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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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NUSCALE SUBCOMMITTEE

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OPEN SESSION

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WEDNESDAY

JUNE 6, 2018

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B1, 11545 Rockville Pike, at 8:30 a.m., Dennis Bley,
Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman

CHARLES H. BROWN, JR. Member

MICHAEL L. CORRADINI, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

1 HAROLD B. RAY, Member
2 PETER RICCARDELLA, Member
3 GORDON R. SKILLMAN, Member
4 MATTHEW SUNSERI, Member

5

6 ACRS CONSULTANT:

7 STEPHEN SCHULTZ

8 DESIGNATED FEDERAL OFFICIAL:

9 MICHAEL SNODDERLY

10 ALSO PRESENT:

11 TOM BERGMAN, NuScale

12 LUIS BETANCOURT, NRO

13 TIM DRZEWIECKI, NRO

14 JEFF EHLERS, NuScale

15 ROBERT FITZPATRICK, NRR

16 TED HOUGH, NuScale

17 NADIM KHAN, NRR

18 SHEILA RAY, NRR

19 OMID TABATABAI, NRO

20 DINESH TINEJA, NRO

21 ANDREA D. VEIL, Executive Director, ACRS

22 KENT WELTER, NuScale

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OPEN SESSION

Overview of Chapter 8, "Electric Power,"

 NuScale Design Certification

 Application 8

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Adjourn 152

P R O C E E D I N G S

8:30 a.m.

1
2
3 CHAIR BLEY: Good morning. The meeting
4 will now come to order. This is a meeting of the
5 Advisory Committee on Reactor Safeguards, a NuScale
6 Subcommittee. I'm Dennis Bley, chairman for today's
7 meeting.

8 Members in attendance today are Charlie
9 Brown, Mike Corradini -- I don't know if Walt's here
10 or not, maybe not, we expect Walt Kirchner to come in
11 --- Jose March-Leuba, Harold Ray, Joy --- we expect
12 Dr. Joy Rempe, Pete Riccardella, Matt Sunseri, Dick
13 Skillman, and our consultant, Steven Schultz, is with
14 us.

15 Mike Snodderly is the Designated Federal
16 Official for this meeting. The Subcommittee will
17 review the staff's safety evaluation report with open
18 items of Chapter 8: Electric Power to the NuScale
19 Design Cert Application. Today we have members of the
20 NRC staff and NuScale to brief the Committee.

21 Before we start and I go into the
22 boilerplate stuff, I'll just comment to the staff.
23 From reading the SER, it really feels like we're
24 premature in this meeting. It is a SER with open
25 items, but all of the most significant open items are

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1 still open. And despite the submittal of responses to
2 the RAIs, there isn't much for us to review and
3 comment on.

4 I'm hoping that the staff will be able to
5 at least give us a little more background on where
6 they stand and what they expect to come out of their
7 review of the main open item on this issue today.
8 Otherwise, in the future. maybe we ought to think
9 about how our schedule is progressing. It does seem
10 a little premature.

11 The ACRS was established by statute and is
12 governed by the Federal Advisory Committee Act, FACA.
13 That means the Committee can only speak through its
14 published letter reports.

15 We hold meetings to gather information to
16 support our deliberations. Interested parties who
17 wish to provide comments can contact our office
18 requesting time after the meeting announcement is
19 published in the Federal Register.

20 That said, we set aside ten minutes for
21 comments from members of the public attending or
22 listening to our meetings. Written comments are also
23 welcome. The ACRS section of the US NRC public
24 website provides our charter, by-laws, letter reports,
25 and transcripts of all Committee meetings including

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1 the slides presented there.

2 The rules for participation in today's
3 meeting were announced in the Federal Register on June
4 5th, and I apologize for that. I'm not sure why it
5 was so late.

6 The meeting was announced as an
7 open/closed meeting which means we may close the
8 meeting after the open portion to discuss proprietary
9 material. And presenters can defer questions that
10 should not be answered in the public session to that
11 time. So we have to leave that up to you if we start
12 straying into proprietary information.

13 No written statement or request for making
14 an oral statement to the Subcommittee has been
15 received from the public concerning this meeting. A
16 transcript of the meeting is being kept, will be made
17 available as stated in the Federal Register notice.

18 Therefore, we request the participants in
19 this meeting use the microphones located throughout
20 the room when addressing the Subcommittee.
21 Participants should first identify themselves and
22 state with sufficient clarity and volume so they can
23 be readily heard.

24 We have a bridge line established for the
25 public to listen in to the meeting. To minimize

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1 disturbance, the public line will be kept in the
2 listen in only mode. I also request that attendees
3 put their electronic devices on silence. We don't
4 want them going off during the meeting.

5 We'll now proceed with the meeting. And
6 I'm going to call upon Omid Tabatabai from the NRC
7 staff to make introductory remarks, and then we'll
8 turn it over to the NuScale folks. Omid?

9 MR. TABATABAI: Good morning. Thank you
10 so much, Dr. Bley, and thank you, the members of the
11 ACRS. As you mentioned, this is a Subcommittee
12 presentation of Chapter 8: Electric Power for NuScale
13 Design Certification Application.

14 We're excited to present to the
15 Subcommittee members. And the interesting part is
16 that this is the beginning of Phase 3 of the review of
17 NuScale Design Certification Application. And this is
18 the first chapter that comes before the ACRS.

19 The team from NuScale is going to start
20 the presentation first. And then after that, the NRC
21 staff will make their presentation with respect to the
22 evaluation of information.

23 Dr. Bley mentioned --- made a comment
24 about this review being premature. And I think, to
25 some degree, we agree with that. And we're hoping

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1 that during our presentation we can provide additional
2 information to the members. With that, I'll turn the
3 microphone back to you.

4 CHAIR BLEY: Thank you. And I guess I can
5 turn it over to Paul Infanger from NuScale. Paul, go
6 ahead.

7 MR. INFANGER: Good morning, my name is
8 Paul Infanger and I'm the licensing project manager
9 for Chapter 8. And my background, education, I went
10 to Ohio State University, a bachelor's in physics,
11 master's in nuclear engineering.

12 And I've been in the nuclear power
13 industry for about 35 years, about 25 years at
14 operating plants and about the last ten years working
15 on new reactors. I was at UniStar for about seven
16 years, and now I've been at NuScale for about three.

17 So we'll start with the introductions, and
18 then I have a couple of opening remarks about the
19 chapter presentation. Kent?

20 MR. WELTER: My name is Kent Welter. I'm
21 a chief engineer at NuScale Power. I graduated from
22 Oregon State University with a PhD in nuclear
23 engineering, about ten years at NuScale and about five
24 years at the NRC in New and Advanced Reactors before
25 joining NuScale.

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1 MR. EHLERS: Yes, my name is Jeff Ehlers.
2 I've been at NuScale since January. I've been in the
3 nuclear industry for probably 15 years, mostly spent
4 at Cooper Nuclear Station. I received my degree in
5 electrical engineering from the University of
6 Nebraska. And now I am serving in the role of the
7 electrical engineering supervisor at NuScale.

8 MR. HOUGH: Good morning, I'm Ted Hough.
9 Good to be here again, see all these faces again from
10 last year. I started my nuclear career back in 1968
11 when I read a book called Accelerators: Machines of
12 Nuclear Physics. And about a year later the Navy
13 recruiter thought that was pretty nice, so I got in
14 the Nuclear Navy that way.

15 And over the years, I worked nine
16 different commercial units, and then ended up at
17 Cooper for about 20 years there. That's how I got to
18 know Jeff. And over the years, I got the lead
19 auditor, Level 3 inspector for electrical cert, and a
20 EE degree from the University of Nebraska. And that's
21 my background there.

22 And I think we can just roll right into
23 the presentation if everybody ---

24 MR. INFANGER: Yes. I just wanted to say
25 a couple of things about Chapter 8. I think Omid

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1 mentioned, this is the first of the chapters. We've
2 brought a number of topical reports to the ACRS. This
3 is the first of our chapters.

4 And although there's quite a number of
5 items that are in the open items in the SER, one thing
6 that we'd like to point out is that for the
7 confirmatory items that are mentioned in the SER,
8 those were in Revision I, which was issued after --
9 was submitted to the NRC after the SER was already in
10 the review cycle. And that's why there's quite a
11 number of confirmatory items. But those have all been
12 --- the responses to all those have been submitted and
13 are on the docket.

14 And also, for the open items, the largest
15 open item is meeting the topical report for the
16 electrical distribution system for non-safety related
17 power. We have submitted an RAI response on that
18 which has provided how we meet all of the SER
19 conditions.

20 So that has been submitted. That was
21 submitted in late March which, again, was after the
22 SER was already in the review cycle. So that's why
23 those things are not in the SER. But we are willing
24 to and able to answer questions about those items. We
25 have the appropriate people here.

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1 CHAIR BLEY: Okay, good. Well, two
2 questions, well, two comments. One is thank you for
3 the list of acronyms. I wish I had it when I was
4 reading this stuff, ha, ha.

5 Number two, have you responded to all the
6 RAIs on this chapter? Or are there still some
7 outstanding that you have not responded to? I know
8 the staff hasn't reviewed them all yet but ---

9 MR. INFANGER: Yes. We responded to all
10 the Chapter 8 RAIs.

11 CHAIR BLEY: Okay, thank you.

12 MR. INFANGER: And with that, Ted, why
13 don't you start the presentation?

14 MR. HOUGH: All right. We'll just jump
15 right in there. Of course, the abbreviations that the
16 member mentioned there, probably most important is all
17 the system names. After that it's pretty much run of
18 the mill acronyms in the industry. I'll just kind of
19 click through those for you.

20 And then again, the purpose of the
21 meeting, to provide an overview of our electrical
22 systems and then present some highlights of the
23 systems. And you can see the presentation's kind of
24 organized just like Chapter 8, 8.1 through 8.4 down
25 there, design basis, offsite power, onsite AC and DC,

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1 and then the station blackout.

2 And then as indicated there, we'll talk
3 about the topical and the road map that'll be provided
4 for that toward the end of the presentation. So
5 there'll be a general flow here.

6 I just want to give you a little bit of
7 background. The starting point that we had when I
8 first got to NuScale in late 2010, October of 2010, of
9 course, you know, your key basis is nuclear safety and
10 regulatory requirements that everybody has to
11 implement.

12 And then in March of 2011, the Fukushima
13 event happened. That weighed heavy on our mind, me in
14 particular. That was a significant emotional event
15 for me, I guess you might say. And then what we had
16 to work with was the robust, inherently safe module
17 design that Dr. Reyes put together.

18 You know, our plant is very simple
19 mechanically. And that was an emphasis that we had
20 all along, make it as simple as possible, don't
21 complicate things. And so my challenge was to put
22 together electrical design that complemented that
23 simplicity.

24 But at the same time, what I had to look
25 for, I can't just put together 12 independent

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1 distribution systems. That's not economical. But,
2 you know, at the same time, look out for GDC 5, things
3 like that, when we shared electrical systems, you
4 know, so they don't impact economics and viability of
5 the plant.

6 So that's where we started. And so moving
7 along here, what we have is design basis. We
8 maintained everything, the fail-safe and loss of
9 power, everything, any active components like
10 solenoids. They would de-energize and move to their
11 safety position, depending on what their function is.
12 Breakers would open, for example, reactor trip and
13 pressurizer, heater.

14 And then once those active components
15 moved to their safety position, via no power,
16 everything from that point on is natural, you know,
17 passive cooling, thermodynamic principles, et cetera.
18 So it's pretty straight forward.

19 MEMBER SKILLMAN: Ted, let me ask you a
20 question here.

21 MR. HOUGH: Yes, sir.

22 MEMBER SKILLMAN: Go back a slide please.
23 On your next to the last bullet, design electrical
24 systems that complement the simplicity, I hear from
25 your background you've obviously dealt with small

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1 plants and likely paralleling diesel engines,
2 paralleling other power supplies.

3 In this design, you can have 12
4 independent machines, each of which is parallel to the
5 other --

6 MR. HOUGH: Yes.

7 MEMBER SKILLMAN: -- under at least a
8 defined set of conditions, the 11 collapse to an
9 island mode of a selected machine.

10 I was considering, as I did this review,
11 whether I thought that was simple or not simple,
12 drawing on my background of paralleling multiple
13 diesel engines, finding the oscilloscope, making sure
14 I knew, if I was on lead, when I was going to close
15 the breakers manually. All of that I did manually,
16 you probably did too.

17 MR. HOUGH: Yes.

18 MEMBER SKILLMAN: Maybe that's going to be
19 same situation for your operators that might have 12
20 of these modules coming on one at time on a particular
21 time period, or at least three or four coming on
22 during a particular time period. Speak to that
23 relative the work simplicity.

24 MR. HOUGH: I think, you know, that's a
25 good point, you know, bringing the units online. Of

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1 course, they'll have to be, you know, brought in
2 parallel online as they come up. Within the island
3 mode factor that you talk about, that is the part of
4 the design that is yet to go in terms of, you know,
5 controls to do that, if it's in the final design
6 phase.

7 But it's fairly simple in the aspect of
8 when the grid gets --- either it goes away or it gets
9 unstable, disconnect from it. Get away from it. And
10 then we move one unit into isochronous. And the rest
11 of them have full bypass capability, the breakers just
12 open. So the operators have very little to do in that
13 event.

14 I know you mentioned the island mode
15 there, but that's probably, I would say, I guess in my
16 opinion, the most complicated thing is getting the
17 controls lined up, all the relaying and stuff to make
18 that happen. But that's still yet to go in the design
19 phase.

20 MEMBER SKILLMAN: Let me just add one
21 more.

22 MR. HOUGH: Sure.

23 MEMBER SKILLMAN: So let's say we're on
24 watch, and we've got --- we're a fully mature 12
25 module plant. And we've got four operating, and we're

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1 bringing two online. What's different here is, when
2 you're paralleling the next two modules, you're not
3 just adding an alternator to pick up load. The
4 instant you connect, you're pumping reactivity to
5 increase power to allow that machine to come out and
6 not only stay synchronized but add to the load
7 capacity.

8 MR. HOUGH: Yes.

9 MEMBER SKILLMAN: And so what's really
10 different in this setup is what it takes to, if you
11 will, parallel, assume load, and had enough reactivity
12 that you are actually taking part of the load.

13 So it's a two-step process, whereas in a
14 diesel or gas turbine, you almost automatically come
15 on up and take load. Here is an action that requires
16 addition of reactivity in addition to paralleling the
17 electrical machine. So how has that been considered
18 in terms of simplicity?

19 MR. HOUGH: I would say not from an
20 electrical standpoint but, you know, each module is
21 connected to its own turbine, right --

22 MEMBER SKILLMAN: Yes.

23 MR. HOUGH: -- independently. So the
24 reactivity controls are ---

25 MEMBER SKILLMAN: So does it load

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1 automatically and increase reactivity automatically?

2 MR. HOUGH: Yes. Dr. Welter might be able
3 to follow on there for me ---

4 MEMBER SKILLMAN: What I'm getting at is
5 the term simplicity. And I'm not challenging that
6 that is accurate. It may be. But I'm imagining a
7 scenario that, at least, I lived through. And it
8 wasn't quite as simple as one might have thought it
9 is.

10 MR. WELTER: Yes. I don't disagree. I
11 guess what Ted is speaking to a little bit is we're
12 going through a lot of that right now. So we have a
13 crew of about 20 folks going through ISV right now,
14 you know, potential operators of the plant going
15 through all these various scenarios on how to start it
16 up.

17 CHAIR BLEY: Would you define your
18 acronyms as you use them, please?

19 MR. WELTER: ISV ---

20 CHAIR BLEY: You've forgotten what the
21 words mean, ha, ha, ha.

22 MR. WELTER: Yes, sorry, independent
23 system verification. It's part of our human factors
24 engineering program. So not all of the details on how
25 to do what you're asking have been worked out. But we

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1 have a human factors engineering program, we have
2 people on the simulator right going through a lot of
3 these various scenarios.

4 MEMBER SKILLMAN: But we're in the
5 conceptual stage, a lot of lessons ahead. You kind of
6 understand exactly where you want to go. There's a
7 lot of work to get there from here.

8 MR. WELTER: Well, I would say from a
9 design certification perspective, we have the
10 electrical and the systems designed, and the
11 capability of the plant is well understood. And now
12 exactly how you want to operate that is still being
13 worked out, yes, so conceptual, if you will. And
14 that's part of the human ---

15 MEMBER SKILLMAN: Yes, fair enough. Thank
16 you. Okay.

17 MR. HOUGH: Okay. So then final bullet
18 there, based on the application of topical, highlights
19 our overall design of AC and DC systems are non-1E.
20 We have the highly reliable DC system we talked about
21 last year with augmented design qualifications and QA
22 provisions.

23 And that system itself powers up the main
24 control room emergency lighting, your post-accident
25 monitoring type Bravo and Charlie variables. And then

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1 there are no power sources required to perform any
2 safety related functions. And so consequently, the
3 design supports exemption of GDC 17 and 18.

4 Here's a picture we put together just to
5 give you kind of a big picture overview of how the
6 systems interrelate to one another. At the top,
7 you'll see the grid or what we call the load, fed by
8 the high voltage system, 13.8, electronically designed
9 as a 345 out to the grid. And then EHV supports the
10 medium voltage system at 4160 through unit auxiliary
11 transformers.

12 And we'll go into a little bit more detail
13 in the next slide here. Then that drops down to a 480
14 system with low voltage. And the ELV 480 system feeds
15 our DC, both DC systems, the normal DC, the highly
16 reliable DC, and over to the right there in the yellow
17 is the plant lighting system. It also feeds security
18 power down there in the blue box.

19 And then the backup power system is
20 actually divided into two pieces, one at a 13.8 source
21 that's called the auxiliary AC power supply, and then
22 the backup diesel generators there, at the 480 level,
23 is also part of the backup power supply system. So
24 that's how they all interrelate to one another in a
25 big picture fashion.

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1 And here's where --- I know this is very
2 hard to see. You know, the pictures are in the
3 application and stuff. At the top there, I would like
4 to point out it's a standard breaker and a half
5 scheme. That's what most places use. It doesn't have
6 to be, but that's we put in there.

7 In the 13.8, there're some interesting
8 aspects of that. Over here at the far left you'll see
9 -- that's the auxiliary power supply unit, an
10 auxiliary AC power supply unit, APS. And it's
11 connected to what appears to be kind of like a swing
12 bus to some of the folks. It might be.

13 But what that allows us to do, in part of
14 this design, part of my background was maintenance
15 rule coordinator at Cooper for five years. And I was
16 on the Advisory Board. And I've seen a lot of folks
17 struggling with unavailability of maintenance. That's
18 why we end up with A4, five, you know, people trying
19 to do too much online.

20 We designed this so that you could take
21 out any component of the AC distribution system and
22 stick device protection in there. They disconnect to
23 the breaker safely. And you can see, I could take
24 this generator here, and move it over to this bus.

25 That main part transformer there was a

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1 component of the AC distribution system. And they
2 still provide 100 percent power. And we put two
3 device protection in there. They disconnect the
4 breaker so it allows safety for the maintenance shops.

5 And you can see, I can take this generator
6 here, and I can move it over to this bus. That main
7 power transformer there will still put out --- each
8 one is built to handle output of two generators.

9 And I can move that other generator. You
10 know, I can take this one, put it over here where it
11 normally would be and put two over here. Now I have
12 this bus and this MPT available. These are three
13 phase main power transformers, about 115 MVA each.

14 So the bus, unless it's the generator
15 itself that goes down on you, I could still put out
16 100 percent power. And that was also a factor in
17 designing this, because you had to have --- it's not
18 like a normal plant where we're going to take the unit
19 down and, you know, have bus outages and bipower.

20 What you have here is a plant that's going
21 to operate 24/7 from all the other units that are
22 still online, so even if I take one generator ---
23 reactor off for refuel. So those are kind of the
24 highlights of the 13.8 system.

25 Now to 4160, you can see it is arranged,

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1 and if you follow it through, you can see there's a
2 ring bus concept built here. And if I have a lockout
3 or anything happened on the UAT, the unit auxiliary
4 transformers there, it'll automatically transfer to an
5 adjacent bus and Ops is selected.

6 And then moving down to the 480 section
7 down here, you can see --- it's real hard to see
8 there, but each one is a main-tie-main configuration.
9 So I have reliability built in there, that if one of
10 those SSTs, you know, trips, or overloads, or
11 whatever, it can go the other side, to the main-tie-
12 main configuration. So we've built a lot of
13 reliability in there.

14 And the other factor was, from the control
15 mass type of simplicity, how do I make this system
16 very simple for the operators? Don't add operations
17 for this, you know, because we knew we had this
18 combined control room to deal with. We knew it had to
19 be simple in the first place. So that was another
20 factor we had to consider.

21 CHAIR BLEY: Ted?

22 MR. HOUGH: Sir?

23 CHAIR BLEY: I don't remember if you've
24 done this yet. How are you responding to the open
25 phase situation?

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1 MR. HOUGH: Actually, BTP 8-9, we don't
2 have any motors, anything like that that would be
3 harmed by an open phase condition. And all of our,
4 again, with a zero power need, 8-9 really is a never
5 mind.

6 CHAIR BLEY: You don't need electric
7 power, but it's darn nice to have. So you're not
8 adding any open phase protection, because you don't
9 need it?

10 MR. HOUGH: No, that's correct.

11 CHAIR BLEY: Okay. Your choice, but ---
12 (Off the record comments)

13 CHAIR BLEY: Oh, I'm sorry. Go ahead,
14 Jeff.

15 MR. EHLERS: Yes. This design doesn't
16 have any stand-by AC units. So the open phase issue
17 is where you have a standby transformer that's
18 energized but not loaded. We do not have one of those
19 in our design. So all of our transformers will be
20 loaded and not ready to be transferred to at some type
21 of emergency or a trip condition.

22 So that's where the open phase causes you
23 a problem. Because once you load that transformer,
24 then that open phase becomes apparent and then causes
25 all your motors, three-phase motors, to be down to two

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1 phases and causes problems.

2 So the times when we don't have that
3 detection, it's because as soon as we lose a phase due
4 to our design, we're going to know immediately,
5 because we're using those transformers. So in the OE
6 that you're -- the operating experience you're
7 speaking of, that was the problem, was that they had
8 a standby transformer that lost a phase.

9 And due to the design of those
10 transformers, they have a delta winding on the center
11 of them that allows the voltage to be placed on the
12 third phase, even though it's not connected to
13 anything. It's a phantom voltage. As soon as you
14 load it, it goes away. But again, we don't have that
15 in our design. So therefore, if we lose a phase,
16 we'll know so immediately.

17 MEMBER BROWN: You said it's a delta
18 output, right?

19 MR. EHLERS: No, no, no. I'm talking
20 about in the middle of the transformer.

21 MEMBER BROWN: No, the three phase ---

22 MR. EHLERS: Yes.

23 MEMBER BROWN: It's a delta ---

24 MR. EHLERS: Right.

25 MEMBER BROWN: -- connected system. And

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1 you can't operate, saying it goes away, that's not the
2 ---

3 (Simultaneous speaking)

4 MEMBER BROWN: When it goes down to two
5 phases, you have an open delta, but it can still
6 supply about 60 percent of the load.

7 MR. EHLERS: Right.

8 MEMBER BROWN: Roughly.

9 MR. EHLERS: With some pretty high phase
10 currents.

11 MEMBER BROWN: Well, there's imbalances.
12 But, I mean, it can ---

13 MR. EHLERS: Right.

14 MEMBER BROWN: -- you can supply about 60
15 percent of the load. So I've got a little bit of a
16 disconnect when you say it goes away.

17 MR. EHLERS: Well, I mean, the voltage on
18 that third phase is --- the problem with the open
19 phase issue is that, in the sense of transformers not
20 loaded, your voltage indications are going to show
21 there's a voltage on that phase. It's going to show
22 that -- your indication's going to say that phase is
23 energized.

24 But as soon as you load it, then this
25 voltage on the open phase goes away. And therefore,

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1 you're down to two phases. So that's the problem with
2 the open phase issue, is that on an unloaded
3 transformer there's no way to detect it, or there
4 wasn't any way to detect that open phase until the
5 transformer was actually loaded.

6 Now, then once you transport --- then once
7 you transfer to that transformer, put load on it, then
8 it became readily apparent that that was already too
9 late. Because you were needing it, and you just cause
10 all your motors, your loads to be operating on two
11 phases instead of three, what they were designed for.
12 Does that make it clear? Did I answer your question?

13 MEMBER BROWN: A little bit. I just never
14 --- I did an open phase delta connected analysis at
15 one time back in one of my old jobs. I never really
16 thought about it under the zero load condition. So
17 trying to connect that back to saying that all of a
18 sudden the voltage can't be sensed, I mean, I'd have
19 to go back and look at that. It's just been awhile --

20 MR. EHLERS: Well, it ---

21 MEMBER BROWN: About 20 years.

22 MR. EHLERS: Yes. In the operating
23 experience, that was the problem for the two cases
24 this occurred, that have been publicized, is where the
25 phase ---

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1 CHAIR BLEY: Well, that's why it was
2 allowed to exist for the length ---

3 MR. EHLERS: Yes, because if it --

4 CHAIR BLEY: -- of time it existed. And I
5 agree with you that it's obvious if you have the
6 transformer loaded. However, you can still get some
7 pretty big phase currents temporarily. And the idea
8 that that can't do any damage, I'm not convinced of
9 that.

