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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACRS)
+ + + + +
NUSCALE SUBCOMMITTEE
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OPEN SESSION
+ + + + +
WEDNESDAY
JANUARY 23, 2019
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ROCKVILLE, MARYLAND
+ + + + +

The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
3D50, 11545 Rockville Pike, at 10:46 a.m., Dennis Bley
and Harold Ray, Co-Chairs, presiding.

COMMITTEE MEMBERS:

DENNIS BLEY, Co-Chair
HAROLD RAY, Co-Chair*
RONALD G. BALLINGER, Member
CHARLES H. BROWN, JR., Member
MARGARET SZE-TAI Y. CHU, Member

1 MICHAEL CORRADINI, Member
2 VESNA B. DIMITRIJEVIC, Member*
3 JOSE MARCH-LEUBA, Member
4 GORDON R. SKILLMAN, Member
5

6 DESIGNATED FEDERAL OFFICIAL:

7 MICHAEL SNODDERLY
8

9 ALSO PRESENT:

10 DOUG BOWMAN, NuScale
11 PROSANTA CHOWDHURY, NRO
12 AMY D'AGOSTINO, RES
13 RYAN FLAMAND, NuScale
14 CARRIE FOSAAEN, NuScale
15 BRIAN GREEN, NRR
16 AMANDA MARSHALL, NSIR
17 LAUREN NIST, NRR
18 STEVE POPE, NuScale
19 MAURIN SCHEETZ, NRR
20 TIM TOVAR, NuScale
21
22
23

24 *Present via telephone

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P R O C E E D I N G S

10:46 a.m.

CO-CHAIR BLEY: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards, the NuScale Subcommittee. I'm Dennis Bley, Chairman for today's Subcommittee meeting.

Members in attendance are Ron Ballinger, Dick Skillman, Charlie Brown, Jose March-Leuba, Margaret Chu, Mike Corradini. On the phone line we have Harold Ray, and we are expecting Vesna Dimitrijevic.

Mike Snodderly is the Designated Federal Official for this meeting.

The Subcommittee will review the staff Safety Evaluation Report with Open Items on Chapter 13, Conduct of Operations, and Chapter 18, Human Factors Engineering, to the NuScale design certification application. Today we have members of the NRC staff and NuScale to brief the Subcommittee.

The ACRS was established by a statute and is governed by the Federal Advisory Committee Act, FACA. That means that the Committee can only speak through its published letter reports. We hold

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1 meetings to gather information to support our
2 deliberations.

3 Interested parties who wish to provide
4 comments can contact our office requesting time after
5 the meeting announcement is published in The Federal
6 Register. We also set aside 10 minutes at the end of
7 the day for members of the public who wish to make a
8 comment. Written comments are also welcome.

9 The ACRS section of the U.S. NRC public
10 website provides our Charter, Bylaws, letter reports,
11 and transcripts of all full and subcommittee meetings,
12 including the slides presented there.

13 This meeting was not noticed in The
14 Federal Register because of the closure of the federal
15 government. But we are here today. The meeting has
16 been noticed on the NRC public website, and some
17 members of the public have been notified of this
18 meeting directly. The meeting was announced as an
19 open/closed meeting. And let me take a break right
20 here and mention how we're going to do that. It's a
21 little different than shown in the agenda.

22 At some time during the first session this
23 morning, we will reach a point where NuScale will go
24 into a proprietary briefing. At that point, we'll
25 close the meeting and turn off the public phone line.

1 We expect to be back following lunch at 12:45. It
2 might be as late as 1:00. But, at that time, the
3 public phone line will be open again, and it will be
4 an open meeting. And there will be another closed
5 session at the end of the day today. But, before we
6 go into that closed session, we'll ask if there are
7 comments from members of the public.

8 No written statement or request for making
9 an oral statement to the Subcommittee has been
10 received from the public concerning this meeting.

11 A transcript of the meeting is being kept
12 and will be made available. Therefore, we request
13 that participants in this meeting use the microphones
14 located throughout the meeting room when addressing
15 the Subcommittee. Participants should first identify
16 themselves and speak with sufficient clarity and
17 volume so they can be heard.

