- or was that kind of a judgment call just
22 based on, I mean, operator action or kind of --

23 DAVID HEACOCK: A judgment.

24 CHAIRMAN JACZKO: A judgment. Okay. Thanks. So, I mean, as
25 a follow-up, I guess the question is this something that should be

1 proceduralized? I mean, is, should we be looking at a procedure? I don't know,
2 maybe this is something for Eric and the staff to think about. You know, is it
3 appropriate to have either an automatic trip or a manual trip proceduralized if in
4 fact when you get the better indications, you've got a warning signal or an alarm.
5 I mean, I guess it was alarm on this --

6 GENE GRECHECK: Mr. Chairman, what is proceduralized is
7 guidance that says that if you'd exceeded your operational basis earthquake
8 you're required to shut the units down.

9 CHAIRMAN JACZKO: Okay.

10 GENE GRECHECK: So, if there is no pending equipment problem
11 that requires a trip, it is much better to be able to shut the unit down in a
12 deliberate manner than it is to trip the reactor.

13 CHAIRMAN JACZKO: That procedure, it could be more of a
14 controlled shut down.

15 GENE GRECHECK: Right. So, if, the procedure says that if you
16 evaluate the event and conclude that you've exceeded the OBE, then you need
17 to shut the units down.

18 CHAIRMAN JACZKO: Okay. And, again, I guess probably part of
19 the corrective action is to make sure that you have good control room indication
20 of that state. I couldn't not ask a question about the CAV, but I mean, we'll get
21 there in a second. I did have a question about your Slide Number 9. The, one of
22 the, if there's anything that I take away from this is we probably never really
23 modeled earthquakes very well, or maybe it's just really hard to do. It's probably
24 just really hard to do, and because I find it interesting that the elevation 291, the
25 design basis earthquake shows a large acceleration on the frequency of about 7

1 or 8 hertz, which tells me that there's some resonant structure in there, or
2 component, that has got a resonant frequency around 7 hertz, and you're getting
3 that large peak there. What's interesting is that seems to be completely on a
4 phase with where the actual resonances appear to be, which is a little bit lower in
5 the 2 to 3 hertz range and a little bit higher into the 10 hertz range. Have you all
6 taken a look at that? Is that telling you anything? You know, it seems, it just
7 seems not real accurate, I guess, so.

8 GENE GRECHECK: Well, there's a couple pieces to that. One the
9 idea that there's a resonance at above 10 hertz is an artifact or something that is
10 becoming apparent from the overall investigation of central eastern United States
11 earthquakes that there clearly are higher frequency contributors to that overall
12 spectrum beyond what was previously anticipated. So, the idea that we're seeing
13 things at higher frequencies is not unexpected based on that modeling. The other
14 piece is that clearly the modeling techniques are conservative. They tend to be
15 relatively simple, and they probably do not, in all aspects, properly characterize
16 things, and I think that's part of the overall evolution of the technology.

17 CHAIRMAN JACZKO: Well, I appreciate that. I mean, I probably
18 would look at that, and, again, it's hard to say whether that's telling me a
19 conservative thing or non-conservative thing, and I think it's just telling me a
20 wrong thing. And that's the challenge, I think, because, you know, you can
21 perhaps design your plan, then, to deal with those frequencies. And if they're
22 really not the actual frequencies you're seeing, you may be missing and actually
23 inducing resonances in higher frequencies where it actually is more significant.
24 But I just thought that was interesting.

25 Now, getting back to the CAV. It is, you know, and I think

1 Commissioner Apostolakis raised a good question about whether this is a better
2 metric. But, you know, what's interesting to some extent is it seems to me this
3 puts us back almost to, you know, to Richter scales because we're back to
4 energy deposition, kind of, which is in essence, you know, a scale or quantity as
5 opposed to the accelerations which are giving you more of a kind of an actual
6 impact on the facility. And one of the things that I found interesting and I guess I
7 had a question for you is that there were at least two aftershocks, two significant,
8 well, two aftershocks, I believe, that were felt in the control room. One, I think,
9 later the day of, and one two or three days later. And one was a 4.2 magnitude,
10 one was about 4.5. did you include those in your calculation of the CAV?

11 GENE GRECHECK: Well, this CAV is specific for this particular
12 event as the specific time history for this event. So that's not a cumulative edition
13 over multiple events.

14 DAVID HEACOCK: All right. We did it in our note case, an usually
15 event on two of those events.

16 CHAIRMAN JACZKO: So, you didn't incorporate. So, they're not in
17 the CAV calculation?

18 DAVID HEACOCK: No.

19 CHAIRMAN JACZKO: And, if I just do, you know, a back of the
20 envelope here, and, looking at, I mean, effectively, I mean, the CAV is a measure
21 of energy deposition which is, to some extent, going to be capped by whatever
22 the magnitude of the event is, because, I mean, the Richter scale magnitude give
23 you -- and I'm not a seismologist -- but just thinking of this from what I know, I
24 mean, that gives you essentially some type of measure effectively of what your
25 original energy deposition is, or energy releases to some extent. Well, I guess

1 there's a logarithmic scale. Is that right? Okay, so, because your aftershocks then
2 were around 4.5, 4.2. so, they're about a factor of 10 lower, at least in the
3 theoretical maximum of the energy deposited. So, I guess you could have
4 contributions to the CAV, let's just say conservatively, maybe they would be a
5 factor 20 percent more additional or not. You're shaking your head. Explain it to
6 me.

7 ERIC HENDRIXSON: There is a threshold for CAV, and the
8 aftershocks were below that. So, mathematically, the CAVs of the aftershock
9 would be zero.

10 CHAIRMAN JACZKO: Okay. So, and that's a calculational
11 threshold? That's a physical, there's a physical basis for the threshold?