10 MR. EHLERS: Well, I mean ---

11 CHAIR BLEY: Then again, you know, Ted's
12 right for the details of your response to accident
13 conditions. You don't need it. On the other hand, if
14 it were my plant, I'd think about it long and hard
15 before I didn't worry about that.

16 MR. EHLERS: I'm just saying, due to all
17 the transformers being loaded, and power flow going
18 through them, an open phase condition would
19 immediately recognized.

20 CHAIR BLEY: Yes, it would. I agree with
21 you on that.

22 MR. EHLERS: Yes. Where the open phase
23 detection system is for unloaded transformers.

24 CHAIR BLEY: I'm not completely sure that
25 under all conditions none of that operating equipment

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1 could be damaged though. That's the other side of it.

2 MR. EHLERS: Well, yes, I agree with that.

3 CHAIR BLEY: And I would worry about that.

4 MR. EHLERS: Yes, I agree with that.

5 CHAIR BLEY: If it were my own plant.

6 MR. EHLERS: Yes.

7 (Simultaneous speaking)

8 MEMBER SKILLMAN: Where in this diagram is
9 the voltage stepped up to the grid, if this is used,
10 for instance, in grid supply versus a local
11 application where you're not really feeding the grid?

12 MR. HOUGH: Okay. Right here is the 13.8
13 bus. That's the main power transformer, 13.8, the 345
14 going out. And you have a double bus configuration to
15 offsite breakers. Does that answer your question?

16 MEMBER SKILLMAN: So could you go to
17 island mode? And back into island mode where you're
18 just feeding in-house, could you then have a
19 transformer fault where you did have an open phase
20 that you did not detect?

21 In other words, could you find yourself in
22 a transient condition going to island mode, separating
23 from the grid, and in that separation end up with the
24 transformer fault that ---

25 MR. HOUGH: As Jeff indicated, I think ---

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1 MEMBER SKILLMAN: That would disable a
2 phase?

3 MR. HOUGH: I think I understand the
4 question. The island mode functionality basically
5 disconnects at this point here. And so again, all of
6 these transformers here, all four of the --- or all
7 eight of the main power transformers are normally
8 energized. And you would know whether they were, you
9 know, had a problem or not right away.

10 And so whatever service unit is designated
11 as the island mode module, you know, it'll pick up the
12 load and just feed it right back through once you're
13 disconnected here from the grid itself. Again, you
14 would know ---

15 MEMBER SKILLMAN: Okay, thank you.

16 MR. HOUGH: Okay. Any other questions on
17 this? Hard to read --

18 MEMBER BROWN: Yes. You mentioned the
19 4160 was a ring bus, and I --

20 MR. HOUGH: yes, sir.

21 MEMBER BROWN: -- I didn't pick that up
22 when I looked at this before.

23 MR. HOUGH: Okay. You have to kind of
24 trace it through, ha, ha.

25 MEMBER BROWN: I'm trying to see where it

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1 circles. It's no connection.

2 MR. HOUGH: There's these ---

3 MEMBER BROWN: Oh, it's that side as
4 opposed to left or right.

5 MR. HOUGH: Yes, yes. And then over here
6 too on the outside.

7 MEMBER BROWN: No, hold it. It still
8 doesn't go back to 4160. So as you come to a 4160
9 bus, off of the 13.8 kV, just pick one of those.

10 MR. HOUGH: Yes, go here.

11 MEMBER BROWN: And then I can go ring bus
12 to the other -- to the left.

13 MR. HOUGH: Yes.

14 MEMBER BROWN: Come down, and there's no
15 connection.

16 MR. HOUGH: Or you can go here.

17 MEMBER BROWN: I don't see any ring bus
18 connection on 4160. I don't really care ---

19 MR. HOUGH: Because it's supposed to --

20 (Simultaneous speaking)

21 MEMBER BROWN: You just made the comment,
22 and I can't find the line.

23 MR. HOUGH: Yes. It is there. And these
24 connection points here get you to the other side.

25 MEMBER BROWN: I'll work on that.

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1 MR. HOUGH: Okay.

2 MEMBER BROWN: I do not see it.

3 MR. HOUGH: Okay. It is there. Again, I
4 apologize for the --- it's kind of hard to, on this
5 large picture, or large schematic, the small picture.

6 All right, the offsite system, again, this
7 would be like 8.2 in the SRP or DSRS, offsite power
8 system is our switchyard and one or more connections
9 to the transmission grid, as you see in there, or a
10 microgrid, or a dedicated service line.

11 We do have a COLA item included in the DCA
12 for the Applicant to describe their own specific
13 switchyard configuration. And here again, we don't
14 rely on any AC power, either onsite or offsite, to
15 mitigate a design basis event. And a loss of offsite
16 power, as Mr. Skillman refers to, we transition to
17 island mode, and the house load is powered from any
18 one of the designated TGs.

19 MEMBER SKILLMAN: What is the house load?

20 MR. HOUGH: It's somewhere right at 30
21 megawatts, so it's about 50 percent power.

22 MEMBER BROWN: Is that per module?

23 MR. HOUGH: No, that's the entire house.

24 MEMBER BROWN: That's the entire --- if
25 you had 12 modules connected to the house load, is

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1 that a 30 megawatt?

2 MR. HOUGH: That's correct. But we put it
3 together that way so that, you know, if something
4 happens in the grid, it'd be nice to be the first one
5 back on. So it's an obstacle once the other 11, if
6 they're all aligned, they'll go into a one percent
7 bypass. So the capability is there. And we maintain
8 a whole house load with one unit.

9 MEMBER SKILLMAN: And that one unit's good
10 for 50 or 60 megawatts electrical? Okay, thank you.

11 MR. HOUGH: And these are smaller, unlike
12 today's units, you know, they run back to, say, like
13 the Cooper 800-plus. And, you know, when you run back
14 to house load, it's somewhere around 20, 22. That's
15 a long ways for that big turbine to drop. Or, well,
16 ours are small, nimble turbines that very easily
17 accommodate that.

18 Okay, onsite AC, we kind of went through
19 some of this, but we'll breeze through it here. We
20 specified all standard AC componentry, you know, look
21 out for short circuit readings that didn't buy
22 anything special as far as off the shelf kind of
23 stuff.

24 And as I noted, we support online
25 maintenance. Any major component, again, can be taken

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1 out without affecting power output unless it's the TG
2 itself.

3 Those main power transformers take the
4 load of two turbine generators, UATs. Any two of the
5 UATs can power an entire site. As you see in the
6 diagram they do not --- it's real small. There's a 6A
7 slide, 6B slide, so a six-pack. And any two of the
8 UATs can supply that entire load.

9 Let's see, as we stated there, the 12-
10 module house load, and again, it is our normal source
11 of power, the term preferred power supply really isn't
12 applicable to NuScale design. That's an existing
13 fleet, that's an offsite power source. Not for us.
14 Our 13.8 buses are our supply, our normal load.

15 And the EMVS is where we have shared
16 loads, shared large loads, that 4160 circ water, site
17 cooling water, chilled water system, any of those big
18 loads that are shared amongst all the units. That's
19 where EMV, that's its role and then, of course, to
20 feed the 480. And the 480, that's where we start
21 breaking it up into module-specific loads. It'll be
22 the main-tie-main configurations, the lower horsepower
23 loads.

24 The plant lighting system here, PLS, is
25 actually listed as a power source. It is the power

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1 source for us, as well as a main load too. And it
2 provided 480, 277, 208, and 120.

3 The next onsite AC system is the backup
4 power supply system. And if all eight of the 13.8
5 buses go dead or, you know, lost for some reason,
6 after a 30-second time delay those units, both the
7 BDGs and the AAPS, will start. And then Ops will
8 manually load them.

9 CHAIR BLEY: I'm sorry, say that again.
10 I didn't quite follow.

11 MR. HOUGH: If all eight of the 13.8 buses
12 go away, that's when we will start the BDGs, backup
13 diesel generators, and the auxiliary AC power source.
14 So after a 30-second time delay, Ops can load them as
15 they see fit.

16 CHAIR BLEY: They don't start
17 automatically?

18 MR. HOUGH: It starts automatically.

19 CHAIR BLEY: Yes, that's what I had
20 thought.

21 MR. HOUGH: Yes.

22 CHAIR BLEY: Okay.

23 MR. HOUGH: After a 30-second time delay.
24 And the BDGs, we put them at 480, specifically to
25 power up charger loads. We had a big sit-down with

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1 Operations. And they said, okay, since we don't have
2 any RTNSS loads, let's put our power where we want it.

3 And we said, okay, where do you want it.
4 And so that's where, you know, control room
5 ventilation, and CVCS pumps, a lot of those loads that
6 Ops wanted for, you know, recovery of the plant,
7 things like that, they said, okay, good. Well, we'll
8 do that. And so the BDGs are, I think the way this
9 calc shows, about 2.4 MVA each. And the AAPS is about
10 14 MVA units.

11 MEMBER BROWN: If you lose the power, if you
12 lose whatever you're losing and the backups come on --
13 -

14 MR. HOUGH: Yes.

15 MEMBER BROWN: -- multiple backup fuses come
16 on, do they operate independently, or do they
17 automatically synchronize, or anything? I forgot to
18 ask that question.

19 MR. HOUGH: Yes, that's a good question.
20 But they're manually loaded, so they've got to
21 manually synced to get ---

22 MEMBER BROWN: Manually synced, okay. So
23 each individual module, BDGs come up and they stick
24 with the ---

25 MR. HOUGH: Well, there's only two for the

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1 whole site.

2 MEMBER BROWN: Oh, that's right. Okay, yes.

3 MEMBER SKILLMAN: Ted ---

4 MEMBER BROWN: I got it.

5 MEMBER SKILLMAN: Oh, excuse me. Excuse me.

6 MEMBER BROWN: No, I'm finished, Dick. I
7 was just re-calibrating.

8 MEMBER SKILLMAN: I appreciate that you got
9 input from Ops, where do they want power, good place
10 to start.

11 MR. HOUGH: Yes.

12 MEMBER SKILLMAN: Was the selection of the
13 loads solely based on Ops preference, or did you
14 inform, did NuScale inform that decision either by
15 items that are deemed critical out of your PRA or out
16 of operating experience?

17 MR. HOUGH: That's a real good question.
18 And I'd answer it, all of the above. You know, of
19 course Ops has had a main influence for us. But we
20 had, I'd say, 80, 90 percent design. And then we went
21 to Ops and said, okay, look, here's where we stand
22 when I had RTNSS loads. And they never independently,
23 they were going, okay, we got these BDGs, what do we
24 do with them? How do we want to do this?

25 And so they came to us, and we sort of met

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1 in the middle kind of thing. But, let's see, you have
2 a third element that just slipped my mind here. The
3 use of those were kind of a joint agreement.

4 MR. WELTER: Yes, so ---

5 (Off the record comments)

6 MR. WELTER: Yes, my mic's on. So if PRA
7 was used throughout the conceptual design process for
8 various systems, so the PRA did influence a little
9 back and forth, iterative, on selection of some of
10 these loads.

11 What you'll find is, in the PRAs, some of
12 the important things from, like, prevention and
13 mitigation of the accident perspective, are the CVCS
14 pumps and the CFDS pumps, and the ability to put water
15 back into the containment or the core.

16 So you'll see that that's consistent with
17 the PRA, and they did have a number of back and forth
18 during the conceptual design phase on, you know, what
19 do the risk results on the inside look like?

20 MR. HOUGH: I will add to that, but thank
21 you for the reminder. That was the third item, and it
22 slipped my mind there.

23 The BDGs, because they're non-safety
24 related, and they don't have to be divisional, we made
25 it so that either one can power up the whole line. So

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1 we increased the size of it.

2 Because the way it was before, we initially
3 started with a divisional. And then if you lost the
4 division, you're going to lose two. That's two out of
5 four, our MPS -- oh, no, we can't go there. So we
6 said, all right, we'll make it so either one can power
7 the whole plant. And so ---

8 MR. WELTER: Yes.

9 MR. HOUGH: -- you played a big role in
10 that.

11 MR. WELTER: Yes, and I was responsible for
12 the PRA group at that time and, I mean, the PRA
13 practitioners also were nice enough to present
14 alternative designs for your consideration, I think.

15 MR. HOUGH: Yes.

16 MR. WELTER: So the PRA would actually
17 suggest you could do away with some of the redundancy
18 and diversity that's in the existing system. But that
19 was provided as input.

20 MEMBER SKILLMAN: Let me ask this. And this
21 might be the wrong time to ask --- the wrong time for
22 me to ask this. But if you're going to answer it
23 later, that'd be fine.

24 I read that you're using ELMS, electric load
25 management system, to design this. And if you've been

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1 in a live plant, and you want them to transition from
2 OLMS to ELMS, you recognize that using ELMS is a
3 special database, and it takes specially qualified
4 people to do it. Can you speak to that at this point?
5 ELMS is your electric load management system and most
6 importantly --- excuse me, I mean ETAP.

7 MR. WELTER: ETAP.

8 MEMBER SKILLMAN: I'm sorry. There was a
9 transition from ELMS to ETAP.

10 MR. WELTER: Okay.

11 MEMBER SKILLMAN: And the ETAP people are
12 like PRA people. It's a different group of electrical
13 people who know how to run that software. And if
14 ETAP's used properly, it will manage your
15 configuration and ensure that the flow and the breaker
16 coordination is what it's supposed to be, if it's done
17 properly.

18 Is ETAP what you have been using from the
19 outset? Or let me say it differently. Was this a mom
20 and pop design that you kind of forced into ETAP?

21 MR. HOUGH: We used ETAP from the onset. I
22 went down to --- in California and got trained myself.
23 And the guys, the entire group were all ETAP.

24 MEMBER SKILLMAN: They're all ETAP
25 qualified, and they've got punch cards, and they're

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1 qualified users?

2 MR. HOUGH: Yes, sir.

3 MEMBER SKILLMAN: I'm serious. I mean, it's
4 a ---

5 MR. HOUGH: Yes it is. It is a complicated
6 program. In fact I made the comment at the ETAP
7 training that, hey, you're doing away with electrical
8 engineers' jobs.

9 And they said oh, no, no, no. ETAP is just
10 a tool for you. You still have to recognize when this
11 thing's giving you an erroneous answer, obviously.

12 MEMBER SKILLMAN: So I heard you say you
13 used ETAP right from the beginning.

14 MR. HOUGH: Yes, sir.

15 MEMBER SKILLMAN: And the individuals that
16 are using it are qualified individuals?

17 MR. HOUGH: All have been trained, right.

18 MEMBER SKILLMAN: Okay, thank you.

19 MR. HOUGH: Yes.

20 CHAIR BLEY: Ted --- oh, I'm sorry.

21 MR. SCHULTZ: Ted, with your response with
22 regard to what the PRA team had offered as options,
23 what was the basis for that, for their discussion
24 associated with other design options?

25 Were they suggesting that a target value, a

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1 target risk profile could be met with different
2 alternatives? It sounds as if ---

3 MR. WELTER: Yes. What they were ---

4 MR. SCHULTZ: -- a more conservative
5 approach was determined by the designers than what the
6 PRA team might have thought was acceptable?

7 MR. WELTER: Yes. And in summary from a,
8 you know, plant risk perspective, the design is very
9 robust. And you could do away with some of the
10 redundancy that's built in with minimal impact,
11 negligible impact to core damage frequency or large
12 release frequency as an example.

13 So that was more of an economic suggestion
14 and reliability suggestion. It was just his input.
15 And so, yes, I mean, overall, the PRA team said you
16 can make it less complicated and cheaper, not
17 complicated but just less robust. And the PRA would
18 support that. But the decision was made by the
19 designers to go with this existing design. And it had
20 to do with, well, I'll speak to ---

21 MR. HOUGH: Yes. And again, the way it was
22 set up before, we really thought everything had to be
23 divisional. But that was, you know, when it was
24 potentially a RTNSS diesel. And it turns out on those
25 loads, there's nothing on there. So they said, geez,

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1 it doesn't have to be divisional.

2 And we can eliminate a potential two out of
3 four scenarios if we were on the diesels and, you
4 know, we lost one. So you get a two out of four
5 signal, and the MPS would, you know, actuate. But we
6 could eliminate that challenge to the safety systems
7 by making either one of them supply both. So we said,
8 okay, we'll do it. It was a good decision, with
9 observation from PRA.

10 CHAIR BLEY: Ted?

11 MR. HOUGH: Yes, sir?

12 CHAIR BLEY: You talked some about the
13 backup diesel generators.

14 MR. HOUGH: Yes.

15 CHAIR BLEY: You also have, I think, just
16 one alternate AC power supply?

17 MR. HOUGH: Yes, sir, good segue into the
18 next slide, ha, ha, ha.

19 CHAIR BLEY: You're welcome. Go ahead.

20 (Laughter)

21 MR. HOUGH: The AAPS is just a single unit.
22 And it's there to supply permanent non-safety loads,
23 things like your fire protection.

24 MEMBER CORRADINI: What is it if it's not a
25 diesel generator?

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1 MR. HOUGH: Okay, we had tentatively,
2 because most facilities around the country will use a
3 combustion turbine generator.

4 MEMBER CORRADINI: Oh.

5 MR. HOUGH: And we said, okay, you know, but
6 it doesn't have to be. It's just ---

7 MEMBER CORRADINI: So it's yet to be
8 specified.

9 MR. HOUGH: We ---

10 MEMBER CORRADINI: Okay.

11 MR. HOUGH: -- put it in that way, and have
12 designed around that. But it's conceptual design
13 information where a ---

14 CHAIR BLEY: But you're thinking it'd be a
15 gas turbine.

16 MR. HOUGH: Yes. There's some places, like,
17 it was in -- wherever, got a hydro unit or whatever.

18 MEMBER CORRADINI: The same size as the
19 backup diesel generator?

20 MR. HOUGH: No. This will be a 14 MVA unit.

21 MEMBER RICCARDELLA: I'm sorry, would you
22 repeat that please?

23 MR. HOUGH: The size?

24 MEMBER RICCARDELLA: Yes.

25 MR. HOUGH: Fourteen MPA.

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1 MEMBER MARCH-LEUBA: These generators are
2 what size?

3 MR. HOUGH: 2.4. These are --
4 (Simultaneous speaking)

5 MR. HOUGH: -- numbers, what they actually
6 buy could be a 2.5. Well, it's a minimum of that, and
7 needs a calc. And then, again, we put that unit, the
8 13.8 bus, up there so that Ops could put the power
9 anywhere they wanted it.

10 And then we have a portable generator
11 connection. Originally, we were going to use it maybe
12 for a flex connection. But they don't need it for
13 that. So it's still there.

14 CHAIR BLEY: Did you --- when you did that,
15 are you using that standard flex connection terminal
16 set so you can hook up a flex generator if you get one
17 from somebody?

18 MR. HOUGH: I'm sure I would be, ha, ha, ha.

19 CHAIR BLEY: You haven't specified though.

20 MR. HOUGH: No, not yet. Okay, moving on to
21 onsite DC, the most ---

22 CHAIR BLEY: Does that show up on the one
23 line, the AAP --

24 MR. HOUGH: I guess.

25 CHAIR BLEY: No. Your portable generator

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1 connection.

2 MR. HOUGH: In this diagram here, yes.

3 CHAIR BLEY: But not on the big one line?

4 MR. HOUGH: Right there, yes. Not the
5 overall one line, no.

6 CHAIR BLEY: Okay. That's what I've been
7 looking at. Okay, go ahead.

8 MR. HOUGH: Yes, this shows a BDG and then
9 a flex connection to that 480 bus that you have there,
10 BDG bus.

11 Okay, the highly reliable DC system, EDSS,
12 again, that's the one that has the augmented
13 provisions applied to it. The Class 1E isolation, if
14 you think about Reg Guide 175 and 3D-4, you're looking
15 in a reverse manner to what we have. It's usually a
16 1E power supply being isolated from non-1E loads, et
17 cetera.

18 In our case, it's a non-1E power supply
19 being isolated from a 1E load down there. And that
20 would be done --- the DC-DC converters, and that'll
21 be, you know, discussed in Chapter 7. That is the
22 power supply from module protection,
23 and neutron monitoring, et cetera.

24 The key here is to recognize, you know, they
25 said, oh look, this is a 1E load. It's got to be 1E

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1 power supply. No, it doesn't, because of the stuff we
2 discussed last year at the topical here. It's not
3 essential to achieve the safety-related function.
4 Therefore it can be a non-1E power supply. And that's
5 specifically really the SER that was issued last
6 December.

7 The system utilizes VRLA batteries, valve-
8 regulated lead acid. The duty cycles in the module-
9 specific subsystem of EDSS, there's two different duty
10 cycles. Again, Alpha, Charlie is Div 1. Bravo, Delta
11 is Div 2. And the Alpha and Delta channel of those
12 are 24 hours. And that's to achieve our ECCS hold
13 mode to hold out ECCS if, you know, if a loss of AC
14 happens, so we can automatically launch ECCS. VHR
15 will go first.

16 MEMBER MARCH-LEUBA: Hey, Ted?

17 MR. HOUGH: Sir?

18 MEMBER MARCH-LEUBA: We have not seen
19 Chapter 15 yet, but that 24 hours would become
20 important, because it goes into ECCS mode
21 automatically. So the question is -- and I assume
22 it's not critical if it's 22 or 26, but about how
23 accurate are we going to be on the timing? It's not
24 going to be 150 hours.

25 MR. HOUGH: No, no, that's ---

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1 MEMBER MARCH-LEUBA: How do you achieve
2 that?

3 MR. HOUGH: We've sized the batteries that
4 way. And then there's also a ---

5 MEMBER MARCH-LEUBA: But aren't the loads
6 going to be variable or not?

7 MR. HOUGH: I'm sorry?

8 MEMBER MARCH-LEUBA: You can size the
9 battery, but the load might be case-dependent or won't
10 be?

11 MR. HOUGH: It will be depending on what
12 vendor we use for the solenoids and things like that.
13 You're right.

14 MEMBER MARCH-LEUBA: So maybe we'll revisit
15 this on the Chapter 15 uncertainties. We will assume
16 this is covered in 24 hours, but it could be 26.

17 MR. WELTER: I'm actually going to --- in a
18 station blackout transient ---

19 MEMBER CORRADINI: You've got a curve.

20 MR. WELTER: Yes. I'll talk to a
21 sensitivity we did where we looked at with DC power
22 and without, where the ECCS actuated to two hours
23 versus 24 in a few more slides and kind of get a feel
24 for the ---

25 MEMBER MARCH-LEUBA: Okay. Thank you.

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1 MR. WELTER: -- plant response.

2 MEMBER CORRADINI: So maybe I'll ask my
3 questions there. But so this is coupled to the timing
4 of this 24-hour changeover? This is coupled to the
5 timing.

6 MR. WELTER: I mean, the station blackout
7 analysis was run with a 24-hour ECCS --

8 MEMBER CORRADINI: Clock.

9 MR. WELTER: -- clock, correct. But we did
10 a sensitivity to that as well.

11 MEMBER CORRADINI: Thank you.

12 MR. WELTER: Yes.

13 CHAIR BLEY: Ted?

14 MR. HOUGH: Sir?

15 CHAIR BLEY: You know, a lot of the
16 machinations we've gone through on the topical report
17 and now here are essentially, I think, because there
18 are no VRLA Class 1A batteries around.

19 Is there any movement in the industry you
20 guys have tracked that were -- I mean, these things
21 are used everywhere. The more you look, the more you
22 find people are using them. Is there any motion to
23 try to get these things classified 1E?

24 MR. HOUGH: The last input that I had was,
25 you know, from the EPRI folks. And they were actually

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1 looking at more advanced batteries, you know, looking
2 at Type A and things like that, to actually have it
3 ready as a 1E qual, for example, for the AP 1000 when
4 their existing VRLAs become, you know, obsolete or
5 whatever. They're actually kind of leapfrogging over
6 VRLA. And that was the last information I had.

7 CHAIR BLEY: Of course, going to lithium
8 would raise other issues, but go ahead.

9 (Laughter)

10 MR. SCHULTZ: Has EPRI discussed a schedule
11 associated with that?

12 MR. HOUGH: I'm not aware of it. But it
13 wouldn't be in our timeframe for sure.

14 (Off the record comments)

15 MR. HOUGH: So the second to the last bullet
16 ---

17 CHAIR BLEY: So the answer is kind of no.
18 Nobody's really trying to --

19 MR. HOUGH: I'm sorry, I didn't --

20 CHAIR BLEY: -- see VRLAs as 1E batteries.
21 The effort is more looking at something beyond that.

22 MR. HOUGH: Not that I'm aware of, right.
23 Fortunately, we don't need it.

24 The Bravo and Charlie channels, those are
25 there to support the PAM functionality from a module-

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1 specific --- get the information from each module. It
2 goes to the control room, and then your EDSS common,
3 they have I and II, feed the displays in the control
4 room for post-accident monitoring. Let's see, so
5 here's ---

6 MEMBER CORRADINI: So ---

7 MR. HOUGH: Sure?

8 MEMBER CORRADINI: No, no. You're on the --
9 I want you to explain the orange. I'm very confused
10 about how the orange is safety related and what that
11 is, unless that's simply valve actuation at time zero.
12 Is that what the Class 1E box --

13 MR. HOUGH: The Class 1E box, that
14 represents the 1E load which is MPS, neutron
15 monitoring, et cetera, all right. You know, that's
16 your sense and command. And then the execute device
17 would be your field solenoid or whatever.