18 And for you guys who have never been here
19 before, today in this room the mics never shut off.
20 So, you'll always be on.

21 We have a bridge line established for the
22 public to listen to the meeting. To minimize
23 disturbance, the public line is kept in a listen-in
24 mode until we invite comments.

25 To avoid disturbance, I request that

1 attendees put their electronic devices in the off or
2 noise-free mode.

3 We'll now proceed with the meeting. But,
4 before I turn it over to NuScale, there are a couple
5 of things I want to mention.

6 I received some notes from members of the
7 Committee, trying to read through the DCD and the SERs
8 on this work. From there, some things aren't
9 completely clear.

10 I'll just mention to everybody, only three
11 or four of us who are now on the Committee were on the
12 Committee in July of 2015, when we visited the plant.
13 And I think only two of those three or four actually
14 went there.

15 We saw some things that you can't find in
16 the DCD or the SER. If you read a little further,
17 like the report we were provided on staffing, you'll
18 find another reference to another report called
19 "Conduct of Operations," which, unlike Chapter 13,
20 really tells us how you operate the plant inside the
21 control room.

22 The one thing that was quite confusing to
23 many of us was, with six operators, kind of who does
24 what? And NuScale and the staff will touch on this
25 today, but they might not go quite as far. So, I want

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1 to get this out for all of you at this point.

2 There are six SROs. Three of them
3 function much like in other plants. The shift
4 manager, the control room supervisor, and the STA,
5 pretty much the same as we're used to seeing. There
6 are three ROs, and those reactor operators, one of
7 them -- they designate him RO1 in that report I
8 mentioned. It's RP-0215-10815, "Concept of
9 Operations". It tells you how it works the way we saw
10 it.

11 And how it works is that that first
12 operator, RO1, runs all 12 plants. You don't divvy
13 the reactors up among all six operators. One person
14 runs all 12.

15 When you read the SER, you'll see a lot of
16 "We meet the criteria laid out in this NUREG" and in
17 this B&O report, but you don't see anything of the
18 sort that, when I was there, gave me some confidence
19 in this approach.

20 And the two things that really anchor this
21 are kind of the cleverness of the main control panel
22 with different colors, different flashing signals. I
23 don't remember about the sounds. But it made it very
24 easy for the one operator who's running all 12 to
25 identify problems in any of the 12 units and sort of

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1 have an initial ranking of what could be most
2 important. That lets them do what they want to do and
3 focus properly.

4 The second thing is, the philosophy tends
5 to be, if things get busy, because you can with this
6 plant, you throw a switch and you go into the passage
7 shutdown mode, passive cooling. And then, the
8 operator can pretty much ignore that unit while they
9 work on others. So, if they get an accident on one
10 unit, the one guy takes it. If it gets too confusing
11 or they get something on another unit, he hands it
12 off. And when it reaches the point that there's more
13 than people can do, they put them into the safe mode.

14 And you don't find that anywhere in the
15 stuff we've read. I'm curious as to why not. I'm
16 going to ask the staff about that when we get to
17 Chapter 18, because it seems to be the key to making
18 this thing work properly.

19 All of that said, it gives you some
20 perspective for when we get to Chapter 18. And at
21 this point, we're back to Chapter 13.

22 And I'm going to turn it over to Doug
23 Bowman, who will do our first presentation.

24 Doug?

25 MR. BOWMAN: Good morning. My name is

1 Doug Bowman. I'm the Supervisor of Plant Operations
2 at NuScale Power.

3 Dr. Bley, I appreciate all your questions,
4 and I think we'll answer some of them in this
5 presentation. But, of course, if we don't, we know
6 we'll get questions from you.

7 And we will go into the background and
8 history of how, a little bit about how we arrived at
9 the conduct of operations that you guys observed in
10 2015.

11 A little bit about me. I have been at
12 NuScale for nearly five years now, working either as
13 an individual contributor performing human factors
14 engineering and operations work or now in my role as
15 the Supervisor, Plant Operations. Prior to that, I
16 worked on the commercial side of the nuclear industry
17 for 24 years. I was Senior Reactor Operator licensed
18 at both D.C. Cook and Byron, held many different
19 positions at both plants from engineering through
20 operations, work control, training, a wide variety of
21 positions, and took the opportunity in 2014 to come to
22 NuScale and work.