12 ERIC HENDRIXSON: Yeah. There's a cutoff, if you will, to reduce
13 minor --

14 DAVID HEACOCK: And the acceleration below 0.025g where not
15 counted.

16 CHAIRMAN JACZKO: Okay. And they're -- so, I mean, in essence
17 then, the CAV doesn't, this is essentially if you have lots and lots of little things,
18 you don't ever accumulate anything?

19 DAVID HEACOCK: You don't add up. No, sir.

20 CHAIRMAN JACZKO: But, I mean, if it is a measure of energy
21 deposition, there is energy deposition as a result of those events in the
22 structures. I mean, so, I mean, to what extent, I mean, is there a cumulative
23 effect, I mean, if you have now, enough, I mean, let's say I have another
24 earthquake, which has a CAV, well, let's say that has accelerations are above the
25 threshold and gives me a CAV of .2, does the equipment in the plant now have

1 experienced a CAV of .37? I mean, is there a cumulative lifetime impact to that?

2 DIVAKAR BHARGAVA: Well, you're absolutely correct, that even a
3 smaller point, 4.5 Richter, would produce some CAV if you didn't use that cutoff
4 acceleration. The original definition of CAV for the threshold which would not be
5 expected to cause damage was not .16, it was .3, which would have accounted
6 for all the small accelerations. Then that was revised to .16g seconds to, with the
7 screening criteria that smaller magnitude earthquakes would not contribute. So, if
8 you take into account the smaller, 4.5 Richter earthquakes, and you calculate
9 CAV from those to add to this, then you would probably use the .3g second
10 criterion --

11 CHAIRMAN JACZKO: Okay.

12 DIVAKAR BHARGAVA: which is equivalent to .16, so, with that, we
13 would have much more margin.

14 CHAIRMAN JACZKO: Okay. And you wouldn't, given that it's, I
15 mean, Richter's scale is a logarithmic scale, so I wouldn't assume that a .4, or a
16 4.2, 4.5 would contribute --

17 DIVAKAR BHARGAVA: You are absolutely right.

18 CHAIRMAN JACZKO: -- anything on a large. But, I mean, and you
19 could just, I mean, that last question, I mean, let's say we have another
20 earthquake today. Is there a cumulative impact, you know, and we got a CAV
21 again that was .74, or .174, again, does it matter then that there was a previous
22 earthquake that gave you a CAV of .174?

23 DIVAKAR BHARGAVA: Well, we do look at the impact of a future
24 event in terms of durations.

25 CHAIRMAN JACZKO: Yeah.

1 DIVAKAR BHARGAVA: Our testing, for instance, accounts for, as
2 Gene mentioned earlier, five OBs and one DB event of 30 seconds each. So, we
3 have qualified equipment for much larger durations that, in general, which are
4 qualified by testing, so. Since this event, the effect of strong motion duration was
5 about three seconds. If you look at the duration and the impact of additional
6 earthquake with some durations, you could easily accommodate another event of
7 this magnitude or higher, because we have qualified our equipment to
8 significantly larger durations by seismic testing or shake table.

9 CHAIRMAN JACZKO: But, does it matter, I guess that's what I'm
10 asking. I mean, next time there's an earthquake at North Anna, what's --

11 [laughter]

12 -- because I'm not going to say there's never going to be one.

13 GENE GRECHECK: Lightning doesn't strike twice. What's the
14 date?

15 CHAIRMAN JACZKO: They -- well, I won't tell you. But, will you
16 come back to us when you're doing your presentation on restart and say we
17 previously had a CAV of .174, this CAV was point -- this latest earthquake was a
18 CAV of .3, and based on the EPRI guidance, we know that a CAV of .3, we don't
19 expect anything, or will you come back and say, so, the CAV was .3, and the
20 previous CAV was .174, so the CAV is, on this equipment, assuming some of the
21 equipment hasn't been exchanged or changed out, is .4?

22 DIVAKAR BHARGAVA: I think the concept of CAV was not derived
23 in this -- in the manner that you described. It was based on CAV's determined
24 from hundreds of earthquakes, each individually.

25 CHAIRMAN JACZKO: Individually, okay.

1 DIVAKAR BHARGAVA: And it was a metric of damage, if the
2 threshold was within, no damage was seen, and that's how the criteria was
3 developed. So, I'm not sure whether you would add the CAV from another event
4 --

5 CHAIRMAN JACZKO: Yeah.

6 DIVAKAR BHARGAVA: -- and I'm not sure. Maybe somebody else
7 could elaborate on that.

8 NILESH CHOKSHI: This is Nilesh Chokshi from the Office of New
9 Reactors. The CAV is associated with that particular event, and it's a local thing,
10 you know, because at different locations, you will measure different based on the
11 history you measure, you will have a different CAV value. Now, the CAV, the --
12 one of the reasons for the long-term evaluation is to see whether you exceeded
13 your elastic limits -- that's what's important what happens in the next earthquake,
14 if you didn't experience that, you haven't used already your capacity.

15 CHAIRMAN JACZKO: Okay. So, the previous CAV doesn't matter.

16 NILESH CHOKSHI: So it doesn't matter, right. So, that's the value
17 of the long-term. That needed to make sure you restore enough margin, that you
18 have the same capacity --

19 CHAIRMAN JACZKO: Yeah. And that's what you'll then largely
20 do with your longer-term assessment is determine whether kind of, what the
21 baseline is going forward, then. Okay. Well, thank you very much. Any other
22 questions or comments? Okay. Well, thank you both for your presentation. I
23 know the staff has a lot of work in front of it as well as all the other work they
24 have in front of it, and I know you'll do a nice, through job. Thank you.

25 [Whereupon, the proceedings were concluded]