18 MEMBER CORRADINI: Okay. But if I get into
19 an accident in a situation where I demand scram,
20 that's not needed once I scram. But does that also --
21 - that does not power any valve actuation. The valves
22 fail to a safe position?

23 MR. HOUGH: That's correct. Every execute
24 device we have fails to a safety position without
25 power. And I ---

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1 MEMBER CORRADINI: This is strictly the MPS?

2 MR. HOUGH: Yes.

3 MEMBER CORRADINI: Okay.

4 CHAIR BLEY: But on loss of AC power, you
5 also scram.

6 MR. HOUGH: Yes.

7 CHAIR BLEY: Without a signal. I mean, it's
8 just ---

9 MEMBER CORRADINI: So let me ask the
10 question now, and then Kent will answer in his exam.
11 So if I have a loss of AC power and DC power and all
12 is not what it's supposed to be, and I mistimed the
13 24-hour changeover --- I can't come up with a better
14 word --- transition, it doesn't matter whether it's a
15 time zero or 24 hours, it's just the most convenient
16 24 hours?

17 MR. WELTER: Yes. When we initially, well,
18 from a safety perspective it does not matter. Now
19 there's --- and I can show that with a transient ---

20 MEMBER CORRADINI: Okay.

21 MR. WELTER: But the 24-hour time period we
22 established sort of early in the design process with
23 discussion with Ops, and looking at OE, and just ---
24 it's more providing time to recover power before you
25 actually actuate the ECCS and blowing down to

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1 containment. So that's more of an operational coping
2 time period that we want to provide.

3 MEMBER CORRADINI: So to put it in brutal
4 terms, you induce a LOCA with a 24-hour clock.

5 MR. WELTER: Well, LOCA is a pipe break. We
6 control, by definition ---

7 MEMBER CORRADINI: So it's a POCA. It's a
8 planned loss of coolant, POCA.

9 (Off the record comments)

10 MR. WELTER: It's a controlled
11 depressurization of the reactor coolant system.

12 MEMBER CORRADINI: Okay. All right. But
13 whether it's 24, it's a matter of Ops deciding what
14 they thought they needed to try to recover from ---

15 MR. WELTER: Correct.

16 MEMBER CORRADINI: Okay.

17 MR. HOUGH: Questions here then?

18 MEMBER BROWN: Yes, do you need AC power to
19 do that? I've forgotten some of the stuff.

20 MR. WELTER: I'm sorry, to do what?

21 MEMBER BROWN: To execute your ECCS.

22 MR. WELTER: No. In the beginning of a
23 station blackout, we assume that ---

24 MEMBER BROWN: You need DC power?

25 MR. WELTER: The DC power keeps it closed.

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1 And when you lose the DC power at 24 hours, the
2 batteries run out, you remove power from the soleoids,
3 and the ECCS valves open, actuate.

4 MR. HOUGH: So the answer to the question is
5 either.

6 MEMBER BROWN: Yes. I'm just trying to,
7 again, I'm trying to calibrate myself, if I lost
8 everything, all the power.

9 CHAIR BLEY: It's probably more a question
10 --

11 MEMBER BROWN: AC, DC, and everything else.

12 MR. WELTER: I'll talk about that a little
13 bit more almost on two more slides.

14 MEMBER BROWN: Okay. But when you get there
15 ---

16 (Simultaneous speaking)

17 CHAIR BLEY: -- station blackout. I'm just
18 thinking if there's no power, that's obviously a super
19 station blackout.

20 MR. WELTER: Yes. I'll talk just a little
21 bit to that in a couple of slides.

22 CHAIR BLEY: When you get there, or maybe in
23 Chapter 15, when we lose the batteries, we don't go
24 from full voltage to zero voltage. It degrades, which
25 to me says there's going to be some random sequencing

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1 of how these valves drift from close to open.

2 Have you thought about that? You know, if
3 you turn off all the DC power, boom, everything works
4 the way you've designed it to work.

5 MR. INFANGER: The 24 hours is on a timer.
6 It's not just a decay away and then they lose DC
7 power.

8 CHAIR BLEY: Okay, so the timer ---

9 MR. INFANGER: The actual timer ---

10 (Simultaneous speaking)

11 CHAIR BLEY: -- the timer, these into the
12 batteries.

13 MR. INFANGER: The batteries are sized to be
14 at least 24 hours. In that 24 hours, you will get a
15 signal that opens all of them and potentially actuates
16 the ECCS.

17 MR. WELTER: Yes, sorry. I should have
18 clarified that.

19 MEMBER CORRADINI: So wait a minute.

20 MEMBER MARCH-LEUBA: This will be an issue
21 with what you were talking about. If your batteries
22 are not large enough, and they only last 23 hours ---

23 CHAIR BLEY: Yes. Then this becomes a
24 question.

25 MEMBER MARCH-LEUBA: I would like to have a

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1 voltage monitor isotopes on the batteries.

2 MEMBER CORRADINI: But get to Dennis'
3 question of the essence. So let's say your design
4 works as planned. But at 22 hours it starts becoming
5 --- it doesn't hit your timer, but it's kind of
6 degrading. What do the valves do? That's what
7 Dennis' question ---

8 MEMBER BROWN: Do some of them close?
9 (Simultaneous speaking)

10 CHAIR BLEY: if, in fact, your batteries,
11 when you get the actual load in the accident and it's
12 ten years into operation, here they're kind of running
13 out of power before you expect it in your design. And
14 now things don't happen all at once like they will in
15 the timer. But you start getting, first one drops
16 out, then another one.

17 MR. WELTER: I'll have to defer to the
18 electrical systems ---

19 CHAIR BLEY: You don't see that as a
20 feasible situation?

21 MR. WELTER: I guess I haven't thought about
22 that at the moment.

23 CHAIR BLEY: I think it's a good thing to
24 think about.

25 MR. WELTER: I'd have to talk with the I&C

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1 folks exactly how the system is designed and how
2 losing a little bit of power --- it's my
3 understanding, you know, you're not going to lose a
4 little bit of power and have, like, one ---

5 CHAIR BLEY: Well, by design you're not.

6 MR. WELTER: Even by that consideration, but
7 ---

8 MR. EHLERS: Well, they'll still be doing it
9 just to --- I know you're talking about a theoretical
10 situation, I mean, they're going to still be doing
11 testing of the batteries to make sure their capacity
12 is there to make the 24 hours on a routine basis.

13 But in this scenario where if, for somewhat
14 of a reason, it didn't make the 24 hours, again,
15 you're only causing an operational issue, not so much
16 a safety one.

17 MR. WELTER: Yes. I mean, you're generating
18 a signal, right. It's not like they're --- I mean,
19 you're generating a signal to actuate. And so when
20 that signal --- we're not generating partial signals
21 to actuate the ECCS system. They're ---

22 CHAIR BLEY: Well, you generate a signal to
23 remove all of the power. And the valves pop open.

24 MR. WELTER: Correct. And if you don't get
25 that signal ---

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1 CHAIR BLEY: If the power degrades ---

2 MR. WELTER: Then you don't generate a
3 signal.

4 CHAIR BLEY: -- before you generate a signal
5 ---

6 MR. WELTER: Then they don't pop up.

7 CHAIR BLEY: -- at some point, they're going
8 to drift open when they don't have enough power to
9 hold them shut.

10 MR. HOUGH: I think there's a -- the missing
11 piece here is the instrumentation and control. And
12 correct me if I'm wrong here, but we have something
13 called the equipment interface module. And it doesn't
14 matter whether you remove power, whether you get a
15 logic signal from one state to a zero state, or an
16 operator reaction as a result of the same. The
17 execute device goes to a safety position, okay.

18 MEMBER BROWN: Say that first part again,
19 something goes to the safe position.

20 MR. HOUGH: They execute device, the
21 solenoid, or whatever, the breaker will go to a safety
22 position.

23 CHAIR BLEY: I'll probably save this for
24 when the PRA guys get here eventually, but we've seen
25 real plants where the easy one isn't electrical, it's

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1 air, air pressure doing the same thing as the
2 electrical is doing here.

3 And if it goes away at once, of course,
4 everything goes to the right position. If it goes
5 away gradually, weird stuff starts happening. A valve
6 over here drifts shut, something over here speeds up,
7 something here happens, and it's not, you know, moving
8 the way you expect.

9 So I hope the PRA guys have thought about
10 that. You're looking at design. And in design, this
11 can't happen. In the real world, sometimes things
12 happen that are outside of your design basis.

13 MEMBER MARCH-LEUBA: Let me postulate that.

14 CHAIR BLEY: But I'll postpone that.

15 MEMBER MARCH-LEUBA: There was an earthquake
16 that partially grounds to one of your cables.

17 CHAIR BLEY: There you go. And there's a
18 ---

19 MEMBER MARCH-LEUBA: So then you have bigger
20 load, and suddenly you only last six hours.
21 Definitely, I would prefer if you have a monitor of
22 the voltage. And do it before the voltage stops, you
23 know, 11 -- yeah.

24 CHAIR BLEY: It's up to you, Matt.

25 MEMBER SUNSERI: So I've got a slightly

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1 different question on this topic. In some of the
2 plants that I've been in, from a reliability
3 perspective, we worked hard to eliminate energized --
4 continuously energized relays and coils from a
5 reliability perspective, especially if they were a
6 single point of vulnerability.

7 So can you comment on the reliability
8 aspects of having your ECCS valve energized to stay
9 closed for the whole operating cycle?

10 MR. HOUGH: That is a good point, something
11 we thought about early on. If you wanted to have a
12 zero power plant, that's what you end up with. And an
13 EQ qual for that has to account for that. So it is a
14 consideration here. You're exactly right.

15 MEMBER KIRCHNER: I'm trying to remember.
16 You presented previously. I think we saw how the
17 valves were, the ECCS valves were --- what's their
18 normal environment? Are they in water or air? I
19 guess they're in air, the actuators?

20 MR. WELTER: Yes, they're inside the
21 containment, yes.

22 MEMBER KIRCHNER: So they're in the
23 containment, they're in air.

24 MR. WELTER: Vacuated containment, minimal
25 air.

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1 MEMBER KIRCHNER: But not accessible?

2 MR. WELTER: Not during normal operation,
3 correct.

4 MEMBER KIRCHNER: So I think Matt's point is
5 a good one.

6 MR. HOUGH: Well, that's the mechanical
7 valve itself.

8 MR. WELTER: That's the mechanical part.

9 MR. HOUGH: Tripped solenoids and stuff like
10 that are outside.

11 MR. WELTER: Yes, that's correct.

12 MEMBER SUNSERI: So I guess the follow-up
13 question is what's the consequence of a spurious
14 opening of the valve?

15 CHAIR BLEY: One valve.

16 MR. INFANGER: Yes. The spurious opening of
17 a single valve is evaluated in 15.6. And essentially,
18 what happens is water starts going into containment.
19 The water level in containment rises. And when you
20 reach the level set point in containment, the rest of
21 the valves open.

22 MEMBER SUNSERI: So I guess the reactor
23 shuts down and ---

24 MR. INFANGER: Yes. Containment isolates
25 the reactor, and it trips, and the DHRS actuates.

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1 MEMBER BROWN: How often are the batteries
2 tested? You made the comment about --- I've forgotten
3 who made the comment about they're periodically tested
4 to ensure that their capacity is satisfactory ---

5 MR. EHLERS: Right.

6 MEMBER BROWN: -- to handle. And so what's
7 the timeframe between capacity tests?

8 MR. EHLERS: That's still to be determined.
9 I mean, that's going to follow the vendor guidance
10 when we get the batteries.

11 MEMBER BROWN: Okay, implementing 1188,
12 1187?

13 MR. EHLERS: Typically, it's going to be
14 --

15 MEMBER BROWN: Are we talking a year, two
16 year --

17 MR. EHLERS: -- two years, four years.

18 MEMBER BROWN: -- refueling cycle?

19 MR. EHLERS: It depends also, typically, on
20 the trend of the capacity, you know, starting ---

21 MEMBER BROWN: The reason I ask is, relative
22 to Dennis' question about the sequential or the
23 degrading part, is batteries are very unpredictable in
24 terms of their post-tested performance. They're
25 innately good.

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I mean, a typical example, I know a buddy of mine came up to visit with me for a week and turned off his car. And half an hour later he went back out to start the car, and it didn't start. The battery was dead. And it did that in a half an hour even though he'd been driving for four hours to get to my house.

So I think it's a good question to ask about the ability to predict the performance of all the batteries, of the number of batteries you've got, and not have some of them do something slightly different than what you --- I'm not saying you're doing it the right way, all I'm bringing out is to amplify Dennis' point.

MR. HOUGH: Those are good points. Let me bring up that we are implementing IEEE 1187, 1188 for the batteries, the monitoring and maintenance of them. And we also have continuous battery monitors installed on the PRA also.

MR. WELTER: I don't know if you can see ---

MEMBER BROWN: Yes, but those --- that's another capacity, that just says that ---

MR. HOUGH: No, that's correct.

MEMBER BROWN: -- you're just putting, well,

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1 you're generating some current at some voltage.

2 CHAIR BLEY: I think it was Paul earlier who
3 said you are going do deep discharge testing on these
4 routinely. No? I misunderstood what you said.

5 (Off the record comments)

6 MEMBER BROWN: There was a periodic test
7 every refueling cycle or something like that, they
8 haven't determined yet. It's a capacity test.

9 CHAIR BLEY: Well, to me a capacity test
10 sounds like a deep discharge test. You're running it
11 way down. If you're not doing that, then the battery
12 performance gets fuzzier.

13 MR. INFANGER: Yes. There's actually a
14 standard for the VRLA batteries. And they don't do a
15 deep discharge for them. You do a more shallow
16 discharge, and you trend it on graphs. So it's just
17 a different process. Because you don't want to ---

18 CHAIR BLEY: No, it's more than a different
19 process, it's not testing what you're worrying about.

20 MR. INFANGER: If you're at 25 percent
21 discharge, and then you trend that, that has been
22 proven to be accurate for determining that the
23 batteries maintain their capacity.

24 MR. EHLERS: The key to both technologies
25 that apply to VLAs and to VRLAs is the trending

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1 portion of it. So whatever test you do is to
2 determine the capacity of your current battery and to
3 ascertain the data to do the trend to see how the
4 capacity is degrading over time, so you can make an
5 informed decision of what point you replace that
6 battery.

7 So that's what he's speaking about, is the
8 actual trend. Whether you do a 25 percent discharge
9 test or you're doing a full deep discharge, which is
10 more common amongst the traditional fleet right now,
11 the purpose of both of those is to get that data for
12 the capacity.

13 CHAIR BLEY: Yes. And what I'm not fully
14 familiar with is substantial data that confirms that
15 a partial discharge gives you the right trend.

16 You know, my experience when these started
17 40, 45 years ago with the phone company who used to do
18 very light testing, and then every time they needed
19 the batteries they didn't work. And they eventually
20 went to deep discharge testing.

21 But if there's plenty of information to
22 prove that a 25 percent gives you the real trend, and
23 not a pseudo trend, that would help me. And I guess
24 usually the standard doesn't point me to all of that
25 research that proves it's good enough. If you guys

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1 can, that would be interesting certainly.

2 MR. HOUGH: The Navy uses these, so ---

3 CHAIR BLEY: Yes, the Navy doesn't share
4 very much.

5 MR. HOUGH: That's correct.

6 MEMBER SKILLMAN: The question I would ask
7 is is this system included in your Maintenance Rule,
8 50.65? I presume that it is. And if it is, then your
9 electrical system is going to be subject to a host of
10 confirmatory tests that it's capable of performing the
11 functional performance requirements for which it is
12 designed.

13 And it would seem to me that, in that
14 context, you're going to have some form of a discharge
15 test, whether it's via a RLA or a different type
16 battery, to confirm the capacitance is what it is
17 required to be. And you're going to pull batteries,
18 replace cells as needed when those cells don't
19 perform. Is that accurate?

20 MR. EHLERS: I believe it is.

21 MEMBER SKILLMAN: I believe it is too. So
22 if that's the case, then whatever that test might be
23 will be the test that is appropriate for that specific
24 battery design. Otherwise, your Maintenance Rule
25 program is not applicable or is not capable of

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1 performing its function. So I think this is going to
2 come out in 50.65 in your Maintenance Rule program.

3 MR. HOUGH: Yes, it's definitely going to --
4 -

5 CHAIR BLEY: I'm partially responsible for
6 us being a little behind. But we're down to the last
7 20 minutes for you guys. So I'm going to let you run
8 a little freer here toward the end.

9 MR. HOUGH: All right.

10 CHAIR BLEY: If we can all do that.

11 MEMBER BROWN: I'll save my other question
12 until the end then. It's not on this, it's a slightly
13 different question. And they won't be able to answer
14 it. But I just wanted to get it on the ---

15 CHAIR BLEY: Thanks, Charlie. Get on the
16 record.

17 MEMBER BROWN: -- I wanted to get it on the
18 table before the meeting was over.

19 MR. HOUGH: All right, moving on to EES's
20 little brother here, EDNS. These are also VRLA
21 batteries with a 40-minute duty cycle. It originally
22 specifies a 30-minute duty cycle in the URD, the
23 utility requirements document. And we certainly put
24 some margin on there. It's been made in 40 minutes.

25 And that way, loads as you see here like,

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1 you know, breaker control power, things like that, if
2 we needed it, you know, the AAPS would be up and ready
3 to load within that 30-minute time period. And so it
4 was a ten-minute margin. So again, this is all non-
5 safety loads for investment protection, power
6 generation, TG emergency lube oil pumps, controller
7 drive supply, et cetera.

8 Moving along here. At this point, I'll turn
9 to my colleague here, Dr. Welter.

10 MR. WELTER: Thank you, Ted. So I'll give
11 that punch line first here, and then we'll look at the
12 three plots.

13 So we're looking at station blackout
14 scenario, a 72-hour coping period. And so I'm going
15 to show a single module analysis. But from an initial
16 conditions perspective, it assumes all 12 modules were
17 operating at 100 percent power prior to the event.

18 Again, the punch line first, all safety
19 functions achieved and maintained for that 72 hours
20 without reliance on AC power or operator action. And
21 those are the safety functions there, the reactor
22 trip, go to passive decay heat removal system, the
23 DHRS, and then eventually the ECCS after the 24-hour
24 time period you talked about.

25 So the criteria for station blackout coping

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1 period, the core remains cooled, maintained
2 containment integrity without AC power. I don't have
3 the plots, but I'll speak to it. We did do a ---

4 CHAIR BLEY: Well, before you do that ---

5 MR. WELTER: Yes.

6 CHAIR BLEY: -- just a quick question. Your
7 Table A.4-1 on station blackout begins at time zero
8 then gets a high pressure signal at nine seconds and
9 a reactor trip on high pressure. Why don't we have a
10 reactor trip at time zero on loss of power? I thought
11 losing power releases the rod.

12 MR. WELTER: AC power?

13 CHAIR BLEY: What kind of power holds the
14 rods up?

15 MEMBER BROWN: That's your EDN system?

16 MR. WELTER: Yes. The EDNS is powered by
17 the DC system, so we go back a few slides ---

18 CHAIR BLEY: We've got 40 minutes there.

19 MR. WELTER: Yes, you've got 40 minutes on
20 that from --- the batteries provide that.

21 CHAIR BLEY: So it comes off the batteries.

22 MR. WELTER: Yes, for 40 minutes.

23 CHAIR BLEY: I didn't realize that. I
24 thought it came off of AC.

25 MEMBER MARCH-LEUBA: But your protection

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1 system must still work for 40 minutes?

2 MR. HOUGH: Module protection?

3 MEMBER MARCH-LEUBA: The planned protection
4 system.

5 MR. HOUGH: It's actually 24 hours and 72
6 hours --

7 MEMBER MARCH-LEUBA: Class 1E?

8 MR. HOUGH: -- on protection.

9 MR. WELTER: On the slide that ---

10 MEMBER MARCH-LEUBA: Class 1E?

11 MR. WELTER: Yes. The slide that Ted had
12 shows the EDNS with a different ---

13 (Off the record comments)

14 MR. HOUGH: There's EDN, and you can see
15 control rod drives there.

16 MR. WELTER: You had onsite DC power on the
17 battery duty cycle ---

18 MR. HOUGH: There's the other one for EDS,
19 for MTS that you're talking about.

20 MR. WELTER: Oh, sorry, 15.

21 MEMBER MARCH-LEUBA: Okay. If you lost all
22 of AC power ---

23 MR. WELTER: Sure.

24 MEMBER MARCH-LEUBA: -- and now you don't
25 scram, your protection system must work.

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1 MR. WELTER: Correct.

2 MEMBER MARCH-LEUBA: What powers it?

3 MR. HOUGH: EDSS is the power supply for the
4 module protection system.

5 MEMBER MARCH-LEUBA: And that's Class 1E.

6 CHAIR BLEY: That's the highly reliable ---

7 MEMBER BROWN: Highly reliable DC power --

8 CHAIR BLEY: -- DC power system.

9 (Off the record comments)

10 MEMBER MARCH-LEUBA: I'm surprised. But
11 it's now creating the plant power?

12 MR. HOUGH: That's correct. It is the
13 normal supply.

14 MEMBER MARCH-LEUBA: My understanding was
15 you lose power, your rods drop. And you ---

16 CHAIR BLEY: That's what I thought I read in
17 this document. But I didn't mark it, so I have to
18 find it.

19 MEMBER BROWN: The EDNS system is the normal
20 DC power system. And I just went back to Chapter 7,
21 okay.

22 CHAIR BLEY: That's EDNS. EDSS is the one
23 ---

24 MEMBER BROWN: EDNS is what supplies the
25 circuit breakers, the reactor trip breakers. It's the

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1 power through the breakers, not the actual trip
2 actuation devices. But that's the power through the
3 breakers.

4 CHAIR BLEY: Through the breakers.

5 MEMBER BROWN: Through those control rod
6 mechanisms. I think that's correct. I haven't
7 reviewed all of Chapter 7.

8 MR. HOUGH: That is correct.

9 MEMBER BROWN: So according to the
10 schematic, you open these DC breakers via the module
11 --- the plant protection system, or whatever the
12 acronym is. But the actual DC power is supplied
13 through the DC breakers. And if the ---

14 CHAIR BLEY: And that's off of the normal
15 DC?

16 MEMBER BROWN: Yes. If, theoretically, your
17 plant protection system would still be energized at
18 this point, although I haven't checked the power
19 sources to that in all cases.

20 CHAIR BLEY: I misread something on that.
21 It's not real clear.

22 MEMBER MARCH-LEUBA: The same power that
23 keeps the rods up is the one that powers the
24 protection system?

25 MR. HOUGH: No.

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1 MEMBER BROWN: No, it's not. That's -- I've
2 told you. I have --

3 CHAIR BLEY: The normal ones light the rods
4 up.

5 (Simultaneous speaking)

6 CHAIR BLEY: The highly reliable system
7 powers the ---

8 MEMBER MARCH-LEUBA: But none of them are
9 Class 1E?

10 CHAIR BLEY: No.

11 MEMBER MARCH-LEUBA: So for 40 minutes, you
12 may or may not have protection if you have a transit?

13 MR. HOUGH: Oh, no. You have protection.

14 MEMBER MARCH-LEUBA: Well, you may not have
15 power to the protection system.

16 MR. HOUGH: That's the EDS highly reliable
17 DC system that provides power to the protection
18 system. And I don't need that system to achieve
19 safety functions.

20 MEMBER MARCH-LEUBA: Even with the rods out?
21 Your rods are being held by the other batteries.

22 MR. HOUGH: That's correct.

23 MEMBER MARCH-LEUBA: You are going to have
24 to run this by me eventually. Because there is
25 something, I mean, what I understood is we don't need

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1 Class 1E power, because if I lose power I scram.

2 MR. HOUGH: Yes.

3 MEMBER MARCH-LEUBA: Apparently now, a non-
4 safety grade, highly reliable but not safety grade
5 power holds the rods up.

6 CHAIR BLEY: Keeps me from shutting down.

7 MEMBER MARCH-LEUBA: Keeps you from shutting
8 down automatically. And another non-safety grade,
9 highly reliable power is supposed to contain the
10 protection system going.

11 MEMBER BROWN: The EDSS systems supplies the
12 module systems and the plant protection system. I
13 counted another figure while we're sitting here
14 talking about it. And I'm just looking at Chapter 7
15 again, Figure 7.0-2 shows the ---

16 (Simultaneous speaking)

17 MEMBER BROWN: They call it the highly
18 reliable DC.

19 CHAIR BLEY: So we're kind of in an odd spot
20 we didn't know we were in here.

21 MEMBER BROWN: Yes.

22 CHAIR BLEY: If you lose that, you're going
23 to scram, but if you don't lose that ---

24 MEMBER BROWN: You don't scram? You don't
25 ---

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1 CHAIR BLEY: You don't scram until you get
2 some signal to scram.

3 MEMBER KIRCHNER: So I think to maintain
4 religious purity here, they have to scram on loss of
5 power. But they don't.