23 Also with me today is Ryan Flamand. Ryan,
24 you want to talk a little bit about yourself?

25 MR. FLAMAND: Sure. My name is Ryan

1 Flamand. I work with Doug in plant operations, have
2 done a lot of the work on HNB as an individual
3 contributor.

4 Specific to Chapter 13, I was involved in
5 the development of conduct of operations, which will
6 be part of what the question I think we might be able
7 to answer today or help answer; and also, a generic
8 technical guidance, which is the basis for the
9 emergency operating procedures.

10 Previous to that, similarly to Doug, I
11 have 15 years commercial operating experience as a
12 Senior Reactor Operator licensed at Palisades. I also
13 was a reactor operator and also an equipment operator
14 for a period of time.

15 Previous to that, I was six years in the
16 Navy, a reactor operator on the USS California.

17 So, that's it.

18 MR. TOVAR: Good morning. My name is Tim
19 Tovar. I'm the Manager of Plant Operations at NuScale
20 Power.

21 I've been with the company for about six
22 and a half years now. My background, I started with
23 a mechanical engineering degree from RPI. I went into
24 the Navy to help pay for that, actually. Seven years
25 in the Navy as a submarine officer, was a radcon

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1 officer on a tender during my shore tour for a couple
2 of years.

3 Then, went into civilian nuclear power,
4 licensed at Robinson Nuclear Power or Robinson Nuclear
5 Plant as a Senior Reactor Operator. Held the
6 positions of Operations Manager and Radiation
7 Protection Manager there. Went to First Energy and
8 was the Fleet Outage Manager for three years there,
9 and then, came to NuScale.

10 So, I've got a C7, 14, and 3, and six and
11 half years' worth of nuclear experience.

12 MS. FOSAAEN: Hi. Good morning. Carrie
13 Fosaaen. I am a Licensing Supervisor with NuScale.
14 I've been there for three and a half years now.

15 Prior to that, I was in commercial nuclear
16 as a licensing individual at Monticello Nuclear
17 Generating Plant. And previous to that, I did a year
18 in decommissioning.

19 My bachelor's is in nuclear engineering
20 and a master's in health physics.

21 And I've been involved with this team for
22 about the last year.

23 MR. BOWMAN: So, I'll go a little bit more
24 into our operational staff --

25 CO-CHAIR BLEY: But, before you go

1 ahead --

2 MR. BOWMAN: Sure.

3 CO-CHAIR BLEY: -- if we raise any
4 questions that your answers would move into the
5 proprietary area, it's up to you to say we'll pick
6 that up in the closed session. Okay?

7 MR. BOWMAN: Sure. Absolutely. We'll
8 protect our proprietary. Thank you.

9 I went through the introductions. I'd
10 like to go through a few more introductions. I
11 believe we're a little different than a typical
12 nuclear vendor. So, right now on staff, the group
13 that did the work, we have 18 previous licensing
14 director operators. We've held licenses at a wide
15 variety of plants covering three different vendors.
16 So, you can see the list up there on the board. In
17 total, we have 569 years of nuclear experience and 16
18 former Navy nuclear veterans.

19 So, our background I believe is a little
20 unique compared to the typical vendor. We have a lot
21 of operations background, and operations was brought
22 in very early to the NuScale design, recognizing the
23 unique challenges that were going to be placed by the
24 fact that we believe we needed fewer operators to
25 operate these plants.

1 A little on logistics. So, "Conduct of
2 Operations," Chapter 13, is primarily a collection of
3 combined operating license holder actions to describe
4 the structure of the organizations and programs that
5 support plant operations. It also gets into
6 qualifications and training of the individuals in the
7 organizations.

8 So, as Dr. Bley mentioned, this
9 presentation is in two parts. There will be a non-
10 proprietary portion first, which will be actually
11 relatively short, and then, we have a proprietary
12 version, which really goes deeper into the details of
13 the Generic Technical Guidelines.