6 CHAIR BLEY: Well, if they lose full power,
7 they do.

8 MR. BERGMAN: If I could interject, Tom
9 Bergman.

10 CHAIR BLEY: Yes, Tom.

11 MR. BERGMAN: That is you lose the --- if
12 you maintain the EDSS you could keep the rods out, but
13 you've lost the EDSS which would cause loss of the
14 module protection system and you will trip the plant.

15 MR. HOUGH: That's correct. That's correct.

16 CHAIR BLEY: You just used the same acronym
17 twice. You didn't mean to.

18 MR. BERGMAN: Oh, I'm sorry, they sound very
19 similar.

20 CHAIR BLEY: If you lose EVMS the rods will
21 fall.

22 MR. BERGMAN: The common system, which is on
23 the current slide ---

24 CHAIR BLEY: Yes.

25 MR. BERGMAN: -- that's the one that keeps

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1 the rods out.

2 CHAIR BLEY: And if you lose that, the rods
3 will drop.

4 MR. BERGMAN: Yes.

5 CHAIR BLEY: Yes.

6 MR. BERGMAN: If you maintain this one but
7 you lose the EDNS -- no sorry, you had it right -- the
8 EDNS powers the control rods. That would keep them
9 out. But if you lost the power supply to the module
10 protection system, you will trip the plant.

11 CHAIR BLEY: You'll get a signal to trip the
12 plant.

13 MR. BERGMAN: Yes. The module protection
14 system controls the Class 1E devices. If you lose
15 that, all the safety systems go to their safe
16 position, regardless of the other power supplies in
17 the plant.

18 MR. WELTER: Yes, and in Chapter --- not all
19 of the -- at the start of a transient, when you look
20 at it in Chapter 15, you look at loss of power as an
21 initiating event, as an example --- or as a coincident
22 event.

23 But the module --- not all the safety
24 functions, you know, happen within time zero, right.
25 So we have power to the module protection system to,

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1 you know, monitor the plant. And we have a number of
2 trips that are going to hit depending on the
3 transient.

4 And so we want power to the MPS for a
5 transient so that MPS can perform its safety
6 functions. Reactor trip is just one of those. We
7 have containment isolation, you know, DHRS, DCCS
8 actuation, so we want highly reliable power to the MPS
9 to protect the plant through the various transients.

10 But to Tom's point, if you lose that, then
11 it goes to the fail safe position. It's a whole
12 different paradigm.

13 MR. EHLERS: Yes. Just to be clear ---

14 MEMBER CORRADINI: Yes, let's be clear,
15 because I thought I understood it now.

16 MR. EHLERS: The initiator for the plant
17 trip is loss of power to the battery chargers. So
18 once you lose that power, you get a sixty second time
19 delay just to alleviate any momentary lapses, you
20 know, drops or spikes.

21 MEMBER BROWN: So that's loss of all AC
22 power then.

23 MR. EHLERS: Right. And so as soon as we
24 lose power to our chargers, to charge the batteries,
25 for better than 60 seconds, we will trip the plant.

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1 CHAIR BLEY: And that's a timer that
2 generates the trip signal?

3 MR. EHLERS: Yes. Well, it's a --- yes, the
4 voltage signal goes to the MPS.

5 (Off the record comments)

6 MEMBER BROWN: So independent of the EDSS
7 and independent of the EDNS, if you lose AC power --

8 CHAIR BLEY: To the chargers.

9 MEMBER BROWN: -- the chargers --- yes,
10 thank you --- chargers, there's an independent timer
11 that then says, Kings X, scram the plant. And I don't
12 know where that comes from or how it gets processed.
13 But if you go back and look in Chapter 7, we should be
14 able to see that.

15 MR. EHLERS: That's in Chapter 7.

16 MR. WELTER: And as a point, since we do
17 have DC power, we hit that trip point sooner on high
18 pressure before that ---

19 MEMBER BROWN: You lost me.

20 (Laughter)

21 CHAIR BLEY: In the current analysis that he
22 wanted to talk about --

23 (Simultaneous speaking)

24 CHAIR BLEY: -- they're going to trip in
25 nine seconds because of --

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1 MR. WELTER: -- in nine seconds, which is
2 within that 60 second window.

3 MR. BERGMAN: It's hard to envision making
4 it 60 seconds with no AC power and not getting a
5 reactor trip somewhere first.

6 MEMBER BROWN: Even though there's no
7 "accident" scenario involved.

8 MR. BERGMAN: Right.

9 MR. WELTER: If I could go back to the
10 earlier line of questioning ---

11 MEMBER SUNSERI: Can you get closer to the
12 mic?

13 MR. BERGMAN: Oh, sorry. The questioning
14 about degraded voltage, that will come up in Chapter
15 7 which is in August. But it does isolate our
16 degraded voltage.

17 MEMBER BROWN: I tried to find that, Tom,
18 and was unable to.

19 (Off mic comments)

20 (Laughter)

21 MEMBER BROWN: Is Rev 0 the current revision
22 for Chapter 7? That's all I've got. So we're due to
23 do that in a couple of months.

24 MR. BERGMAN: I'm assuming we have Rev. 1,
25 Chapter 7.

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1 MR. SNODDERLY: Yes.

2 MR. BERGMAN: I don't know how many ---

3 MEMBER BROWN: Mine's 2016. So that's Rev.
4 0. So I have not seen a Rev. 1 yet.

5 MR. BERGMAN: We reissued the DCA as
6 Revision 1 in March, mid-March, all the chapters.

7 MR. SNODDERLY: Yes, this is --- yes.

8 MR. BERGMAN: I'll certainly be in touch.

9 MEMBER BROWN: I was unable to find it
10 anywhere.

11 MR. SNODDERLY: This is Mike Snodderly from
12 the ACRS staff. So as Tom said, Revision 1 came in on
13 March 15th, 2018. And I was going to make a request
14 to the staff. Because also on the public website
15 right now it's still Rev. 0. But, yes, Rev. 1's in,
16 hopefully we can get ---

17 MEMBER BROWN: That's where I got it.

18 MR. SNODDERLY: Yes. Hopefully, we can get
19 that up to date. But otherwise, we'll get access for
20 you guys.

21 MEMBER BROWN: And just to get the
22 proprietary version, not the non-proprietary version
23 that's on the public website. I think it's --- or is
24 it totally non-proprietary?

25 MR. BERGMAN: Oh, no. The design

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1 certification application is non-proprietary.

2 MEMBER BROWN: Is totally proprietary?

3 CHAIR BLEY: Non-proprietary.

4 MEMBER BROWN: Non-proprietary, okay. Is
5 there any proprietary version of Chapter 7?

6 MR. BERGMAN: There should not be, no.

7 MEMBER BROWN: Okay. I'm just trying to
8 clarify.

9 MR. BERGMAN: Some chapters have security-
10 related information which is redacted but --

11 MEMBER BROWN: Okay.

12 MR. BERGMAN: -- will lead us into Chapter
13 7.

14 CHAIR BLEY: I want to come back to Jeff
15 just so I understand this. And maybe we'll get to it
16 again in Chapter 7. But this timer that starts when
17 you lose AC power to the battery chargers, I've got
18 two or three things about it. Is it a mechanical
19 timer or a digital timer?

20 MR. EHLERS: I can't speak to that.

21 CHAIR BLEY: Is it in the protection system
22 or is it, you know, kind of a separate thing?

23 MR. EHLERS: It's part of the MPS system.

24 CHAIR BLEY: It's part of the MPS.

25 MR. EHLERS: Yes.

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1 CHAIR BLEY: And does it do anything else
2 other than generate a reactor trip signal? We'll want
3 to know all about that come --

4 MR. EHLERS: Okay.

5 CHAIR BLEY: -- Chapter 7 time.

6 MR. WELTER: The next slide. This is a plot
7 of a reactor pressure vessel water level above the top
8 of the active fuel. This is collapsed liquid level.
9 This is a plot generated from NRELAP 5, a NuScale
10 proprietary version of RELAP.

11 It's a 72-hour time period, so it's a fairly
12 long plot. We kind of already talked about it a
13 little bit, where you lose AC power to the battery
14 chargers. There is a timer. But, you know, you're
15 going to lose your secondary site heat removal,
16 because you're not, you know, providing any power to
17 your feedwater pumps.

18 And since they are fairly smaller reactors,
19 when you lose that secondary site heat removal, it'll
20 be fairly quick increase in primary system pressure.
21 And you're going to trip the reactor on a high
22 pressure signal within about ten seconds, so fairly
23 quickly.

24 And then you're also going, on the reactor
25 trip, you're going to get a containment isolation

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1 signal which then you also get a DHRS actuation
2 signal. So within ten seconds of this transient,
3 you've tripped the reactor, you've isolated
4 containment, and then you've transitioned to your
5 passive DHRS system.

6 CHAIR BLEY: And the containment isolation
7 and DHRS comes off of the reactor trip signal?

8 MR. WELTER: It's a separate ---

9 CHAIR BLEY: It's separate.

10 MR. WELTER: Separate, but the logic is when
11 you get a reactor trip, well, the DHRS is actuated on
12 CNV isolation. So the containment needs to isolate
13 before the DHRS can function.

14 MEMBER MARCH-LEUBA: I thought DHRS was
15 counting on high pressure or it needs --

16 (Simultaneous speaking)

17 MR. WELTER: Yes. Well, the trip signal
18 comes on the high pressure. And then the CNV
19 isolation comes on the reactor trip, and a DHRS
20 actuation comes on the CNV isolation. We don't want
21 to ---

22 MEMBER MARCH-LEUBA: But I thought the DHRS
23 valves needed high pressure to open. What am I
24 missing?

25 MR. WELTER: No, I'm just giving the

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1 sequence of the trips. Because we don't want to
2 actuate the DHRS before the reactor's tripped or the
3 containment's isolated. So there's a logic to the
4 trip sequence. They're right after each other.
5 There's not a delay in between them. So we have to
6 make sure there's a logic that happens.

7 MEMBER BROWN: You said CNV or CNB?

8 MR. WELTER: CNV containment, I'm sorry.

9 CHAIR BLEY: That's the vessel containment.

10 MR. WELTER: Containment vessel, CNV. So
11 reactor trip, CNV isolation, DHRS actuation.

12 MEMBER KIRCHNER: So this is the result of
13 the decayed ---

14 MR. WELTER: Yes. Can you go back a slide,
15 please?

16 MEMBER KIRCHNER: -- system pulling down the
17 pressure.

18 MR. WELTER: Yes, and slowly over time,
19 right. You're going to be reducing, well, the
20 pressure is --- yes, the pressure goes down pretty
21 quickly on the second slide. I wasn't ready to go to
22 the second slide yet.

23 So this is just the water level. So it
24 stays pretty high in the reactor coolant system. It's
25 an elevated water level, so you have natural

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1 circulation cooling. And then in 24 hours, you have
2 that ECCS timer. Because we still have DC power in
3 this scenario.

4 This is a loss of AC with DC power. And
5 then when you get the 24-hour signal, then you have a
6 rapid depressurization at that --- well, actually the
7 depressurization isn't that rapid at that time. You
8 have a rapid loss of inventory as the re-circulation
9 valves and the RVV valves at the top open
10 simultaneously, and the ECCS system actuates.

11 MEMBER KIRCHNER: So why even actuate the
12 ECCS?

13 MR. WELTER: It's on a 24-hour timer. So
14 the plant is designed to do that.

15 MEMBER KIRCHNER: But why actuate it if you
16 don't need it?

17 MR. WELTER: You would have --- h'mm ---

18 MEMBER KIRCHNER: You would reduce the
19 pressure. You've got natural circulation cooling.
20 Why breach containment?

21 (Off the record comments)

22 MR. WELTER: It's a controlled
23 depressurization. It's --- yes.

24 CHAIR BLEY: No, I understand that.

25 MR. WELTER: Yes. No, I understand the

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1 question.

2 CHAIR BLEY: But it's the ECCS actuation
3 where you've breached containment.

4 MR. WELTER: Yes. And so this whole timer
5 thing is interesting in terms of how we had it in the
6 design and all and had others add in. It's not a
7 safety feature. And so if we wanted to keep it ---

8 (Simultaneous speaking)

9 MR. WELTER: What's that?

10 MEMBER MARCH-LEUBA: If you lost your
11 feedwater, you don't have any way for heat to go
12 outside. And if your vessel is intact, your thermos
13 bottle prevents you from losing heat. So you need it.

14 MR. WELTER: We don't need the --- we have
15 the DHRS ---

16 MEMBER MARCH-LEUBA: The DHRS is still
17 working?

18 MR. WELTER: -- that will work, yes. Right,
19 that's the first passive safety system. We've
20 designed a system to fail safe on loss of power. And
21 we've designed an ECCS system to fail safe in its fail
22 safe position as it is depressurizing, right? It's
23 opening valves and depressurizing.

24 And from an operations perspective, you
25 don't want to depressurize that, even though it's fine

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1 from a safety perspective, we want to give the
2 operators time to recover the power so you don't
3 actuate ECCS.

4 So it's not --- you know, the thing is you
5 could say why not 36 hours, right? Well, the way our
6 system is designed, we'd have to add more batteries,
7 right, because of the way that the system is designed
8 to keep the valves closed from an operational
9 perspective, to give them --- it's an investment
10 protection thing.

11 So when you're looking at how long to do
12 this, it is -- this timer, it's an economic question.
13 So you can keep it longer, and add more batteries, or
14 this is kind of the spot we pick.

15 CHAIR BLEY: I'm still --- I'm learning a
16 lot this morning.

17 MR. WELTER: Yes.

18 CHAIR BLEY: The 24-hour timer does exactly
19 what?

20 MR. WELTER: For this, it sends an ECCS
21 actuation signal.

22 CHAIR BLEY: ECCS actuation.

23 MR. WELTER: Correct. To de-energize the
24 solenoids to open the five ECCS valves.

25 MEMBER CORRADINI: So can we just back up?

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1 So this stylized station blackout is a scenario that
2 you have to look at relative to station blackout
3 assumptions. But a more severe one will be that I
4 lost DC at time zero.

5 MR. WELTER: So we did look at that
6 sensitivity. Well, severe, it's not really more
7 severe from a safety perspective. You'll have a ---
8 if you go to the next slide as an example.

9 So, you know, DHRS is cooling the system for
10 the first 24 hours, and you see you get almost below
11 100 PSI in the reactor coolant system before ECCS
12 actuates. So once it actuates, if you go to the next
13 slide, the bump in containment pressure is very small
14 at about 35 PSI.

15 And if I didn't have DC power, we did a
16 sensitivity case, and we --- now, here's where it gets
17 just a little bit more subtle, is that we have an
18 inadvertent actuation block mechanism on our ECCS
19 valves. So we have another --- and this is a
20 mechanical system that prevents the ECCS valves from
21 opening above a certain pressure or differential.

22 So if we didn't have DC power, if we didn't
23 have power to the solenoids, and that got removed, and
24 you're at high pressure, at 18.50, you have an IAB
25 mechanism that will block the valves from opening, and

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1 you wouldn't -- until you got down to a range of 800
2 to 1,000 PSI with those valves actually open.

3 So if you go back to the previous slide, we
4 did a sensitivity where we opened at the lower range
5 of 800 PSI, and it would open in about two hours. So
6 you would have the start of the transient, loss of all
7 power, everything, super station blackout, and you
8 would come down --- you'd go to DHRS cooling, you
9 would come down and we, for the transient, you would
10 open around 1,000 to 800 PSI.

11 And then you'd get a little bit more rapid
12 depressurization. The containment pressure would go
13 up to about 200 instead of 35. So you can open it
14 earlier, way earlier, at two hours. You still get the
15 same top of active fuel level, and you have a slightly
16 higher containment pressure.

17 MEMBER CORRADINI: So what was the
18 containment pressure at two hours?

19 MR. WELTER: What's that?

20 MEMBER CORRADINI: What was the containment
21 pressure at two hours?

22 MR. WELTER: At spike, it gets about 200
23 PSI.

24 MEMBER CORRADINI: so the 35 pound spike
25 goes to 200?

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1 MR. WELTER: Yes, yes, yes. Because you're
2 depressurizing at a higher pressure, about 800 versus
3 100.

4 So that's the sensitivity. So, you know,
5 and in Chapter 15, we do sensitivities of power/not
6 power. And you'll see similar phenomenon in Chapter
7 15 analysis when we don't have DC power. So we do
8 that sensitivity to evaluate.

9 And again, that 24-hour timer is not a
10 safety feature. It's purely for investment
11 protection. But we do evaluate it as, you know,
12 extreme examples of it not working.

13 And actually, in the PRA there was a
14 question on, you know, the degraded power. And I'm
15 not going to attempt to answer the details on the I&C
16 system. But in the PRA we do look at partial failures
17 of the ECCS system. And you will see that when that
18 chapter comes. So irrespective of it's a mechanical
19 or electrical, we do look at that failure in the PRA.

20 MEMBER KIRCHNER: What's the containment
21 vessel design pressure?

22 MR. WELTER: One thousand PSI. It's a
23 stainless steel, well, it's a carbon steel, dual clad,
24 and stainless steel containment vessel.

25 MR. SCHULTZ: Kent, the partial failure

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1 you're talking about is valves not actuating, or the
2 timing of the event, valve performance ---

3 MR. WELTER: Right. So when you're looking
4 at ---

5 MR. SCHULTZ: -- or both of those?

6 MR. WELTER: Well, yes. The PRA, from a
7 Level 1 perspective, when you're looking at the ECCS
8 system, it's the five valves, right. And we look at
9 combinations of if one of them opens and four of them
10 don't, and two open, and three don't, the top or the
11 bottom. They look at all those various combinations.
12 And there's definitely cases where at least the core
13 damage, you have some open and some don't. So that's
14 on the PRA.

15 MR. SCHULTZ: Thank you.

16 MEMBER SUNSERI: If you go back just one
17 slide, so what's the slight decreasing trend? Is that
18 just cooling from the DHS system, or you're not losing
19 any inventory, it's just ---

20 MR. WELTER: No. It's all bottled up. Yes,
21 you don't start depressurizing and losing inventory
22 until 24 hours. Okay.

23 MEMBER SKILLMAN: Kent, where else --- you
24 say that the 24-hours is really driven by investment
25 protection and the recognition that you will

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1 conceivably be good 48 or 96 hours, except that does
2 the battery hold, and hence you're increasing the
3 battery capacity that would be required to extend
4 beyond 24?

5 MR. WELTER: You need more batteries to go
6 beyond 24, yes.

7 MEMBER SKILLMAN: Is there any other
8 function that shares that same facet in your thinking?
9 In other words, we really could have more margin or
10 have more time. But because of our economic model,
11 this is as far as we're willing to go relative to our
12 battery capacity.

13 MR. WELTER: That's interesting. I
14 actually, from a safety perspective, want to push it
15 to eight hours. Because when you look at the data,
16 you've got plenty of time within eight hours. So if
17 I was going to start back ten years ago, I would have
18 proposed eight hours instead of 24.

19 MEMBER SKILLMAN: Except that what you're
20 doing then is you're pitting yourself against your
21 heat generation rate and your decay heat removal
22 capability, right?

23 MR. WELTER: It doesn't change after eight
24 hours. So if you look there after --- if you see
25 where that dip is, that's way back in the five-hour

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1 period. It's at very low pressure, very low already.
2 I think that 24 hours is quite high, actually, on the
3 high end. And ---

4 MEMBER SKILLMAN: Okay, so --

5 (Simultaneous speaking)

6 MEMBER SKILLMAN: -- so your answer, I would
7 have preferred to have less than 24. But my question
8 is ---

9 (Simultaneous speaking)

10 MEMBER SKILLMAN: -- is 24, is that marker
11 24 spinning up other decisions that we should know
12 about?

13 MR. WELTER: Well, it sizes the batteries.

14 MR. HOUGH: Yes, but it was done early on.

15 MR. WELTER: It was done early on, yes. And
16 it's ---

17 MR. HOUGH: As Kent says, you know, can see
18 here. You know, less than eight hours, it's almost an
19 equilibrium. And we know where we're at. And then we
20 said, okay, we'll give you a factor of three, give Ops
21 time to do something if they wanted to. So that was
22 ---

23 MEMBER SKILLMAN: So if you went to 12 you
24 --

25 (Simultaneous speaking)

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1 MEMBER SKILLMAN: If you went to 12, you
2 conceivably have your battery capacity?

3 MR. HOUGH: I think you could drop it, yes.

4 MEMBER SKILLMAN: Just, I mean, that's what
5 we're here to talk about.

6 MR. WELTER: Yes.

7 MEMBER SKILLMAN: So the answer could be
8 yes.

9 MR. HOUGH: Yes.

10 CHAIR BLEY: Well, for this one particular
11 case.

12 MEMBER SKILLMAN: For this scenario. Okay,
13 thank you.

14 MR. HOUGH: I think we're back to almost the
15 last of the slides here. As I noted early on, we're
16 going to talk about the road map.

17 Late last year, there was discussion on a
18 phone call to staff in looking for, you know, some way
19 to validate incorporation of the topical report,
20 conditions of applicability, and the five conditions
21 of the SER.

22 And so we received that RAI on January 29th
23 and responded on, as Paul indicated, in late March.
24 And that's Table 839 in the latest revision there.
25 And it provides --- here's an example of that table

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1 right here.

2 I can't fill out that left-hand column,
3 because that's proprietary information. We'd have to
4 go to a closed session and show you how to put that
5 in. But you can see on the right, it directs the
6 reader to appropriate sections within the DCA to
7 perform the validation of the ---

8 CHAIR BLEY: And by the way, we have all of
9 those things on the left from the topical report.

10 MR. HOUGH: That's correct, that's correct.
11 Let's see, and we did make some, you know, conforming
12 changes as a result of doing the road map. You know,
13 for example, Reg. Guide 141 for testing, we added that
14 in so that we could include that in Chapter 14.

15 And then places where it didn't explicitly
16 say without power, we added that verbiage in there.
17 So it's fairly easy to validate now.

18 And then, so in conclusion, the distribution
19 system is in support of the use of the topical.
20 There's no power required for any safety related
21 function, or Type A variable, or manual operator
22 action. So everything's non-1E, our backup power
23 sources, the result is that their asset protection and
24 black start, if you want it.

25 And as I noted earlier, it's designed to

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1 support online maintenance and be a very flexible
2 system. And as a consequence, it supports exemption
3 to GDC 17 and 18.

4 CHAIR BLEY: I have a separate question on
5 Section 832.1.1, highly reliable, direct, current
6 power system. Your first sentence says, "The EDSS is
7 composed of two DC distribution systems that provide
8 a continuous fault tolerant source." And you don't
9 define fault tolerant there. It means lots of things
10 to lots of people in other applications. What do you
11 mean by fault tolerant?

12 MR. HOUGH: We just mean we do the FMEA.

13 CHAIR BLEY: Okay, ha, ha, ha, ha.

14 MR. HOUGH: We're not adversely affected.

15 CHAIR BLEY: You think it's pretty reliable,
16 that's what you think, okay.

17 MR. HOUGH: Yes, sir. Right.

18 CHAIR BLEY: I want to thank you for a real
19 good discussion. And we'll get on to more of this
20 later perhaps. Before we get there, Charlie, I had
21 one thing.

22 I want to point out, you know, this is one
23 of the glitches in these design reviews when we go
24 chapter by chapter. There's an awful lot of Chapter
25 7 that's having us confused because of the

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1 interactions among these things. And we'll hit that
2 more and more. So we'll try to keep track of that and
3 look for things. Charlie?

4 MEMBER BROWN: My question relates to that
5 little bit of what Dennis said before earlier that we
6 haven't done Chapter 7, and there is some flow back
7 and forth. But with all the energized type stuff, you
8 know, go to the fail safe position, as well as other
9 systems that are not necessarily safety related, has
10 there been a consideration of evaluating "I'm
11 operating normally?"

12 And you had inadvertent actuation of various
13 parts of the plant. And where is the description of
14 that? I pawed through this thing, the Chapter 8, and
15 tried to go through Chapter 7. I don't know whether
16 --- I haven't done a complete thing on Chapter 7.
17 That was just what I call skating. I mean, there's a
18 number of other components that get power.

19 The other question was the energizing of
20 electric plant components. I was trying to find out
21 how that gets executed. I couldn't find direct
22 reference in Chapter 7 to control systems that actuate
23 breakers, et cetera, other stuff that may have some
24 impact.

25 As I go through the plant networks, does it

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1 have a separate --- are they analoged, the old style
2 where you just turn a switch, and a relay opens
3 someplace, or a contactor, or what? There was no
4 description of how, at least that I found in that
5 cursory look.

6 So that's the question I'll probably be
7 addressing. I don't expect an answer now. It's just
8 something that's going to be on the table when we get
9 to Chapter 7.

10 CHAIR BLEY: I had the same thing.

11 MEMBER BROWN: Okay.

12 CHAIR BLEY: Well, I don't know if it
13 belongs there or here on some of this, but ---

14 MEMBER BROWN: It's too late here right now.

15 (Simultaneous speaking)

16 MEMBER BROWN: Yes. Because they're kind of
17 unrelated since they're not I&C type systems. But do
18 you use main control room stuff through a computing
19 system, the teachable, or whatever you want to call
20 it, if somebody grabbed control of it, could you
21 initiate selected component actuations that would ---

22 MR. WELTER: Yes.

23 CHAIR BLEY: I don't think you need to
24 answer this --

25 MEMBER BROWN: I don't want him to answer it

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1 right now. It's just on the table. That's all.

2 MR. WELTER: I think you'll see it later.

3 CHAIR BLEY: Tom, you had something?

4 MR. BERGMAN: Just to clarify, so yes.

5 Chapter 7, Revision 1 does have changes in response to
6 RAIs in it. That would be the appropriate version to
7 read.

8 And then Rev. 0 of Chapter 8 has been
9 corrected. Rev. I, there is no flex connection. That
10 was part of our ELAP analysis. So there is no flex
11 connection in Rev. 1.

12 CHAIR BLEY: Is that the only substantive
13 change?

14 MR. BERGMAN: Well, no. Rev. 1 captured all
15 the staffs' RAIs that we had ready up to that point.

16 CHAIR BLEY: Oh, okay. So we got that stuff
17 as responses to the RAIs. It's now in my ---

18 MR. BERGMAN: But the large open item in
19 Chapter 8, there's an RAI subsequent to the staffs'
20 issuance of that. It was kind of in parallel, but it
21 was already damaged in review that closes most of
22 that.

23 CHAIR BLEY: Okay. On the large RAI that
24 we're going to hear more from the staff about, are
25 discussions continuing on that? Are you comfortable

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1 with where that's headed, or do you have anything you
2 want to say about that before we hear from the staff?

3 MR. HOUGH: I just read a lot in developing
4 that table in here --

5 CHAIR BLEY: Okay. Fair enough. At this
6 time, we're going to recess for a break. We'll come
7 back at 25 minutes until 11:00. We're going to lose
8 three people at noon for an internal meeting. It'd be
9 nice to finish by noon, but if we don't, we can go
10 over a little bit. We'll recess right now until 25
11 until.

12 (Whereupon, the above-entitled matter
13 went off the record at 10:16 a.m. and resumed at
14 10:34 a.m.)

15 CHAIR BLEY: We are back in session. We look
16 forward to hearing from the staff. And I sincerely
17 hope you're able to go beyond what you gave us in
18 slides today. Omid, I'll turn it over to you.

19 MR. TABATABAI: Okay. Yes, good morning,
20 everyone. Thank you very much for the opportunity for
21 the staff to present their Safety Evaluation Report
22 with open items with respect to Chapter 8, Electric
23 Power of the NuScale Design Certification Application.

24 Today, I just want to make sure that we
25 understand, the Chapter 8 that NuScale has presented

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1 to us is not the ordinary ones that we have seen in
2 the past. That's why we have involvement from many
3 other branches, expertise to a new Chapter 8.

4 It's not quite standalone. We have
5 reviewers, support from Instrumentation and Control,
6 Containment, Ventilation, Mechanical Engineering,
7 Reactor Systems, and Plan Systems, and PRA, who
8 contributed to this review.

9 I'm Omid Tabatabai, I'm the Chapter PM for
10 Chapter 8. Lead Project Manager for NuScale Design
11 Certification is Greg Cranston. I just wanted to
12 recognize these colleagues of mine who have
13 significantly contributed to this review. And by the
14 way, they are available, they are in the audience, in
15 case there are questions in those areas, they should
16 be able to support us.

17 Just want to, before we get into the
18 technical presentation of Chapter 8, just as a matter
19 of background, NuScale Power submitted its Rev. 0 of
20 Design Certification Application back in December of
21 2016.

22 And then, they submitted a Revision 1 in
23 mid-March 2018. And they're currently working on
24 preparing Revision 2, which includes all of the back
25 and forth RAIs, followup RAIs, and other requests from

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1 the staff to incorporate into the Design Certification
2 Application.

3 This SER that the staff has prepared is
4 based on Revision 0. I just want to make sure that,
5 although we have more up-to-date information, but the
6 SER does not reflect that, because of the timing, as
7 was mentioned earlier.

8 Again --

9 MEMBER CORRADINI: So, just to be clear, so
10 this is Revision 0 that we're going to see the review
11 of.

12 MR. TABATABAI: Yes.

13 MEMBER CORRADINI: And Revision 1 is in
14 preparation?

15 MR. TABATABAI: Revision 2. Revision 1 has
16 --

17 MEMBER CORRADINI: Revision 2?

18 MR. TABATABAI: Yes.

19 MEMBER CORRADINI: But if I go to the NRC
20 website for it, all that's there is Revision 0.

21 MR. TABATABAI: The whole application?

22 MEMBER CORRADINI: Yes.

23 CHAIR BLEY: The public website.

24 MEMBER CORRADINI: The public website.

25 MR. TABATABAI: It should be actually

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1 Revision 1, we have --

2 MEMBER CORRADINI: Really? Okay.

3 MR. TABATABAI: We have --

4 MR. SNODDERLY: As of yesterday, it still
5 wasn't up yet.

6 MR. TABATABAI: Okay.

7 MR. SNODDERLY: We can make that -- hopefully
8 you guys will get to it.

9 MR. TABATABAI: I know my project management
10 colleagues, they were working on clearing it for
11 posting it on the website --

12 MR. SNODDERLY: All right, great.

13 MEMBER CORRADINI: That's the reason I asked,
14 is that's --

15 MR. TABATABAI: Right.

16 MEMBER CORRADINI: -- where I go to check
17 what's publicly available. But that's fine, thank
18 you.

19 CHAIR BLEY: So, since we've interrupted you
20 here for a second, I'm going to state something I
21 think I noticed here. And whoever is doing Chapter
22 8.1 can address this, or you might want to, Omid.

23 When I read Section 8.1 and go through all
24 of the comments through the GDCs and through the other
25 NRC documents and SECYs, it seems there's an awful lot

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1 of things that remain -- I don't think they have an
2 open item number attached to them, but you say you're
3 still evaluating exemptions to GDCs 17, 18, 33, 34,
4 35, 38, 41, and 44.

5 Those don't -- well, two of them are part of
6 the giant open item. The rest don't seem to have open
7 items, but it's still ongoing work --

8 MR. TABATABAI: Right.

9 CHAIR BLEY: -- that you're --

10 MR. TABATABAI: That's correct.

11 CHAIR BLEY: -- involved in. Okay.

12 MR. TABATABAI: That's correct.

13 CHAIR BLEY: So, those are not finished yet?

14 There's an awful lot in 8.1 that's --

15 MR. TABATABAI: That's correct.

16 CHAIR BLEY: -- still in process?

17 MR. TABATABAI: Right. I think during the
18 presentation, it was mentioned that the RAI question
19 that we sent for the Topical Report that how NuScale
20 is basically incorporating information in the ECA,
21 that RAI, evaluation of that RAI response is still
22 ongoing, which feeds into those GDCs.

23 CHAIR BLEY: Okay.

24 MS. RAY: This is Sheila Ray. If I may add
25 to Omid's response, 8.1 is really meant to be an

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1 introduction and an overview, and it should be
2 pointing to other sections in Chapter 8 where we do
3 make technical evaluations. But, yes, those GDCs are
4 still open and still under review.

5 CHAIR BLEY: Okay. And they could have RAIs,
6 but they don't as yet? Separate ones?

7 MS. RAY: Correct.

8 CHAIR BLEY: Okay.

9 MR. TABATABAI: For the Chapter 8,
10 specifically, we have issued ten RAIs, which contain
11 about 25 questions. And NuScale has responded to all
12 of the questions.

13 This SER has two open items and one big, as
14 you mentioned, and the other one relates to the
15 electrical penetration assemblies. And we will
16 address all of the confirmatory items and open items
17 during the Phase 4 of our review.

18 So, this was my introduction to this, before
19 we get into the technical substance of this
20 presentation. With that, I would like to ask my
21 colleague, Sheila Ray, to continue.

22 MS. RAY: Thank you. As Omid mentioned, my
23 name is Sheila Ray. I am the Reviewer for 8.1, 8.3-2,
24 and I will be presenting for 8.4, my colleague Fanta
25 Sacko is on business travel, so I will be presenting

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1 on her behalf. So, thank you.

2 Section 8.1 is the introduction. The
3 electric power system for the NuScale design is
4 comprised of nonsafety-related AC and nonsafety-
5 related DC power systems. The design does not depend
6 on onsite or offsite AC or DC electrical power system,
7 including that from the transmission grid for safe
8 operation.

9 The NuScale design with non-reliance on
10 electrical power accommodates a site location where
11 offsite transmission grid is not necessarily
12 available. As NuScale mentioned, the normal source of
13 power is one or more of the 12 operating power module
14 main generators.

15 The staff reviewed the design of the
16 electric power systems necessary for the safe design
17 and operation of the plant or whose failure might
18 adversely affect their safety-related or risk-
19 significant safety functions.

20 The staff used the DSRS and SRP, as well as
21 the graded review approach for its review.

22 MEMBER MARCH-LEUBA: Go back to -- stay
23 there. That's an interesting concept that they
24 wouldn't be -- that the plant would be sited in a
25 place where there would be a permanent loss of offsite

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1 power. Is that what we're considering?

2 MS. RAY: I would not say it's a permanent
3 loss of offsite power, they may not be connected to
4 the bulk power system.

5 MEMBER MARCH-LEUBA: So, there will be a
6 complete loss of offsite power and they will have
7 their own --

8 CHAIR BLEY: They won't have any offsite
9 power.

10 MEMBER MARCH-LEUBA: It's an interesting
11 concept. We need to consider the implications of
12 that, because you can make into an extended period of
13 problems, if you have a common cause failure between
14 the modules.

15 MS. RAY: I understand your point.

16 MEMBER MARCH-LEUBA: Yes. So, we need to
17 consider that for the review.

18 MS. RAY: At this time, since it's nonsafety-
19 related power, and that is really where --

20 MEMBER MARCH-LEUBA: Okay.

21 MS. RAY: -- we'll transition perfectly to my
22 next slide. This is where the open item comes in.
23 The major open item, Open Item 8.3-1, is recurring
24 throughout Chapter 8 in that this open item is
25 referenced in all of the sections: Section 8.2 for

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1 offsite power systems, 8.3.1 for onsite AC systems,
2 8.3-2 for onsite DC systems, as well as 8.4 for
3 station blackout.

4 MEMBER SKILLMAN: Sheila, as you begin, is
5 this the totality, the exact wording of Open Item 8.3-
6 1 or is this a Cliffs notes version of 8.3-1?

7 MS. RAY: It would be essentially the Cliffs
8 notes version.

9 MEMBER SKILLMAN: Okay.

10 MS. RAY: However, in the SER, we do refer to
11 a specific RAI, and that is RAI 9359.

12 MEMBER SKILLMAN: No, I go it. Okay, thank
13 you, Sheila. Thank you.

14 MS. RAY: You're welcome. So, this
15 particular open item is repeated in each section of
16 Chapter 8. And I will discuss the details of this
17 open item up-front, so many of the details will not be
18 repeated later on in the continuous sections.

19 As previously stated, the NuScale design
20 does not rely on safety-related AC or DC power
21 systems. A Topical Report was submitted on the safety
22 classification of passive nuclear power plant electric
23 systems and the staff approved the Topical Report with
24 five additional conditions.

25 The open item relates to the exemptions to

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1 GDC 17 and 18, as described in DCA Part 7, regarding
2 the staff verifying that the design does not require
3 safety-related power. In addition, the Chapter 15
4 review on accident analyses is still ongoing.

5 Staff issued an RAI regarding how the
6 NuScale design meets these conditions of
7 applicability.

8 CHAIR BLEY: There are parts of your review
9 of Chapter 8 that cannot complete until the Chapter 15
10 is done, because it's essentially referred to here in
11 Chapter 8?

12 MS. RAY: Correct. And it's not just Chapter
13 15, we have been talking to our friends in Chapter 7
14 review, PRA, Chapter 6. So, there's a lot of review
15 that will feed into the conclusion of our chapter.

16 MEMBER MARCH-LEUBA: Going back to my
17 previous comment, if you don't have any grid
18 whatsoever, how do you start the first modules?

19 MS. RAY: If you remember, NuScale mentioned
20 the backup diesel generators and the AAPS are black-
21 start capabilities.

22 MEMBER MARCH-LEUBA: Okay. You are
23 considering that, right?

24 MS. RAY: So, what I -- I think you will get
25 a flavor from our review that many of these things are

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1 still non-safety. As of right now, we still have the
2 open items, so we're not concluding that they should
3 be non-safety or safety-related. So, our review is
4 essentially not fully complete yet, because of this
5 major open item.

6 MEMBER CORRADINI: What -- then let me ask
7 the question. I guess I took the open item to be that
8 NuScale has yet to document how it meets the
9 limitations and conditions from the Topical Report --

10 MS. RAY: They have --

11 MEMBER CORRADINI: -- but it's more than
12 that?

13 MS. RAY: So, they have provided a response.
14 The staff is still evaluating that response.

15 MEMBER CORRADINI: Do -- probably, we have it
16 and I don't remember seeing it.

17 CHAIR BLEY: We got the response.

18 MEMBER CORRADINI: We got the response?
19 Okay. So, go ahead, I didn't mean to interrupt.

20 MS. RAY: No problem. So, the responses to
21 RAI 9359, staff is still evaluating. And that
22 includes not just Chapter 8 reviewers, that includes
23 Chapter 15, 6, a lot of the other reviewers. And
24 we'll be evaluating it in Phase 4 of our review. So,
25 staff has issued the RAI and now, we are currently

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1 evaluating the response.

2 And now, I will --

3 MEMBER CORRADINI: Well, I don't even --

4 MS. RAY: Yes?

5 MEMBER CORRADINI: -- know how to ask my next
6 question, but I'm --

7 MS. RAY: Sure.

8 MEMBER CORRADINI: -- struggling to
9 understand this interconnection, because is it the
10 passive nature of the plant that makes this
11 interconnection more complex than a typical active
12 plant? I would think there still -- or is it the fact
13 that they're claiming that there's no need for Class
14 1E power?

15 MS. RAY: It is -- correct. It's the second.
16 It's, do they need safety-related power? In order to
17 determine if they need safety-related power, we need
18 to look at how they're safely shutting down and doing
19 accident mitigation. Do they need power for those
20 functions and does it have to be safety-related power?

21 MEMBER CORRADINI: So, then, let me ask --
22 oh, okay. All right. I guess my obvious question is,
23 why are we looking at this at all right now,
24 considering that everything else has to be considered
25 before we look at this?

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1 MS. RAY: Does that --

2 MEMBER CORRADINI: Sorry to ask the question

3 --

4 MS. RAY: No, it's a great --

5 MEMBER CORRADINI: -- but I'm struggling.

6 MS. RAY: -- question. Honestly, the staff
7 asked the same question. It's a scheduling issue.

8 MEMBER CORRADINI: Okay. So, then, in my
9 role as Chairman, I will say, don't be surprised when
10 we upset your apple cart schedule, because although
11 this is first, somehow in my mind, it's at the end,
12 because everything feeds into it

13 MS. RAY: I would agree with your assessment.

14 MEMBER CORRADINI: Okay, fine.

15 CHAIR BLEY: So, along that line, do we have
16 a -- do you have a likely point in the overall
17 schedule when Chapter 8 will be complete?

18 MS. RAY: So, we're currently working on our
19 Phase 4 review, and I will leave it to Omid to discuss
20 the schedule date of our Phase 4 review.

21 CHAIR BLEY: In your talk, are you going to
22 address at all any of the responses from NuScale with
23 regard to the big open item, 3-1?

24 MS. RAY: I cannot. The staff is still
25 evaluating the response.

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1 CHAIR BLEY: Okay. So, it's wide open?

2 MS. RAY: It is.

3 MEMBER BROWN: On other, just to make sure,
4 the Topical Report is still Rev. 1 of 16497?

5 MS. RAY: I believe so. Yes, that's correct.

6 MEMBER BROWN: Okay. And that's in the RAI
7 that you, I think you referenced, if I did it
8 correctly, if I can find the right place here, I lost
9 it. There was a RAI, something -- what was --

10 MS. RAY: 9359?

11 MEMBER BROWN: 9359, yes, I think -- is that
12 the one we got part of the package, Mike?

13 MR. SNODDERLY: Yes. But let's make sure
14 we're all on the same page right now. So, the Topical
15 Report, I believe was issued as Rev. 1. And an SE has
16 been issued by you guys approving that Topical, with
17 a set of limitations and conditions.

18 MS. RAY: Correct.

19 MR. SNODDERLY: Those limitations and
20 conditions are scheduled to be addressed within the
21 Safety Evaluation for Chapter 8. Which, right now, is
22 -- the Safety Evaluation is on Rev. 0, but you're
23 aware of Rev. 1 and they are working on Rev. 2, which
24 -- I'm sorry, yes, okay.

25 MS. RAY: Let's -- you're right on the

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1 Topical Report is Rev. 1. We evaluated DCA Rev. 0.
2 In Phase 4, we'll evaluate DCA Rev. 1, as well as the
3 RAI response to the Topical.

4 MR. SNODDERLY: Okay.

5 CHAIR BLEY: Okay. And let me ask you one
6 more question about these Revs. When we got the
7 NuScale response to the big RAI, all of the pages are
8 labeled Rev. 2, which is okay, I managed to put them
9 where they belong within the Rev. 0 version of Chapter
10 8.

11 My question is, and maybe you don't know the
12 answer to this, were there any substantive changes in
13 whatever was Rev. 1, because the page numbers are
14 certainly very different in the Rev. 2 response to
15 your RAI than they are in Rev. 0?

16 MS. RAY: I can't answer that --

17 CHAIR BLEY: Because you haven't --

18 MS. RAY: -- because we haven't --

19 CHAIR BLEY: -- looked at Rev. 1?

20 MS. RAY: Correct.

21 CHAIR BLEY: But -- I'm a little confused
22 now. You said your next task will be to review Rev.
23 1 with a response to the RAIs, but I thought it was
24 said earlier that you've received Rev. 2, which
25 includes all of that folded into one.

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1 MS. RAY: No, we've only received DCA Rev. 1.

2 CHAIR BLEY: And the RAI responses that --

3 MS. RAY: Correct.

4 CHAIR BLEY: -- fit into that one?

5 MS. RAY: Correct.

6 CHAIR BLEY: Okay. Go ahead.

7 MEMBER RAY: Well, before she goes ahead, I
8 just want to make a comment, for what it's worth, that
9 in my experience, we as a Committee would not want to
10 finish our review until the staff had finished their
11 review.

12 MS. RAY: We understand.

13 MEMBER RAY: Okay.

14 MS. RAY: We absolutely understand.

15 MEMBER RAY: And that would include Chapter
16 8. Okay, thank you.

17 MEMBER SKILLMAN: Let me add one more, if I
18 may, please. If I read the Safety Evaluation for the
19 Topical Report, that is 0815-16497 Rev. 0, and I
20 compare it with Rev. 1 of that same Topical, Rev. 0
21 had six conditions, Rev. 1 has five. And the last
22 three are different in Rev. 1.

23 And it appears as though, some of the word
24 changes are substantive, leading me to believe there
25 was a great deal of deliberation in your Safety

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1 Evaluation of that Topical Report to Rev. 1 that may
2 be influencing what we're talking about here.

3 What drove the change in the conditions from
4 six to five, because those five conditions plus the
5 other three are really the NRC's backstop for the
6 super wanadine DC system, at least that's the way I
7 interpret the collage of information.

8 MS. RAY: I understand your question, I may
9 want to defer that to the closed session.

10 MEMBER SKILLMAN: Yes, ma'am, that would be
11 fine. Thank you.

12 MR. TABATABAI: And if I may add something?
13 You're right, we had some interactions with NuScale
14 with respect to our conditions of the SER for the
15 Topical Report.

16 And those issues were discussed among
17 various branches, electrical engineering staff were
18 not involved in that. And that discussions were led
19 by the Reactor Systems Branch and Dr. Drzewiecki here
20 is our expert for that topic. Tim, if you would like
21 to say something now?

22 DR. DRZEWIECKI: Yes. I can say, in terms of
23 some of the changes in language, there was one
24 condition that was kind of focused on a sequence that
25 had to do with, if you have any kind of AOO, that if

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1 you don't take credit for your DC power system, at
2 some point in time, a few hours into that event,
3 you're going to have a pressure inside of your RCS
4 that is low enough such that you will actuate the ECCS
5 system. Which is not a LOCA, but it's a LOCA-like
6 type of event.

7 So, one of our conditions was that you would
8 go through and do a PRA-type of an analysis, such that
9 you can show that that is not expected to occur on the
10 frequency of an AOO or during other life of the plant.

11 Our first version of that language needed to
12 be sharpened a little bit. In fact, if you go back to
13 the record, I believe it was Mr. Skillman -- I'm
14 sorry, not Mr. Skillman, Mr. Stetgar that gave us
15 feedback on that as well. So, we had to sharpen up
16 some of that language. That was a change, that was
17 probably one of the largest changes in the conditions.

18 Also, our first Rev., the first time we did
19 a review of that SER, we were trying to write it for
20 a general plant. It was not NuScale-specific, it
21 could have been applied to any type of advanced
22 reactor. Coming out of that meeting, it was decided
23 that it should be focused and applied only to the
24 NuScale design. So, that also had an effect.

25 So, in terms of the precise changes in the

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1 language, I have to go back and see what changed
2 exactly, but that's the context in which those changes
3 were made.

4 CHAIR BLEY: So, just to get this clear, when
5 we reviewed the Topical with you folks, you had an SER
6 at that time, we made suggestions, other people made
7 comments. You issued a revised SER that had somewhat
8 different language on the conditions?

9 DR. DRZEWIECKI: Yes.

10 CHAIR BLEY: Okay. And I guess I never went
11 back and looked at the revised SER, but we had it. We
12 have it, yes.

13 MEMBER SKILLMAN: And that was very helpful.
14 Thank you.

15 MEMBER CORRADINI: But just to close the
16 loop, and there were some things we suggested, they
17 politely told us, no.

18 MR. TABATABAI: Right. As part of the
19 Topical Report, there were some examples to help the
20 staff with their review. And I think Committee
21 recommended to take them out of the SER, any reference
22 to those examples. That was the other changes.

23 MS. RAY: I'll turn it over to Nadim now.

24 MR. KHAN: Thank you, Sheila. I am Nadim
25 Khan and I will be discussing Section 8.2, offsite

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1 power system.

2 The offsite power system for the NuScale
3 Power Plant includes a switchyard and one or more
4 connections to a transmission grid, micro-grid, or
5 dedicated service load. However, the offsite power
6 system is not needed for safe operation, such as the
7 ability to achieve and maintain safe shutdown.

8 The Applicant has stated that the passive
9 design of NuScale Power Plant does not depend on
10 offsite AC power for safe operation and does not rely
11 on offsite AC power to support safety-related
12 functions.

13 The Applicant has stated in DCA Part 7 that
14 offsite power is not required. The staff reviewed the
15 offsite power system to ensure that it will perform
16 its design function during all operating and accident
17 conditions.

18 The review of the offsite power system is
19 awaiting for the completion of Open Item 8.3-1, to
20 address the offsite power system's ability to achieve
21 and maintain safety-related function and safe
22 shutdown.

23 With that, I will turn it over to Bob.

24 MR. FITZPATRICK: Thank you. I'm Bob
25 Fitzpatrick and I'm going to discuss Section 8.3.1 of

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1 the SER on onsite AC power systems.

2 The following nonsafety-related systems are
3 the major constituents of the onsite AC power system:
4 the high voltage system at 13.8 kV, the medium voltage
5 at 4.16 kV, and the low voltage at 480 and below.
6 There are two backup diesel generators at the 480 volt
7 level and one auxiliary AC power source at the 13.8 kV
8 level.

9 The overall system operation, there are 12
10 sets of module support systems separated into two six-
11 module sections, north and south, which each section's
12 buses powering multiple module loads. However, no
13 individual loads are shared between the modules.

14 We had one open item, and that was on
15 electrical penetration assemblies. In Rev. 0 of the
16 FSAR, it's stated that there are no AC circuits that
17 penetrate containment. However, that statement left
18 out, for example, pressurizer heaters.

19 So, as we looked into this, we issued a
20 couple of RAIs on this issue, and the response to the
21 last RAI did not meet our deadline for Phase 2 SER,
22 but we feel we have a path for resolution that will be
23 addressed in our Phase 4 SER.

24 There were also a few areas where the staff
25 sought clarity in the FSAR. And for these areas that

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1 needed clarity, the Applicant has successfully
2 responded to our RAIs and these items are now
3 confirmatory, and, again, to be addressed in Phase 4.

4 An example of the confirmatory items was, we
5 had a question about how many modules could be
6 connected to any of the 13.8 buses. And it sounded,
7 from what we were reading in the FSAR that maybe up to
8 three could be connected to any given bus and we
9 wanted to know if everything was sized accordingly.

10 And NuScale, in their response to our RAI,
11 they said, no, only two will be on any given bus, and
12 they explained that to us. So, that's an example of
13 just trying to straighten things out and we have an
14 acceptable answer on that.

15 So, in summary, for the Chapter 8, we had
16 two open items and four clarification items. The open
17 item with respect to GDC 17, the Applicant has
18 documented the disposition for the conditions of
19 applicability, with an answer to our question.