14 And the Security and Fitness for Duty
15 Programs will not be covered as part of this.
16 Although they are a part of Chapter 13, we are not
17 covering them in this presentation.

18 All right. So, organizational structure.
19 Section 13.1 included "See all actions to describe the
20 corporate or home office management and technical
21 support organizations, onsite operations
22 organizations," and then, the qualifications for each
23 management -- all the positions that are listed there.

24 13.2 lists all the training programs. So,
25 this includes the initial and continuing License

1 Training Program for the Reactor Operators and Senior
2 Reactor Operators. And then, there's a list of
3 programs that are required for initial and periodic
4 retraining in qualifications. This is the list from
5 10 CFR 51.20, the list of training programs that are
6 required.

7 Section 13.3 covers the emergency plan.
8 It does include some description that comes out of the
9 standard plant design. And that really is regarding
10 the Technical Support Center. So, it provides
11 descriptions for the ventilation systems for the
12 Technical Support Center, communication systems, the
13 TSC workstations, the emergency response data systems.
14 And then, there are three COL actions contained in
15 there to develop the Operation Support Center, the
16 emergency offsite facility, and the overall emergency
17 plan.

18 MEMBER CORRADINI: I had a question, but
19 I'm not sure if -- are you done with 13.3 now --

20 MR. BOWMAN: Yes.

21 MEMBER CORRADINI: -- and you're about to
22 go to 4?

23 MR. BOWMAN: I'm going to move on.

24 MEMBER CORRADINI: Okay. So, you have a
25 plethora of acronyms. Explain to me what an "ISV" is,

1 and when is it done? Because that connects to the
2 open item in this section.

3 MR. BOWMAN: Correct. So, Integrated
4 System Validation is the final test of the Human
5 Factors Engineering Program. Integrated System
6 Validation is a test of the procedures, the human-
7 system interface, and the operators, to ensure that
8 they can safely operate the plant under the conditions
9 we've set. So, that is an open item because we
10 completed testing in September of this year, and we
11 are currently working through completing the report of
12 that testing effort.

13 MEMBER CORRADINI: Oh, so on your
14 simulator, or what I remember to be the thing, it has
15 already been done? You just have yet to document it
16 and show it to the staff?

17 MR. BOWMAN: That's correct. We've
18 completed all the testing required for ISV.

19 MEMBER CORRADINI: Okay. Okay. Somehow
20 that escaped me.

21 MR. BOWMAN: Okay.

22 CO-CHAIR BLEY: Well, it's not in what we
23 read.

24 (Laughter.)

25 MR. BOWMAN: It isn't. It is an open

1 item.

2 MEMBER CORRADINI: Okay. You helped me.
3 Thank you.

4 CO-CHAIR BLEY: So, this -- and we'll ask
5 the staff about this -- if this is complete, when you
6 respond finally to the staff, that hits an awful lot
7 of the open items that are in the SER.

8 MR. BOWMAN: That's correct.

9 CO-CHAIR BLEY: Maybe 80 percent of them.
10 I'm just guessing off the top.

11 MR. BOWMAN: And I actually have a slide
12 at the end that I'll go through and --

13 CO-CHAIR BLEY: Oh, okay.

14 MR. BOWMAN: -- delineate each open item,
15 how we believe it's going to be closed.

16 CO-CHAIR BLEY: We had a question from one
17 of the members who's not actually here and a couple
18 from other members. They pointed to this section.
19 So, I think that's a place to bring it up.

20 Here it speaks of the fact that the number
21 of modules is up to 12. The question was, is this the
22 place that's actually set or is it set somewhere in
23 other parts of the DCD?

24 MR. TOVAR: The --

25 CO-CHAIR BLEY: Yes, go ahead.

1 MR. TOVAR: To answer your question, the
2 design certification application is written around 12
3 modules. And our staffing was geared towards
4 operating up to 12 modules.

5 CO-CHAIR BLEY: And if you operate less
6 than 12 modules, if somebody puts in less than 12, two
7 questions came up. One is -- well, three questions
8 maybe -- one is, do you operate the way you planned to
9 operate with 12 with a fewer number, if there's only
10 one or two or three? The same staffing? Or would
11 that be a COL thing that somebody might want to
12 change?