20 And they've supplied us with two additional
21 tables for Chapter 8 that presents a roadmap as to how
22 to go through that. We have not reviewed that,
23 finished reviewing that yet, so that's still seeing as
24 open, and it will be addressed in Phase 4.

25 The other open on electrical penetration

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1 assemblies, as discussed on the other slide, the staff
2 feels we have a path to resolution on this. And as
3 stated also before, the confirmatory items will be
4 addressed in our Phase 4 SER.

5 CHAIR BLEY: Bob, a path to resolution means,
6 you've agreed with them to do something a little
7 different than their response said? Or you think --

8 MR. FITZPATRICK: No.

9 CHAIR BLEY: -- their response is resolution?

10 MR. FITZPATRICK: It's just open, but we feel
11 -- the status of that is actually -- Swagata Som, who
12 retired end of May, was our lead on this item. And
13 so, she briefed me before leaving that it looks good,
14 but --

15 CHAIR BLEY: Okay.

16 MR. FITZPATRICK: -- I haven't had time to
17 get to it yet.

18 CHAIR BLEY: Okay, fair enough.

19 MR. FITZPATRICK: So, I don't think I'm going
20 to have a problem with it, but that's where it is.

21 MS. RAY: Bob, if I may add, this is Sheila,
22 we received the last response on the electrical
23 penetrations after we had submitted our SE. So, it's
24 a timing issue as well.

25 MEMBER KIRCHNER: Bob?

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1 MR. FITZPATRICK: Yes, sir?

2 MEMBER KIRCHNER: May I ask, GDC 18, this is
3 at risk, I'm doing it from memory, this talks about
4 tests and inspection and includes batteries. Given
5 the role their battery DC system, one would expect
6 that 18 would apply to that, because it's risk-
7 significant, would it not?

8 MR. FITZPATRICK: No.

9 MEMBER KIRCHNER: No?

10 MR. FITZPATRICK: No.

11 MEMBER KIRCHNER: So, you're just going to go
12 -- your position now is just to do a blanket waiver on
13 17 and 18?

14 MR. FITZPATRICK: No, we're evaluating that.
15 Part of -- I think, some clarification, this might
16 help. We reviewed Chapter 8 as if they're going to
17 meet all the requirements.

18 MEMBER KIRCHNER: Okay.

19 MR. FITZPATRICK: When we wrote up the SER,
20 we were told we couldn't say it in that -- that's just
21 not the right way to say it. So, we're -- it's an
22 open item. Now, Open Item 8.3.1 --

23 MEMBER KIRCHNER: Yes.

24 MR. FITZPATRICK: -- 8.3-1, in terms of
25 Section 8.3.1, there are 15 items in here that would

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1 feed-up to that one open item.

2 MEMBER KIRCHNER: Right.

3 MR. FITZPATRICK: And GDC 18, 17, and then,
4 all these other things that you find in the DSRS as --

5 MEMBER KIRCHNER: Yes.

6 MR. FITZPATRICK: -- supplemental guidance --

7 MEMBER KIRCHNER: Right.

8 MR. FITZPATRICK: -- that they need to meet
9 if they have to meet 17 and they don't have to meet if
10 they don't have to meet 17. So, it looks like a great
11 big, big open item, but in terms of work to solve it,
12 we need the answers from everybody else and we need to
13 wait until the end, everyone else is done with their
14 review.

15 But the actual solution of that, if
16 everything turns out right, is just some wording
17 changes in the SER. So, it looks like we're very
18 preliminary in coming here, but if things work out,
19 we're not.

20 MEMBER KIRCHNER: So, just rhetorically,
21 since there are a number of exemption requests to the
22 GDCs, whose principles I would think still apply in
23 some reasonable manner, even if you do come down and
24 say, it's not safety-related, how are you going to
25 approach these? Are you going to put conditions then

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1 on the exemption? Or look for some further PRA-based
2 --

3 MR. FITZPATRICK: No, actually, we're going
4 to look to, like Reactor Systems, when they finish
5 their review of Chapter 15 and they say, okay, the
6 Chapter 15 analyses work and the analyses didn't
7 require any electrical power, AC or DC, to get there,
8 then we're done.

9 We don't need to apply any exemptions, they
10 don't need this, it's done another way. So, that --

11 MEMBER KIRCHNER: So, then, you'll document
12 that --

13 MR. FITZPATRICK: Right.

14 MEMBER KIRCHNER: -- accordingly in the SE?

15 MR. FITZPATRICK: And what we're talking
16 about is any electrical input from GDCs, the 33 and 4
17 and all that. It's just, if it's not needed, then we
18 just write it off that way. But we don't know that
19 until others finish some really detailed work.

20 DR. SCHULTZ: So, Bob, originally, you were
21 thinking of saying something like, it meets the intent
22 of the GDC, or something like that, and rather what
23 you want to do is to indicate that the GDC just does
24 not need to apply --

25 MR. FITZPATRICK: Well, yes --

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1 DR. SCHULTZ: -- to this design?

2 MR. FITZPATRICK: My draft said, pending
3 resolution of this big issue, that it looks --

4 DR. SCHULTZ: Of course.

5 MR. FITZPATRICK: -- acceptable.

6 DR. SCHULTZ: Yes, right.

7 MR. FITZPATRICK: And I was told that, that's
8 really not the way we write things, because it's --

9 DR. SCHULTZ: I understand now.

10 MR. FITZPATRICK: -- it could be misleading.

11 DR. SCHULTZ: Yes.

12 MR. FITZPATRICK: So, apparently, the other
13 way is misleading too, in a way.

14 DR. SCHULTZ: It has to be turned around.

15 MR. FITZPATRICK: Right. That's where we
16 are.

17 CHAIR BLEY: Bob, you reminded me of
18 something I meant to ask right in the beginning.
19 Everybody's -- I'd be interested in anything anyone
20 has to say. This is the first time we've used the
21 DSRS. How is it working? Have you found it needs
22 revision too or is it working out pretty well?

23 MR. FITZPATRICK: Well, actually, it worked
24 out fairly well. The thing is, when we brought this
25 to ACRS, the DSRS --

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1 CHAIR BLEY: Yes.

2 MR. FITZPATRICK: -- we said we would leave
3 some of the things about Class 1E in, because we
4 wouldn't know --

5 CHAIR BLEY: Exactly.

6 MR. FITZPATRICK: -- so, we did. So, if we
7 had known -- I'll make the same comment I made when we
8 talked about that. If we had known ahead of time that
9 we really wouldn't have a need for Class 1E power, it
10 would have been a more condensed version and less work
11 to go through. But it's just what we came up with.

12 CHAIR BLEY: Okay. Other than that, though
13 --

14 MR. FITZPATRICK: Yes.

15 CHAIR BLEY: -- it's been okay?

16 MR. FITZPATRICK: It's worked out well.

17 MS. RAY: This is Sheila Ray. I would add,
18 also at the time of writing of the DSRS, we were not
19 aware of an exemption to GDC 17 and 18. So, when we
20 used DSRS, in my opinion, that was one of the
21 challenges. It does not address review capability
22 with the addition of an exemption, or exemptions.

23 MEMBER BROWN: I would make one observation.
24 The DSRS -- and I'm segueing back to when we did this
25 review and wrote a letter on it, whatever we did back

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1 two years ago, three years ago, whatever it was.

2 The fact that you are addressing exemptions
3 or not should not be a reason for not having a general
4 DSRS that applies to SMRs, where you don't delete
5 stuff, you just say, hey, it's now no longer
6 applicable. You do what you're doing now, you address
7 exemptions.

8 So, you don't want to write a specific that
9 says, oh, you've got these exemptions to all these
10 things, before you know what's going on. You would
11 still have a general DSRS. So, I think you really
12 want to maintain it in a generalized basis, so that
13 you can then adapt it to other SMRs that come on, will
14 have different exemptions potentially.

15 So, I'm just providing a counterpoint to, we
16 could have had a simpler DSRS. I just think the
17 purpose is to make it so that the Applicant knows what
18 he's supposed to be thinking about, and if there are
19 things that you can exempt or take out, then you do
20 that at the time. That's just an observation.

21 MR. FITZPATRICK: And with that, I will turn
22 it back to Sheila, for Section 8.3.2.

23 MEMBER MARCH-LEUBA: I still have a comment.
24 This morning, we were -- I was very confused with the
25 use of timers all over the place, which are used to

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1 turn on and off the electrical systems. I assume you
2 guys didn't review that part. Are we passing it to
3 Reactor Systems for them to consider or how is that
4 handled?

5 MR. TABATABAI: I think, if I'm not mistaken,
6 we have I&C staff here, if you want to chime in on
7 this timer issue --

8 MEMBER MARCH-LEUBA: So, somebody --

9 MR. TABATABAI: -- otherwise, we can get the
10 response --

11 MEMBER MARCH-LEUBA: My point is --

12 MR. TABATABAI: -- on that.

13 MEMBER MARCH-LEUBA: -- somebody needs, from
14 the staff, needs to understand how all those things
15 flow together. Because even the NuScale staff was
16 confused when they were trying to explain it to us.
17 So --

18 MS. RAY: I think we understand your point,
19 I can definitely say, Chapter 8 did not look at it.
20 However, our friends --

21 MEMBER MARCH-LEUBA: So, we --

22 MS. RAY: -- from other chapters might have.

23 MEMBER MARCH-LEUBA: We should remember, when
24 we look at Chapter 7 and/or 15.

25 MR. TABATABAI: We took notes of the

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1 discussion on that topic, so we will be --

2 MR. BETANCOURT: So, this is Luis Betancourt
3 from I&C. We have reviewed that aspect and we're
4 going to be seeing you guys in August, but we took
5 note of that comment and we're going to put that
6 discussion in the presentation.

7 MEMBER MARCH-LEUBA: Make sure you have a
8 nice flow diagram of how they work.

9 (Laughter.)

10 MR. BETANCOURT: Yes, thank you.

11 MEMBER MARCH-LEUBA: Because I definitely --
12 and second, maybe while you're there, I don't know if
13 it's still I&C or who, but we talked about if, in case
14 those timers fail or the batteries don't have
15 sufficient power, you're going to have degraded
16 voltage and have actuation of equipment out of order.
17 Whose going to handle that?

18 MR. BETANCOURT: So, this is Luis Betancourt
19 again. We're going to be talking about that as well.

20 MEMBER MARCH-LEUBA: Okay.

21 MR. BETANCOURT: And possibly NPS due to
22 degraded voltage, as well as the 24-hour timers. So,
23 that was part of the Chapter 7 review.

24 MEMBER MARCH-LEUBA: Somehow, you need to get
25 this report of Reactor Systems to say, what happens if

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1 this valve opens before that valve?

2 MR. BETANCOURT: Yes.

3 MEMBER MARCH-LEUBA: You have to have some
4 analysis of some kind.

5 MR. BETANCOURT: I will leave that to team,
6 but, yes.

7 MEMBER MARCH-LEUBA: Yes, but make sure you
8 guys interface --

9 MR. BETANCOURT: Okay. So, then, in that
10 Chapter 7 ACRS presentation, we will discuss that.

11 MEMBER MARCH-LEUBA: Excellent, thank you.

12 MS. RAY: Thank you, Luis. I think you can
13 get a flavor of all of the interactions we had in
14 reviewing our chapter. So, Section 8.3.2 is on DC --

15 MEMBER CORRADINI: Hold on --

16 MS. RAY: Yes?

17 MEMBER CORRADINI: Hold on a sec. So, let me
18 observe something, and I could be wrong, but I'm
19 guessing, NuScale is pioneering a path on passive
20 safety systems, with interesting inherent attributes.

21 I would venture to say, if we ever get past
22 this, to other unusual systems, that the staff is now
23 writing design criteria or alternatives, et cetera,
24 they're going to see the same thing.

25 Is this method of review logical for these

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1 sorts of systems? Where this sits here and you're
2 doing it by chapter, and yet, this chapter is totally
3 or highly interactive with another one.

4 You might want to think about this from a
5 process standpoint, because all the advanced systems
6 with all the various funny looking coolants and funny
7 looking designs, all basically have passive system
8 approaches, attributes that are quite similar to
9 NuScale in this regard. So, I'm wondering if this
10 whole process makes sense, from a scheduling and
11 efficiency and effectiveness standpoint.

12 You might want to look at this now, since it
13 may affect -- it may help you here and it may help you
14 downstream, since I know staff has three or four
15 others that are already starting to interact, but
16 don't have water as the fluid of interest, but has
17 very similar decay heat removal systems, things that
18 don't want to have Class 1E power, that same sort of
19 general attributes. Just a thought.

20 MS. RAY: Thank you for your comment, we do
21 understand.

22 MEMBER CORRADINI: I won't forget it, because
23 I'll bring it up again once we see, June 19.

24 CHAIR BLEY: For people who are wondering,
25 that's the licensing modernization meeting.

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1 MR. TANEJA: I may be speaking -- this is
2 Dinesh Taneja from the I&C Branch. I may be speaking
3 out of line right now, but we already started looking
4 at the usefulness of using the DSRS and the lessons
5 learned from DSRS review and looking at the potential
6 advance reactor designs coming in.

7 And we have already started working on a
8 strawman of the review standard that should address
9 most of your concerns that you've raised today. So,
10 let's hope that we can come to you in a few months
11 with our idea of what we are thinking and get your
12 feedback at that time.

13 MS. RAY: Thank you, Dinesh. So, back to
14 onsite DC power systems, Section 8.3.2. As NuScale
15 mentioned, there are several DC systems. The highly
16 reliable DC system is the EDSS.

17 There's the EDSS-common, that serves common
18 loads, such as the Main Control Room emergency
19 lighting and Post-Accident monitoring. The EDSS-MS
20 serves each module. In addition, the EDNS is also
21 non-Class 1E and serves loads related to power
22 generation.

23 The NuScale design uses Valve-Regulated Lead
24 Acid batteries.

25 The staff performed an audit of a NuScale

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1 document, which describes how the NuScale Plant meets
2 the conditions of applicability described in the TR.
3 But specifically, the staff evaluated the design
4 qualification and quality assurance provisions that
5 are applied to the EDSS system.

6 MEMBER BROWN: Just a little technical
7 question, I guess, but I just thought of it.

8 MS. RAY: Yes?

9 MEMBER BROWN: The EDSS, in your first
10 bullet, says you apply this to Main Control emergency
11 lighting, PAM, et cetera, et cetera. So, that is a DC
12 system. Is there -- so, that's battery-powered?

13 MS. RAY: Correct, that is a DC --

14 MEMBER BROWN: And I presume, since most of
15 your emergency lighting and other things are AC, that
16 you go from the battery to invertors, you've still got
17 that same routine --

18 MS. RAY: Right.

19 MEMBER BROWN: -- there's not some magic --

20 MS. RAY: Correct.

21 MEMBER BROWN: -- DC stuff you're going to
22 stick in there?

23 MS. RAY: Right.

24 MEMBER BROWN: That's all I wanted to know,
25 I mean, that's --

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1 MS. RAY: And I will just add, we do evaluate
2 lighting in Chapter 9. So, we'll come back to you on
3 lighting.

4 MEMBER BROWN: Yes, I'm just -- my mind will
5 be basically waiting for the elucidation of these
6 details.

7 MS. RAY: Excellent.

8 MEMBER KIRCHNER: I have a related question,
9 if I may?

10 MEMBER BROWN: Have at it.

11 MEMBER KIRCHNER: Yes. The plant protection
12 system, I assume is the source of the Post-Accident
13 Monitoring information? Or the module protection
14 system, I think NuScale calls it.

15 MS. RAY: I'm going to turn to my friend,
16 Luis.

17 MR. BETANCOURT: This is Luis Betancourt,
18 I&C, again. So, the plant protection system, all it
19 does is basically for common components and it
20 basically does two things: the Control Room
21 habitability and the Control Room integrity.

22 The module protection system, that's where
23 it's contained -- the wording that, because they use
24 protection system in the plant protection system, many
25 people think that's the actual protection system, as

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1 defined by the GDCs. It's a terminology issue, that's
2 the way the NuScale used that.

3 MEMBER KIRCHNER: Well, I'm just thinking of
4 things like the neutron detectors for power and such,
5 so you know that you scrambled. Those probably are
6 feeding in through the protection system?

7 MR. BETANCOURT: Right.

8 MEMBER KIRCHNER: And then, I would assume,
9 then, they're tapped and used for the -- get my
10 terminology right -- the PAM, the Post-Accident
11 Monitoring --

12 MR. BETANCOURT: That's correct.

13 MEMBER KIRCHNER: -- system, right?

14 MR. BETANCOURT: Yes.

15 MEMBER KIRCHNER: So, when you have
16 interrelated systems like that, which for its primary
17 function, is a 1E-type system, doesn't the power have
18 to be therefore 1E?

19 MR. BETANCOURT: No, we were able to discuss
20 that in the last Topical review.

21 MEMBER KIRCHNER: Yes.

22 MR. BETANCOURT: So, the conclusion that we
23 made was, if that variable has to be credited for
24 manual action, then that power has to be safety-
25 related. In the case of NuScale, that's still under

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1 review.

2 Assuming that in the case that there's no
3 amount of credited operator action, per the
4 regulations, that power doesn't have to safety-
5 related. It has to be some of it safety-related and
6 nonsafety-related --

7 MEMBER KIRCHNER: Yes.

8 MR. BETANCOURT: -- and that's why we have
9 this highly reliable.

10 MEMBER KIRCHNER: Well, I guess we'll have to
11 hear more from you in August about these things like
12 these timers that --

13 MR. BETANCOURT: Yes.

14 MEMBER KIRCHNER: -- are supposed to
15 function, and if they don't, whose scrambling the
16 reactor?

17 MR. BETANCOURT: Yes. We will discuss that
18 in August.

19 MEMBER KIRCHNER: Okay, thank you.

20 CHAIR BLEY: A nice figure to lock all that
21 stuff together would be helpful. I don't know if
22 there is one or not.

23 MR. BETANCOURT: Say that again?

24 CHAIR BLEY: A nice figure for your
25 presentation --

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1 MEMBER KIRCHNER: Older people need figures.

2 (Laughter.)

3 CHAIR BLEY: I think it would be helpful.

4 There might be one in Chapter 7 already, but --

5 MR. BETANCOURT: Yes.

6 CHAIR BLEY: -- I don't know.

7 MR. BETANCOURT: There are and I have --

8 CHAIR BLEY: Okay.

9 MR. BETANCOURT: -- I have to provide that to
10 you.

11 CHAIR BLEY: All right. I have not looked at
12 7. Thank you.

13 MS. RAY: Thank you. Next slide. So, in
14 Section 8.3.2, the open items are related to the
15 classification of the highly reliable DC system and
16 the GDC 17 and 18 exemptions.

17 The completion of the staff's review of
18 onsite DC power systems is awaiting the completion of
19 the major open item. Next slide.

20 MEMBER SKILLMAN: Sheila, let me ask this --

21 MS. RAY: Sure.

22 MEMBER SKILLMAN: -- I'm in the SER --

23 MS. RAY: Yes.

24 MEMBER SKILLMAN: -- for Chapter 8, and I'm
25 on 8-48 to the top of the page.

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1 MS. RAY: Forty?

2 MEMBER SKILLMAN: 8-48 at the top of the
3 page.

4 MS. RAY: Yes.

5 MEMBER SKILLMAN: And the italicized text
6 reads as follows. The EDSS structures, systems, and
7 components are further augmented by applying design
8 qualification and QA provisions typically applied to
9 Class 1E DC power systems, using a graded approach.

10 So, the short version is, EDSS, it's not 1E,
11 but we're going to apply QA to it so it's somewhat
12 like a 1E system?

13 MS. RAY: Correct. And --

14 MEMBER SKILLMAN: Okay.

15 MS. RAY: -- that's covered in the Topical
16 Report.

17 MEMBER SKILLMAN: Question is, how do you
18 know where to stop, in terms of applying 18
19 characteristics of Appendix B? Where do you stop? Do
20 you stop at records retention?

21 Do you stop at Criterion 3, design control?
22 Do you stop at testing, NTS? How do you choose where
23 to go no further? In other words, what's the boundary
24 for saying, this is enough for this system?

25 MS. RAY: So, what we evaluated in the DCA

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1 was how they are meeting the TR. And so, we did an
2 audit to look at, how are they meeting those
3 requirements, as stated in the TR?

4 So, in our review, since the TR is approved
5 by the staff, our review on the NuScale DCA review
6 was, are they meeting the TR? And the audit showed,
7 yes, they are. And we evaluated some documents from
8 NuScale where they're referencing the appropriate
9 standards and what they have stated in the TR.

10 MEMBER CORRADINI: But I -- that kind of
11 answer tells me that you kind of did it on a case-by-
12 case basis.

13 MS. RAY: We did it for the EDSS
14 specifically.

15 MEMBER KIRCHNER: So, if you give them a
16 waiver on 18, on test and inspection, you've got this
17 statement here about this further augmenting the EDSS,
18 why would that not fall into tech specs?

19 This morning, earlier, surely you heard us
20 talking about battery testing and such, wouldn't that
21 be critical to the reliability of this system for its
22 application?

23 I'm just trying to followup on Dick's
24 question and push you a little. So, if there's an
25 exemption and then, there's no limits or conditions or

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1 it doesn't have to be covered in tech specs or -- but
2 we're talking about how highly reliable this system
3 is. So, how do you know it's highly reliable?

4 MS. RAY: And that's where the TR comes in.
5 Based on the provisions in the TR. And those are
6 proprietary in the TR, it is meeting certain standards
7 or meeting certain criteria, in order to establish
8 augmented quality as well as testing requirements.

9 MEMBER KIRCHNER: Okay. Well, maybe I have
10 to wait for --

11 MEMBER BROWN: Well, but there's also an RAI
12 still to that TR.

13 MEMBER KIRCHNER Yes.

14 MEMBER BROWN: Is that --

15 MS. RAY: Correct, but --

16 MEMBER BROWN: -- have you completed that and
17 --

18 MS. RAY: No.

19 MEMBER BROWN: So, you're relying on the TR,
20 but you haven't got the TR upgraded or agreed based on
21 the RAI responses?

22 MS. RAY: We haven't finished the evaluation
23 of the RAI. However, we did perform an audit to look
24 at how specifically the EDSS meets the conditions
25 related to the EDSS.

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1 MEMBER BROWN: In the TR, as initially --

2 MS. RAY: In the TR.

3 MEMBER BROWN: -- without the RAI --

4 MS. RAY: Correct.

5 MEMBER BROWN: -- clarifications or
6 improvements or revisions?

7 MS. RAY: Correct. When we --

8 MEMBER BROWN: And those were deemed
9 sufficient for the EDSS, but not sufficient for other
10 things, because they may not have been resolved yet
11 with the RAI?

12 MS. RAY: So, the other items are essentially
13 outside the scope of the electrical. They are -- our
14 colleagues in other chapters, on the other conditions.

15 MEMBER BROWN: Okay.

16 MS. RAY: So, we have --

17 MEMBER BROWN: I guess okay.

18 MS. RAY: You'll hear more about it later, is
19 really -- in other chapters is what I can --

20 MR. TABATABAI: If I can --

21 MEMBER BROWN: You're assuming I'll remember
22 it that long.

23 MS. RAY: I'll make sure you remember.

24 MR. TABATABAI: If I may add something, Mr.
25 Brown? The RAI is not written for the Topical Report

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1 itself. The Topical Report is done. Topical Report
2 is supposed to be a standalone document.

3 However, because the Topical Report was
4 referenced or incorporated by reference in Chapter 8,
5 the staff wrote the RAI that how basically the DCA
6 meets the Topical Report. So, just want to make sure
7 we are clear.

8 MEMBER BROWN: Okay, thank you. I understand
9 now, sort of.

10 (Laughter.)

11 MEMBER MARCH-LEUBA: Okay. Changing the
12 topic again, all these highly reliable DC systems,
13 have you considered external hazards, like seismic or
14 more important, flooding? Because this is not light
15 water. All these batteries, if I remember correctly,
16 they're located underground in a basement?

17 MS. RAY: They're in a seismic Cat I
18 structure.

19 MEMBER MARCH-LEUBA: Yes, but they're like a
20 wall away from a seven million gallon pool of water
21 and they're in the basement? I mean, are they
22 floodable? Is that part of your consideration?

23 MEMBER CORRADINI: First of all, if we're
24 getting to things that we've got to go to closed
25 session, you stop us.

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1 MS. RAY: Yes, sir.

2 MEMBER CORRADINI: Okay.

3 MS. RAY: We may take that one into closed
4 session.

5 MEMBER MARCH-LEUBA: Okay, I'll remember.

6 MS. RAY: Okay. I may not be able to answer
7 it, since that may not have been completely part of
8 the electrical review, we may have to have our
9 colleagues in Structures, I'm not sure if they're
10 here, but --

11 MEMBER MARCH-LEUBA: Okay.

12 MS. RAY: -- we will do our best. The last
13 topic to cover, quickly, is station blackout. As I
14 mentioned, the Lead Reviewer is on business travel, so
15 I'll be presenting for her.

16 The NuScale design does not rely on the use
17 of onsite or offsite AC power for the performance of
18 safety-related functions for any design basis event.
19 And a safe and stable shutdown is automatically
20 achieved and maintained for 72 hours without operator
21 actions.