13 MR. TOVAR: For the licensed operator
14 staffing --

15 CO-CHAIR BLEY: Yes.

16 MR. TOVAR: -- what we have written is up
17 to 12 operating --

18 CO-CHAIR BLEY: So, 1 to 12 --

19 MR. TOVAR: Correct.

20 CO-CHAIR BLEY: -- it applies?

21 MR. TOVAR: If there's any operating
22 units, then, currently, we have the requirement for
23 six licensed operators.

24 CO-CHAIR BLEY: Another question that came
25 up was, if a utility decides to build one of these

1 with less than 12 modules -- say they're going to do
2 three at first -- are all of the common systems going
3 to be installed at that time? Or could there be
4 something less than what we see for the supporting
5 systems?

6 MR. TOVAR: I would say that we don't have
7 any official like written documentation for this, but
8 the reactor building and all the common systems
9 associated with that would have to be built and,
10 essentially, installed. The option to only build --

11 CO-CHAIR BLEY: As described, all of them?

12 MR. TOVAR: As described. There may be
13 some components that may be installed at a later date,
14 but, essentially, all the piping and everything that
15 goes through the walls, all that would have to be
16 really laid out.

17 The option, if we only had six or less
18 modules to only build one of the turbine buildings,
19 and then, build the second turbine building at a later
20 date, would be a possibility. But, again, this is --

21 CO-CHAIR BLEY: Is that something that
22 would require an amendment to the -- well, I forget
23 how you describe it -- that would come up during the
24 COL, and it would be an exception to the design cert?

25 MR. TOVAR: I think that there would have

1 to be a bit of engineering work if there was plans to
2 build like a two-unit, four-unit, six-unit NuScale
3 plant. Because there would be some impacts, if
4 nothing else, from the seismic aspect of it. If you
5 only built one building, it may have some impact.

6 But, again, I'm getting out of my area of
7 expertise, and we don't have anything written down as
8 far as this goes. The design certification
9 application is for 12 units, and the understanding is
10 that, to make it cost-effective, the customer is going
11 to install over a period of time the 12 units.

12 CO-CHAIR BLEY: The 12 units? Well, we'll
13 take this to the staff, too, because it seems to me,
14 if you did something less, it would mean an exception
15 to the design cert, a change to the rule at the COL
16 stage. So, we'll see what they have to say about
17 that.

18 And the other question I remember people
19 passing around was: suppose you built three, and
20 then, you're going to add another three. Nobody was
21 able to find anything that described, if you're doing,
22 essentially, construction work while you're operating
23 three units, three modules, what kind of controls need
24 to be in place to allow that construction work to go
25 ahead? And we didn't see anything written about that,

1 or at least I didn't.

2 MR. TOVAR: Correct. We have COL action
3 items that describe generating the procedures that
4 would control those activities. So, we don't
5 currently have any of those procedural guidance, any
6 of that procedural guidance --

7 MEMBER CORRADINI: So, that falls to the
8 owner/operator of the plant --

9 MR. TOVAR: Correct.

10 MEMBER CORRADINI: -- to define how they
11 would modify or even stop operation, commercial
12 operation of a plant as certain construction
13 operations are taking place? They would have to
14 develop the procedures to decide what turns on and
15 what turns off, et cetera?

16 MR. TOVAR: Correct. In our construction
17 plans, it's always been envisioned that we would have
18 the facility built. We'd install a module, and while
19 modules were being installed, subsequently, that we
20 could start up and operate the modules that were ready
21 to be operated. So that we could, basically, be
22 commercially generating power and a revenue stream as
23 the rest of the plant was built out.

24 CO-CHAIR BLEY: So, as you see it, this is
25 an item for the COL to deal with?

1 MR. TOVAR: Yes, as far as the specific
2 procedures --

3 CO-CHAIR BLEY: Because construction work
4 could be threat to the operating.

5 MR. TOVAR: Correct, but --

6 CO-CHAIR BLEY: And it's dependent on how
7 it's done.

8 MR. TOVAR: If you look at the actual what
9 it takes to install a module, it's very similar,
10 essentially, to a refueling actually.