22 The staff reviewed the SBO-related
23 information provided in the FSAR and the RAI responses
24 against the guidelines of Reg Guide 1.155 and the
25 DSRS.

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1 The staff requested a regulatory audit to
2 seek clarification on NuScale's assumptions and
3 methodology on the SBO Transient Analysis and the SBO
4 sensitivity case. The SBO sensitivity case
5 demonstrates the NuScale design does not rely on DC
6 power from the EDSS to meet the requirements of 10 CFR
7 50.63.

8 The staff verified and accepted the
9 methodology assumptions and results of the SBO
10 Transient and sensitivity case, with respect to the
11 electrical.

12 And in conclusion, there are two items
13 awaiting the completion of Open Item 8.3-1. And the
14 last slide is a summary.

15 We have two open items, one on the EPAs,
16 electrical penetration assemblies, and the second one
17 related to the exemptions of GDC 17 and 18. And the
18 staff is currently working on the Phase 4 review.

19 MEMBER CORRADINI: So, can we just go back?
20 I don't understand --

21 CHAIR BLEY: How far back?

22 MEMBER CORRADINI: I'm back to Slide 11, that
23 she just -- not that far. So, what is it about 8.4
24 that is pending? It's really dependent on everything
25 else, assuming everything else -- I'm going to use

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1 Bob's approach.

2 Assuming everything goes as planned, then
3 the analysis is appropriately using systems to address
4 this sort of station blackout. Is there something
5 particular about station blackout that is an open item
6 or is this just appended onto everything else, because
7 it's using a nonsafety system?

8 MS. RAY: It is --

9 MEMBER CORRADINI: It's the latter?

10 MS. RAY: It's depending on GDC 17 and 18.
11 So, in order to conclude everything is okay with
12 station blackout, if you -- in our DSRS, we do use GDC
13 17 and 18, in 8.4. So, we cannot make that conclusion
14 --

15 MEMBER CORRADINI: Oh, okay. I see.

16 MS. RAY: -- until we complete the open item.

17 MEMBER CORRADINI: All right. So, it's
18 connected in that regard?

19 MS. RAY: Correct.

20 MEMBER CORRADINI: Okay. Thank you.

21 MS. RAY: And that concludes the staff's
22 presentation.

23 CHAIR BLEY: Thank you very much. Anything
24 more from the Committee? I'm going to take us, after
25 we collect comments, into the closed session, just in

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1 case. There were a few things that came up and we'll
2 just do that to see.

3 But before that, I want to make sure the
4 phone line is open and we'll look for comments there.
5 Is there anybody in the room who would like to make a
6 comment? If so, please come to the microphone.

7 If there's anybody on the phone line who
8 would like to make a comment, please identify yourself
9 and do so. I'm not sure if the phone line is open or
10 not, but we'll keep trying. Anybody there? I don't
11 hear anybody, so I guess we have no comments from
12 there.

13 At this time, I'd like to go around the
14 table and I'm going to start with Charlie. Any final
15 comments?

16 MEMBER BROWN: Only to reiterate downstream,
17 evaluating the inadvertent actuation via either
18 internal, because somebody makes a mistake, and/or
19 whether the plant design and architecture is
20 susceptible to external influences?

21 My quick review was unable to clear that up
22 relative to the electric plant controls, where there
23 seems to be some definition relative to the protection
24 systems and safeguard systems.

25 CHAIR BLEY: We'll raise that again in

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1 Chapter 7.

2 MEMBER BROWN: Yes, it's all Chapter 7 stuff.
3 So, then, I couldn't find the connection to the
4 electric plant controls, how they are managed within
5 the overall architecture. So, that's the only comment
6 I would reiterate, to make sure it doesn't get lost.

7 I'm sorry, I did not have my microphone, did
8 you hear me, young lady? Thank you. Did you all hear
9 me? I figure my voice carries well enough.

10 CHAIR BLEY: Walt?

11 MEMBER KIRCHNER: No further comments at this
12 point. Thank you.

13 CHAIR BLEY: Thank you. Jose?

14 MEMBER MARCH-LEUBA: No comments.

15 CHAIR BLEY: Michael?

16 MEMBER CORRADINI: No further comments.

17 CHAIR BLEY: Pete?

18 MEMBER RICCARDELLA: No comments.

19 CHAIR BLEY: Matt?

20 MEMBER SUNSERI: No additional comments.

21 CHAIR BLEY: Dick?

22 MEMBER SKILLMAN: Yes, sir, one comment. My
23 comment is aimed on the Safety Evaluation, Page 8-9.
24 This is the SER, Chapter 8. At Paragraph 8.1.4.8.
25 Before I make my comment, I would like to make a

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1 statement.

2 I have a vivid memory of what we went
3 through at TMI when we transitioned to natural
4 circulation. The reason that we maintained pressure
5 up until that time was because we were maintaining
6 NPSH for one reactor coolant pump, and we knew that
7 one pump was a run-out and we needed that NPSH.

8 Once we stopped that pump, we lost the
9 pressurizer level, stopped the pump, and we had
10 instrumentation that showed us that we went into
11 natural circulation. But we maintained subcooling,
12 because we did not know the condition of the core.
13 Emphasis, did not know the condition of the core.

14 In another event, Walt and I lived this, we
15 both operated a power reactor in downtown Manhattan.
16 That power reactor was named Savannah. We had a
17 couple of events where we lost pressurizer level.

18 But our gold standard was to maintain
19 pressurizer pressure, no matter how many pumps we had
20 operating, because we wanted to maintain subcooling on
21 that fuel.

22 So, to my point, in the Safety Evaluation,
23 the NuScale design does not rely on pressurizer
24 heaters to establish and maintain natural circulation
25 and shutdown conditions. I get it, for what we've

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1 been presented regarding this reactor design.

2 But from a systems perspective, it seems
3 that this reactor, if you will, is a hybrid. Most of
4 the time, it's a P, pressurized water reactor, but it
5 can go to conditions that are very similar to a B.
6 And when it goes to those conditions, it may have
7 reactivity requirements that depend on subcooling.

8 And so, I'm going to be very skeptical as we
9 go ahead about the technical accuracy of whether or
10 not pressurizer heaters, and I translate that to be
11 subcooling, is really not needed. Whether it's a 1E
12 power system, whether it's an Evinrude with some kind
13 of an alternator that will make sure subcooling
14 exists.

15 I've seen the analysis, I understand the
16 explanations we've been given today, but I'm skeptical
17 on the this one point. And to me, this will be the
18 turning point for whether you need a 1E system or not.
19 Do you really not need subcooling driven by
20 pressurizer heaters when this plant has gone into a
21 quasi-PWR/BWR mode? Thank you.

22 CHAIR BLEY: Thanks, Dick. Harold?

23 MEMBER RAY: Just to say again, although our
24 review is independent of the staff, it does include
25 review of the staff's conclusions and I look forward

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1 to being able to do that when the time is appropriate.

2 CHAIR BLEY: And our consultant, Dr. Schultz?

3 DR. SCHULTZ: My comments are two, and one is
4 just a recognition, both in the presentation by
5 NuScale and then, by the staff, it's very clear that
6 what -- one of the things that's ongoing here is that
7 the reviews, although they're presented sequentially,
8 we are beginning with Chapter 8, you've got, as you
9 said at the beginning of your presentation, a dozen
10 staff members from different areas within the
11 organization working together to perform the review.

12 And the material that the Committee is
13 wrestling with today is a lot, to a great extent,
14 associated with trying to knit those pieces together.
15 As is the staff. So, that's one side of the comment.

16 The other is, looking at this from a
17 different angle, as the material is presented, one of
18 the things that is difficult in the situation where
19 we've got a major, a major open item, as we go through
20 it section by section, piece by piece, the conclusion
21 by the staff is all affected by that.

22 But I think, in fact, there is a gradation
23 of to what extent that review is in fact completed.
24 But they all seem to be tied together by one final
25 comment saying, well, we'll just have to wait and see

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1 if that is resolved.

2 More information about the level of
3 conclusion that in fact has been reached to this point
4 in the review would be helpful, because we are going
5 through an iterative process here.

6 CHAIR BLEY: Thanks, Steve. I want to thank
7 NuScale and the Staff for very good discussions today,
8 that's added some clarity.

9 We're on the schedule to write an interim
10 letter. If we write an interim letter on this
11 chapter, it won't say more than, we look forward to
12 seeing your SER when it has content.

13 MEMBER CORRADINI: There is, in past letters
14 such as this, a conclusion that there's a myriad of
15 system interactions that may alter our conclusions.

16 CHAIR BLEY: And that's reasonable too. For
17 me, I --

18 MEMBER CORRADINI: That's the only that I --

19 CHAIR BLEY: -- we have no conclusion thus
20 far, other than we don't see any showstoppers, I
21 think. And I guess, you do want a letter? Yay or
22 nay?

23 MR. TABATABAI: Yes. Actually, I just wanted
24 to mention that we are scheduled to present to the
25 full Committee on July 11. So, we took notes of some

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1 comments and questions that you had and hopefully, by
2 then, at least if we are not giving you the full
3 conclusion, because the reviews are still ongoing, as
4 you've heard, so to whatever extent we can, we can
5 come back to the Committee and --

6 CHAIR BLEY: Yes, for us to write a letter,
7 you're going to have to come back.

8 MR. TABATABAI: Yes.

9 CHAIR BLEY: If you can emphasize anything
10 that answers any of the questions, that will be very
11 good. I suspect the letter won't say much more than
12 I just said, although we might add something. And I
13 understand you want it, so we will help you out and do
14 one, if it helps.

15 But I guess that's it. Anything else from
16 any of the members?

17 MEMBER CORRADINI: You want to go to the
18 closed session?

19 CHAIR BLEY: I do. At this time, we need to
20 clear the room, turn off the phone lines, and we're
21 going off the public record and onto a closed record.

22 (Whereupon, the above-entitled matter went
23 into closed session at 11:37 a.m.)

24

25

NuScale Nonproprietary

ACRS Presentation

Chapter 8 Overview



Ted Hough

Electrical Design

Kent Welter

Nuclear Safety

Jeff Ehlers

Electrical Design

Paul Infanger

Licensing

June 6, 2018

Abbreviations

- AAPS – alternate AC power supply
- AC – alternating current
- BDG – backup diesel generator
- BPSS – backup power supply system
- CFDS – containment flooding and drain system
- COA – condition of applicability
- CHWS – chilled water system
- CNV – containment vessel
- CVCS – chemical and volume control system
- CW – circulating water
- DC – direct current
- DCA – design certification application
- ECCS – emergency core cooling system
- EDNS – normal DC power system
- EDSS – highly reliable DC power system
- EHVS – electrical high voltage system

Abbreviations

- ELVS – electrical low voltage system
 - EMVS – electrical medium voltage system
 - FSAR – final safety analysis report
 - HP – horsepower
 - LTR – licensing topical report
 - MCR – main control room
 - MCS – module control system
 - MPS – module protection system
 - MPT – main power transformer
 - MS – module specific
 - NMS – neutron monitoring system
 - OPS – operations
 - PAM – post accident monitoring
 - PCS – plant control system
 - PLS – plant lighting system
 - PPS – plant protection system
 - PZR – pressurizer
-

Abbreviations

- RAI – request for additional information
- RG – regulatory guide
- RT – reactor trip
- SBO – station blackout
- SDIS – safety display and indication system
- SER – safety evaluation report
- SPS – security power system
- SST – station service transformers
- TG – turbine generator
- UAT – unit auxiliary transformer
- VRLA – valve regulated lead acid

Purpose

- Provide an overview and highlights of the electrical systems pertinent to Chapter 8 of the NuScale DCA
 - design basis
 - off-site power
 - on-site power (AC)
 - on-site power (DC)
 - station blackout
 - FSAR Table 8.3-9
 - TR-0815-16497 “Conditions of Applicability”
 - TR-0815-16497 “NRC additional conditions”

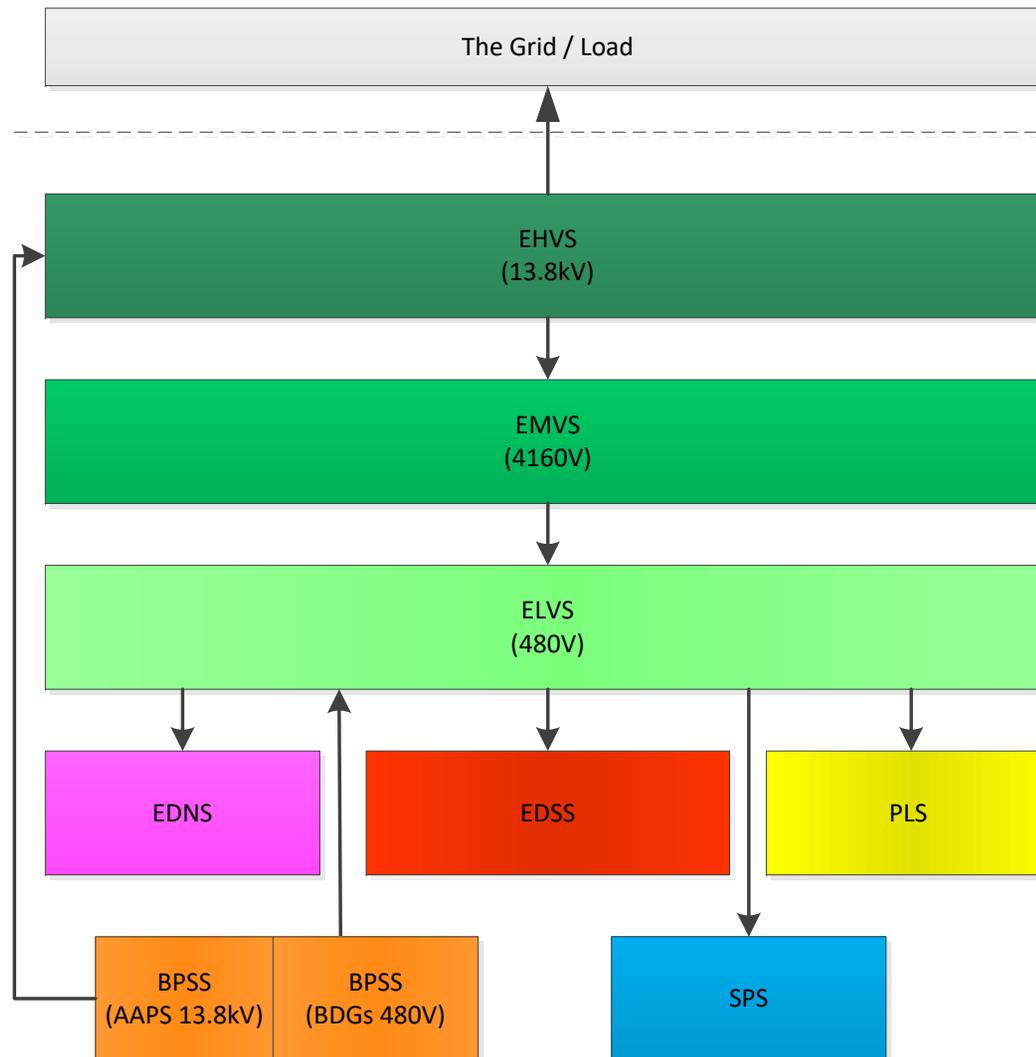
Starting Point

- **Key influences in the overall electrical design**
 - nuclear safety and regulatory requirements
 - Fukushima electrical insights/dependence on power
 - the robust, inherently safe module concept
 - our plant mechanical design emphasizes simplicity
 - design electrical systems that compliment the simplicity
 - 12X factor, electrical impact regarding viability and economics

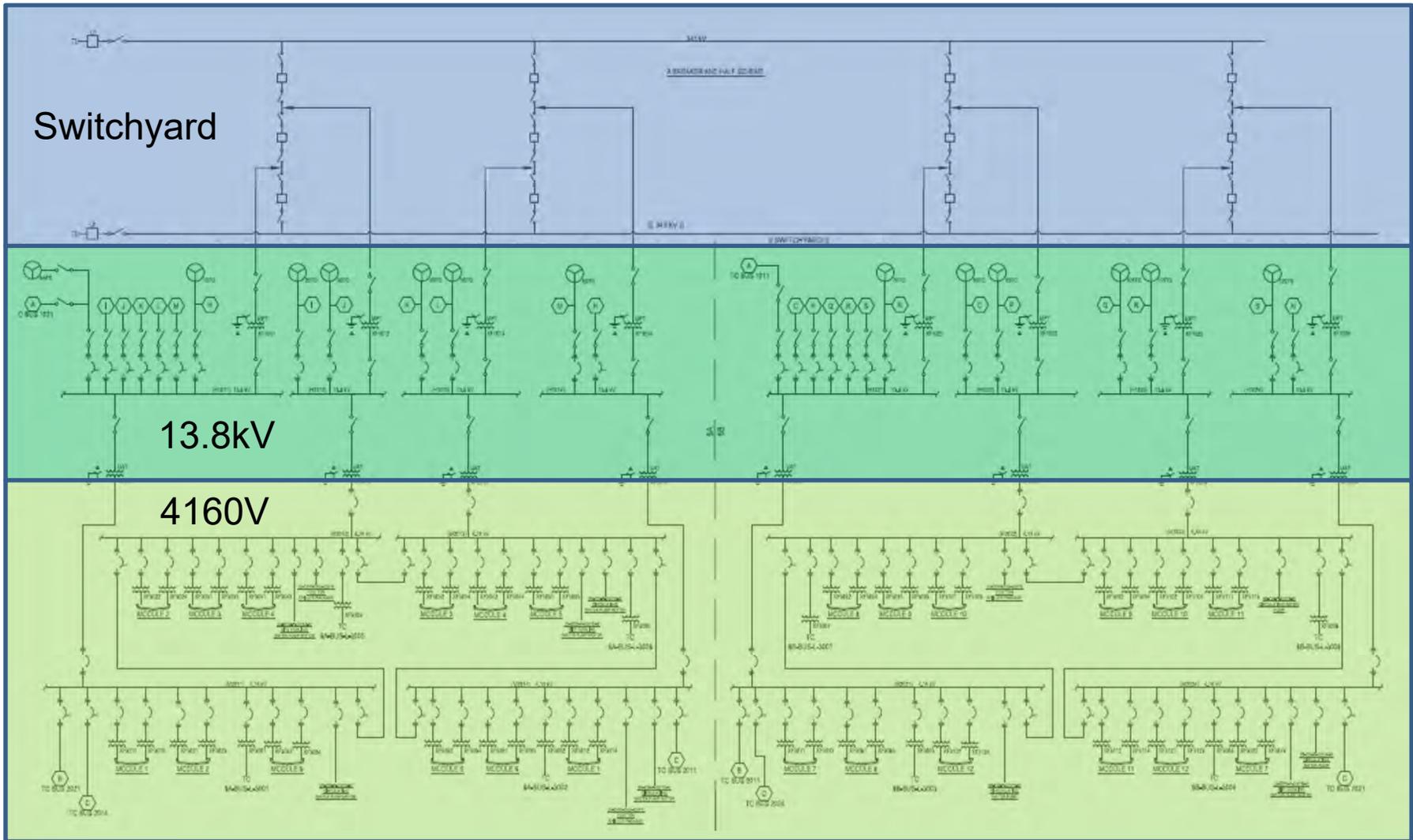
Design Basis

- Safety-related components “fail-safe” on a loss of electrical power
 - solenoids (de-energized) – valves close/open depending on function
 - breakers (RT + PZR) – open
- Safety-related systems rely on natural passive mechanisms based on fundamental physical and thermodynamic principles
- Based upon the application of Safety Classification of Passive Nuclear Power Plant Electrical Systems, TR-0815-16497, the following are key electrical design features:
 - AC and DC electrical distribution systems are classified as non-Class 1E
 - highly reliable DC power system (EDSS) has augmented design, qualification, and QA provisions
 - MCR emergency lighting and PAM B&C variables powered by EDSS
 - power sources are not required to support safety-related functions
 - design supports exemption to GDC 17 and 18

Overall Electrical Design



Overall Single-Line Drawing



Off-Site Power System

- The off-site power system includes the switchyard and one or more connections to a transmission grid, micro-grid, or dedicated service load.
 - COLA Item (8.2-1) to describe the site-specific switchyard layout and design including off-site power connections
- The passive design of the NuScale power plant does not rely on AC power and does not require an off-site power system to mitigate design-basis events.
- On a loss of off-site power the plant is designed to transition to “island mode” with house load powered from the designated TG unit.

On-Site AC Power

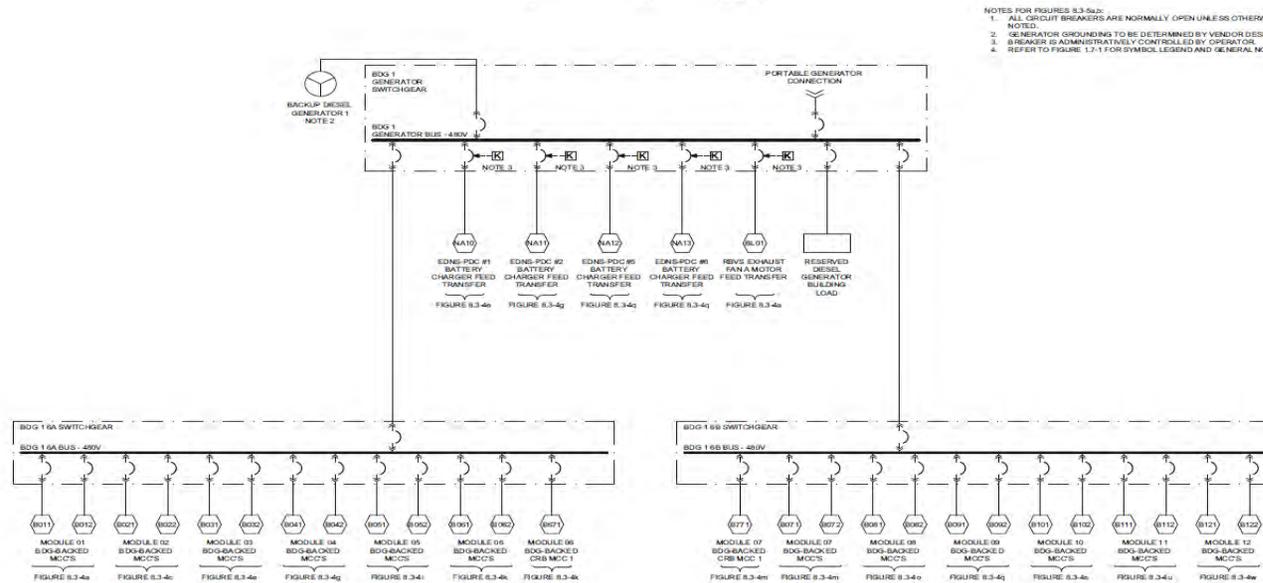
- Use of standardized industrial AC electrical distribution equipment
- Support online electrical bus outages with multiple modules in service (e.g., transformer capacities, short circuit ratings, etc.)
- Electrical distribution levels
 - EHVS – 13.8kV (main generators, MPTs, buses)
 - one generator can power entire 12-module house load
 - normal AC power source to on-site loads
 - EMVS – 4160V (UATs, buses)
 - supports large shared plant loads (CW, SCW, CHWS)

On-Site AC Power

- ELVS – 480V (SSTs, buses)
 - station service transformers (main-tie-main configuration)
 - module-specific and lower HP shared loads
- PLS – 480V, 277V, 208V, and 120V
 - plant lighting loads and misc. power panel loads
- BPSS
 - auto start on loss of all AC to 13.8kV buses (30-second time delay), manually loaded
 - backup diesel generators (BDGs – 480V)
 - support selected plant loads (battery chargers, control room ventilation, CVCS pumps, CFDS pumps)

On-Site AC Power

- BPSS
 - auxiliary AC power source (AAPS – 13.8kV)
 - support permanent nonsafety loads when normal AC not available
 - 13.8kV so OPS can distribute power as needed
 - portable generator connection (480V)



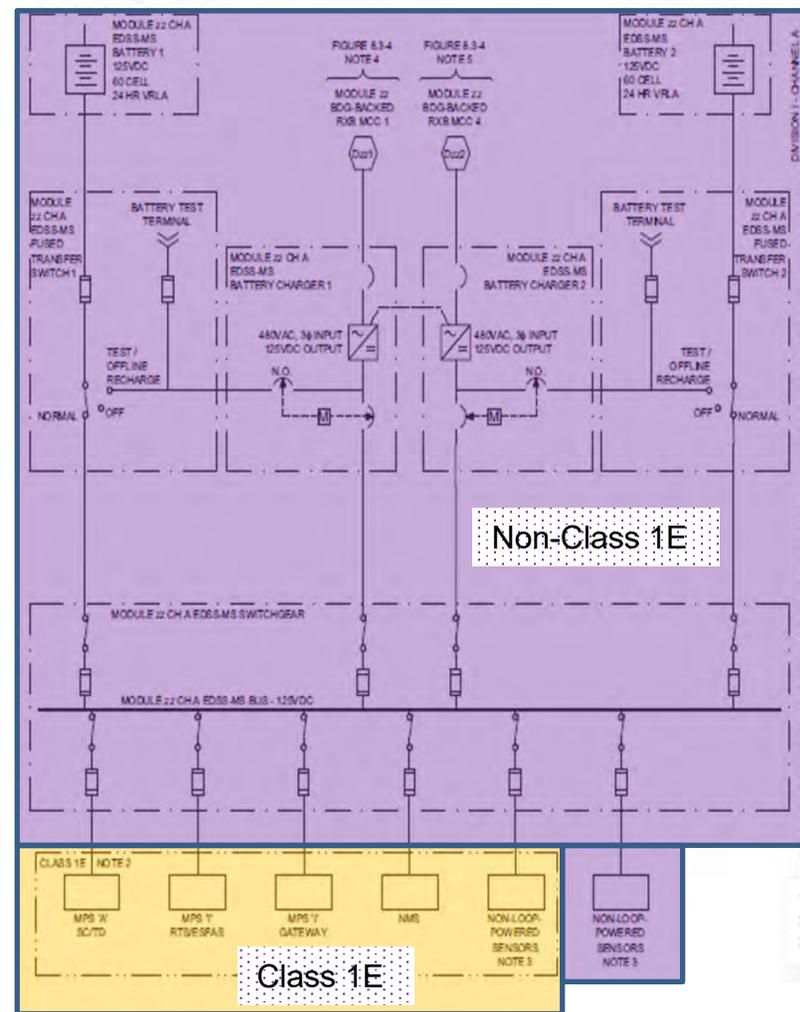
On-Site DC Power

- EDSS (highly reliable DC power system)
 - augmented design requirements
 - augmented QA requirements
 - Class 1E isolation – performed by the MPS and NMS power supply components (i.e., DC-DC converters)
 - VRLA batteries
 - battery duty cycle
 - EDSS MS Channel A & D – 24 hours (ECCS Hold Mode)
 - EDSS MS Channel B & C – 72 hours (PAM Support)
 - EDSS-C Division I & II – 72 hours (PAM Support)

On-Site DC Power

- EDSS – 125V
 - EDSS-MS (module specific)
 - not shared per RG 1.81
 - power to MPS and NMS
 - 4-channel system to support 4-channel MPS and NMS
 - EDSS-C (common)
 - shared common loads (PPS, MCR emergency lights, SDIS)
 - two divisions

EDSS-MS Channel A



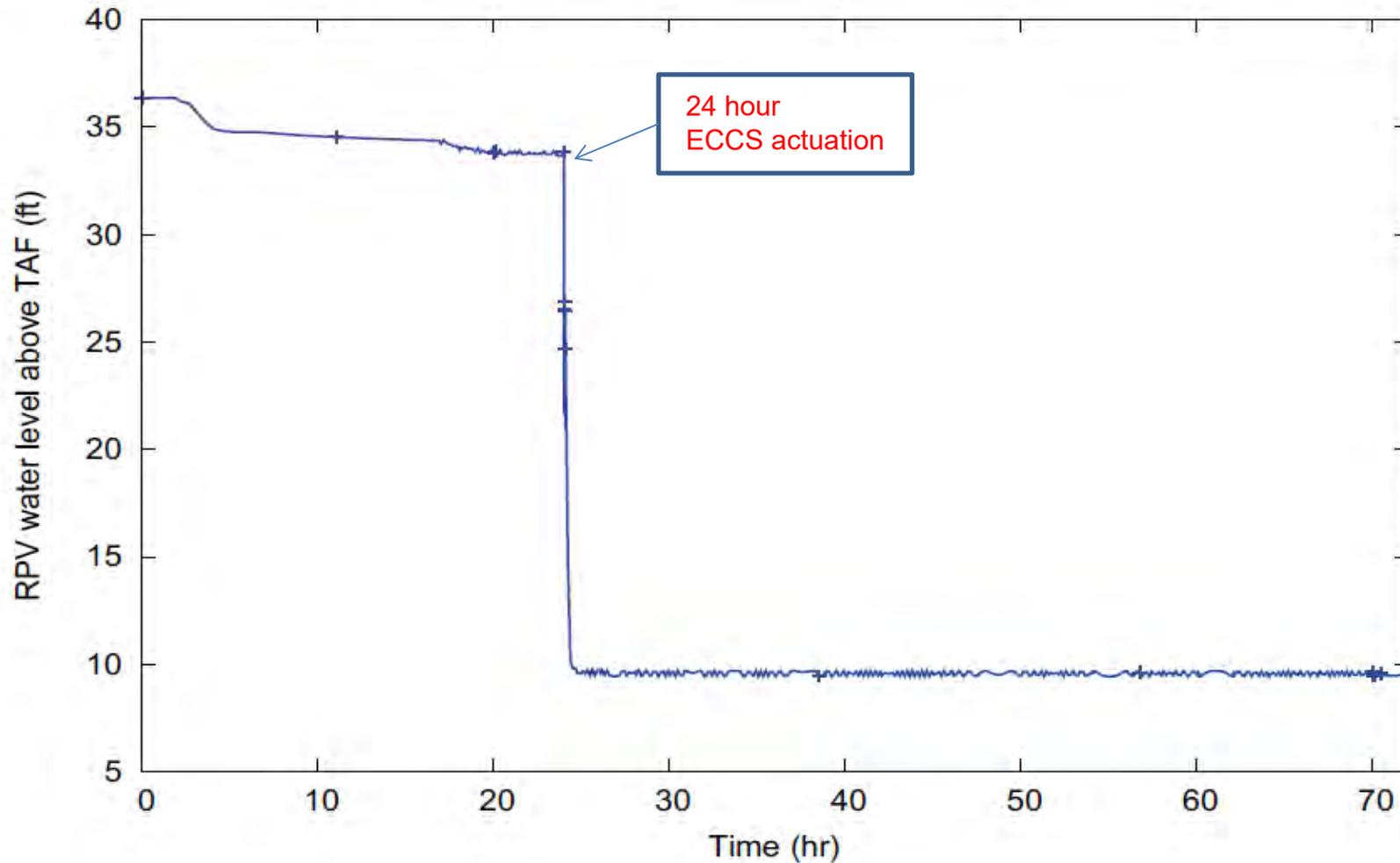
On-Site DC Power

- EDNS – 250 VDC, 125 VDC, and 208 VAC
 - VRLA batteries and 40-minute battery duty cycle
 - supports nonsafety loads/functions related to investment protection and power generation, for example:
 - nonsafety I&C (PCS and MCS)
 - control rod drive power supply
 - electrical distribution control power
 - TG emergency lube oil pumps

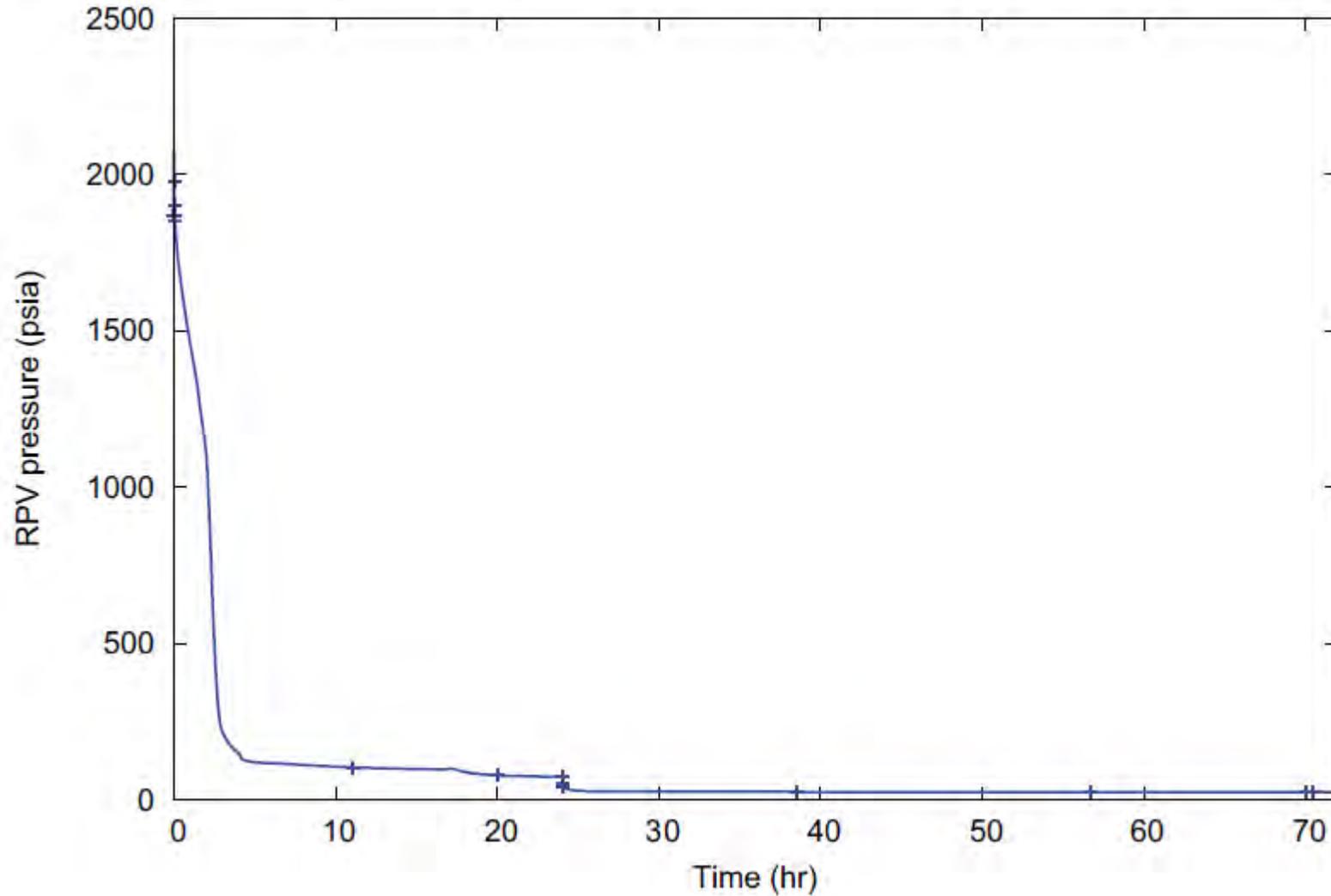
Station Blackout

- Passive plant design coping duration (SECY-94-084 and SECY-95-132)
 - station blackout (72 hour coping duration)
 - SBO analysis includes all 12 modules operating at 100% prior to the event
 - all safety functions achieved and maintained for 72 hours without reliance on AC power or operator action (reactor trip, decay heat removal system, emergency core cooling system)
 - core cooling and containment integrity maintained without AC power
 - sensitivity case demonstrates core cooling and containment integrity maintained without DC power as well
 - EDSS available to support PAM

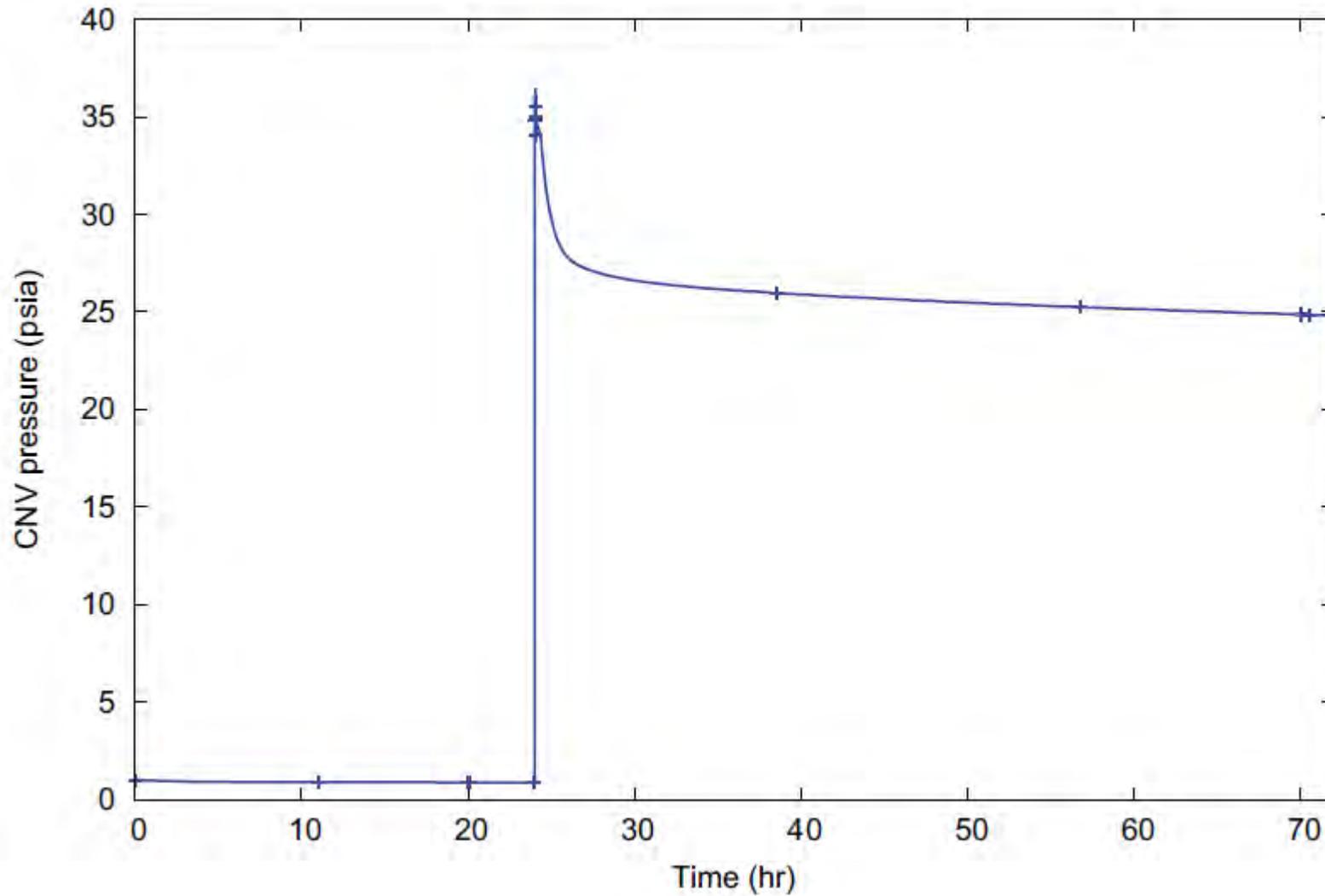
Station Blackout (RPV Level)



Station Blackout (RPV Pressure)



Station Blackout (CNV Pressure)



Electrical Topical Report Evaluation

- NuScale received NRC eRAI No. 9359 on 1/29/18 requesting the addition of a table to the FSAR providing a cross reference for the “conditions of applicability” provided in the LTR and the “five conditions” identified in the associated SER
- NuScale responded to the RAI on 3/27/18 with the addition of Table 8.3-9 (addresses COAs and SER conditions) and Table 8.3-10 (addresses augmented design provisions), which provide the required FSAR cross references for the LTR and associated SER
 - as a result of the FSAR cross reference evaluation, numerous conforming changes were made to the Tier 2 FSAR to enhance validation

Table 8.3-9 FSAR Cross Reference

Table 8.3-9: FSAR Cross Reference for the Conditions of Applicability and NRC SER Limitations and Conditions for TR-0815-16497-P-A

<u>Table 3-1 Section I Condition Number</u>	<u>FSAR Sections that Demonstrate Condition is Satisfied</u>
1.	<u>Design Basis Event Assumptions</u> <ul style="list-style-type: none"> • <u>15.0.0.6.4 and 15.0.4 (72 hour stabilized condition DBE end state without operator actions required)</u> • <u>15.0.0.6.5 (DBE analysis includes loss of electrical power)</u> • <u>8.4.2 (SBO Loss of AC and DC power for 72 hour duration)</u>
1.a.	<ul style="list-style-type: none"> • <u>3.9.4 (CRDS does not rely on electrical power)</u> • <u>8.4.2 (SBO reactor trip)</u>
1.b.	<ul style="list-style-type: none"> • <u>4.3.1.5 (Shutdown capability does not rely on electrical power)</u> • <u>15.6 (Decrease in inventory event analyses do not rely on electrical power or credit active injection sources)</u> • <u>8.4.2 (SBO does not rely on electrical power for shutdown or inventory control)</u>
1.c.	<ul style="list-style-type: none"> • <u>5.4.3.1 (DHRS function does not rely on electrical power)</u> • <u>6.3.1 (ECCS function does not rely on electrical power)</u> • <u>15.0.0.6.3 (DBE analysis does not credit electrical power for DHRS or ECCS functions)</u> • <u>Table 15.0-2, Table 15.0-3, Table 15.0-4 (Fuel and core acceptance criteria confirm core cooling)</u> • <u>8.4.2 (SBO core cooling relies on DHRS and ECCS)</u>
1.d.	<ul style="list-style-type: none"> • <u>6.2.4.2.1 (CNV isolation function does not rely on electrical power)</u> • <u>8.4.3 (SBO containment integrity does not rely on electrical power)</u>
1.e.	<ul style="list-style-type: none"> • <u>6.2.1, 6.2.2, and 6.2.5.1. (Passive CNTS and UHS design does not include active ESF heat removal and combustible gas control systems)</u> • <u>Table 15.0-2 (DBE thermal hydraulic acceptance criteria confirm containment peak pressure margin)</u> • <u>8.4.3 (No credit for active ESF heat removal for containment integrity in SBO analysis)</u>
1.f.	<ul style="list-style-type: none"> • <u>6.5.3 (Active fission product removal systems are not required)</u> • <u>Table 15.0-12 (DBA radiological consequences show guidelines maintained)</u>
1.g.	<ul style="list-style-type: none"> • <u>5.2.2. 1 (Overpressure protection system does not rely on electrical power)</u> • <u>8.4.2 (SBO RPV pressure margin)</u> • <u>Table 15.0-2 (DBE thermal hydraulic analyses confirm margin to RCS pressure acceptance criteria)</u>

Conclusion

- The electrical distribution system supports the application of Safety Classification of Passive Nuclear Power Plant Electrical Systems, TR-0815-16497
- The electrical distribution system is not required to support any safety-related function or manual operator action (no RG 1.97 Type A variables), and thus is classified as non-Class 1E
- Backup power sources (BDGs, AAPS) are available for asset protection, designated plant loads, and black start
- The electrical distribution system has flexibility to support bus outages with multiple modules in service
- The design supports exemption to GDC 17 and 18

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Presentation to the ACRS Subcommittee

NuScale Power, LLC
NuScale Design Certification Application Review

Safety Evaluation with Open Items: Chapter 8

ELECTRIC POWER

June 06, 2018

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- ♦ Lead Project Manager - Gregory Cranston
- ♦ Chapter 8 Project Manager - Omid Tabatabai

Overview of Chapter 8 Review

- ♦ NuScale submitted its DCA, Rev 0, in December 2016, and a Rev 1, on March 15, 2018. The staff's SER is based on the review of Rev 0 of the DCA.
- ♦ Today's presentation is the first ACRS briefing by the NRC Staff in support of the NuScale DCA review.
- ♦ Issued a total of 10 RAIs with 25 Questions. All RAIs have been responded.
- ♦ The staff's SER with Open Items contains two open items and will be discussed in the subsequent slides.
- ♦ Open and Confirmatory Items will be closed in Phase 4 of the Review.

Technical Topics

Section 8.1 – Introduction

Technical Topics

- NuScale Design:
 - ♦ The electric power system for NuScale design is comprised of non-safety related AC (or ac)(alternating current) and non-safety related DC (or dc) (direct current) power system.
 - ♦ This design does not depend on onsite or offsite AC or DC electrical power system, including that from the transmission grid for safe operation.
 - ♦ The NuScale Power Plant design with non-reliance on electrical power accommodates a site location where an offsite transmission grid is not available.
 - ♦ The normal source of power is one or more of the twelve (12) operating power module main generators.

- Staff's review:
 - ♦ The staff reviewed the design of the electric power systems necessary for safe design and operation of the plant, or whose failure might adversely affect their safety-related or risk-significant safety functions.
 - ♦ The staff reviewed the design of the electric power systems in accordance with the applicable DSRS or SRP and consistent with the graded review approach.

Technical Topics

Section 8.1 – Introduction

Open Item 8.3-1

- FSAR, Tier 2, Section 8.3 and DCA Part 7 state that the design does not rely on safety-related AC or DC power systems
 - ♦ This position is supported by the application of the evaluation methodology described in NuScale topical report (TR)-0815-16497, “Safety Classification of Passive Nuclear Power Plant Electrical Systems.”
- The open item relates to the exemptions to GDC 17 and 18 regarding the staff verifying that the design does not require safety-related power.
- Furthermore, the staff’s evaluation of accident analyses are in Chapter 15 which has not been completed to demonstrate that
 - 1) fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and
 - 2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.
- Staff issued a safety evaluation approving TR-0815-16497 with five additional conditions.
- The NuScale DCA did not directly address the conditions of applicability and the five additional conditions.
- NRC staff issued RAI 9359, Question 1-1, to address the conditions of applicability and the additional conditions associated with TR-0815-16497.
- Staff is evaluating the RAI response.

Technical Topics

Section 8.2 – Offsite Power System

Technical Topics

- NuScale Design:
 - ♦ The Offsite Power System includes the switchyard and one or more connections to a transmission grid, micro-grid, or dedicated service load.
 - ♦ The passive design of NuScale Power Plant does not depend on offsite AC power for safe operation and does not rely on offsite AC power to support safety-related function.
 - ♦ The applicant stated in DCA Part 7 that offsite power is not required.

- Staff's review:
 - ♦ The staff reviewed the offsite power system to ensure that it will perform its design function during all operating and accident conditions.

Open Items

- The completion of the review for the offsite power system is awaiting for the completion of OPEN ITEM 8.3-1

Technical Topics

Section 8.3.1 – Onsite AC Power Systems

Technical Topics

The following nonsafety-related systems are the major constituents of the onsite AC power system:

- ◆ Electrical High Voltage System (EHVS) (13.8 kV)
- ◆ Electrical Medium Voltage System (EMVS) (4.16 kV)
- ◆ Electrical Low Voltage System (ELVS) (480 Volts and 120 Volts)
- ◆ Backup diesel generators (BDGs) (480 volts)
- ◆ Auxiliary ac power source (AAPS) (13.8 kV)

The review focused on the following:

- Overall system operation
- Electrical penetration assemblies (EPAs)
- A few areas where the staff sought clarity in the FSAR

Technical Topics

Section 8.3.1 – Onsite AC Power Systems

Open Items

There are two open items associated with onsite AC power systems:

- Open Item with respect to GDC 17 and 18 (Open Item 8.3-1)

The applicant is to document in the DCA the disposition of the conditions of applicability and the additional conditions imposed by the staff review associated with TR-0815-16497

This relates not only to the Applicant's request for exemptions to GDC 17 and 18 but also their associated guidance documents from the DSRS

- Open item with respect to EPAs

The staff has a path to resolution for this item

- The confirmatory items will be addressed in our phase 4 SER

Technical Topics

Section 8.3.2 – Onsite DC Power Systems

Technical Topics

- The onsite DC power systems include the non-Class 1E EDSS and the non-Class 1E EDNS.
 - The EDSS-common (EDSS-C) plant subsystem serves plant common loads that have functions that are not specific to any single NuScale Power Module (NPM). These plant common loads include Main Control Room (MCR) emergency lighting and Post-Accident Monitoring (PAM) information displayed in the MCR.
 - The EDSS-module-specific (EDSS-MS) plant subsystem consists of up to 12 separate and independent DC electrical power supply systems, one for each NPM.
 - The EDNS is shared between the NPMs and provides both DC power and AC power (through inverters) to non-safety related loads that support functions related to investment protection and power generation.
- The NuScale design utilizes Valve-Regulated Lead Acid batteries in the DC systems.
- The objective of the staff review is to determine that the onsite direct current (DC) power system satisfies the requirements of 10 CFR 50, Appendix A, General Design Criteria (GDC) 2, 4, 5, 17, and 18 and will perform its design function during all plant operating and accident conditions.

Technical Topics

Section 8.3.2 – Onsite DC Power Systems

Open Item

- The open items in this section are related to the classification of the highly reliable dc system (EDSS), and GDC 17 and 18 exemptions.
- The applicant stated in DCA Part 7 that onsite power is not required for the mitigation of design basis events.
- The completion of the staff's review of onsite dc power systems is awaiting the completion of OPEN ITEM 8.3-1

Technical Topics

Section 8.4 – Station Blackout

Technical Topics

- NuScale Design:
 - ♦ The NuScale Power Module (NPM) design does not rely on the use of onsite or offsite AC power for the performance of safety-related functions for any design basis event.
 - ♦ A safe and stable shutdown is automatically achieved and maintained for 72 hours without operator actions.

- Staff's review:
 - ♦ The staff reviewed the information pertaining to SBO in the FSAR to determine whether the design is capable of withstanding and recovering from a complete loss of ac electric power for a minimum of 72 hours.
 - ♦ Staff performed an audit of the methodology and assumptions of the SBO Transient Analysis and SBO sensitivity case.

- The completion of the staff's review of station blackout is awaiting the completion of OPEN ITEM 8.3-1

Summary

- Two Open Items:
 - ♦ Electrical Penetration Assemblies
 - ♦ Relating to the exemptions to GDC 17 and 18, regarding the staff verifying that the design does not require safety-related power.
- Staff's review:
 - ♦ Currently working on Phase 4 review.