11 CO-CHAIR BLEY: A refueling, yes.

12 MR. TOVAR: And you're limited to moving
13 one module at a time, just due to the equipment to
14 assemble those modules. So, it really is no different
15 from the refueling activities that would take place.
16 And you could have up to 11 modules operating when
17 you're moving the module to do the refueling
18 activities.

19 MEMBER SKILLMAN: I have a bunch of
20 questions, but every question I have is from
21 documentation that is marked confidential. So, I'm
22 going to wait until the end for that confidential
23 period. But let me ask one or two questions.

24 A hundred and sixty megawatt reactor,
25 small by comparison. NuCore's are up to 4,000

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1 megawatts. You were at Cook and Byron. Byron is a
2 big plant, real big. And you were at Palisades,
3 medium size. And you were at Brunswick.

4 MR. TOVAR: No, I was at Robinson.

5 MEMBER SKILLMAN: Robinson.

6 MR. TOVAR: Yes.

7 MEMBER SKILLMAN: Medium big.

8 MR. TOVAR: Right. I also spent time as
9 a Fleet Outage Manager at Perry, Davis-Besse, and
10 Beaver Valley.

11 MEMBER SKILLMAN: Well, big, middle, and
12 small.

13 (Laughter.)

14 I was on the Oversight Board for FENOC for
15 a long time.

16 But here's where I'm going with my
17 question. Please stick with me. A hundred and sixty
18 megawatt reactor. Between the three of you, you've
19 got some significant PWR experience with big machines.
20 What is it in the FENOC -- excuse me -- in the NuScale
21 training that is going to make sure that the one
22 reactor operator that might be looking at 12 plants on
23 the indications that Dr. Bley was talking about isn't
24 complacent in thinking he or she is looking at process
25 heating units versus a live core reactor that has real

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1 consequences for an accident?

2 I ask this question based on the No. 1
3 lesson we learned out at TMI-2, and that's respect for
4 the technology. I think we're so comfortable with no
5 scrams. We operate 24-month fuel cycles. We go
6 almost breaker to breaker. We have crews on watch
7 right now that have never experienced a trip. So,
8 it's easy to get lulled into believing an accident
9 can't happen, a trip won't happen, and when it does
10 happen, all the automatic systems are going to take
11 over.

12 Here is a man or a woman looking at one,
13 two, three, six, maybe 11 units, with a module being
14 moved. What makes sure that individual really
15 understands that this is not just a little process
16 heating unit, 160 megawatts, but this is a live core
17 plant that can have a loss-of-coolant accident, even
18 though it's very, very improbable and you only have
19 these two high-impact human factors items? What keeps
20 them focused?

21 MR. TOVAR: A couple of things. One is,
22 I think one of the things that we did bring to NuScale
23 is the operating experience. Now the 18 licensed
24 operators, previously licensed operators, that we saw
25 is just the people that are currently on staff and

1 currently within the operations group. That doesn't
2 take into account Dale Atkinson, who was the Chief
3 Nuclear Officer up at Energy Northwest. It doesn't
4 take into account other folks that are scattered
5 throughout the organization with their operating
6 experience. And it doesn't take into account the
7 people that have cycled through our organization that
8 have had tons of operating experience and input into
9 this.

10 So, one of the things that we're very
11 proud of is that operating experience, that we have
12 baked in a lot of the human factors into the human-
13 system interface that helps as far as reducing human
14 errors and, basically, ensures that the operator is
15 less likely to make mistakes.

16 So, we do those things, but in Chapter 13
17 it's training. Now there is a COL action item to
18 develop that. I certainly would expect that we carry
19 on the current culture in the nuclear industry in
20 training our operators to understand that nuclear is
21 special. Reactivity, radiation, residual heat, and
22 that they fully understand and internalize that, the
23 special nature of that.

24 I think the operating experience that we
25 have with Fukushima, with TMI, with Chernobyl, and the

1 realization that an event like Fukushima can happen
2 and whole countries can shut down their entire nuclear
3 industry, essentially. You know, Germany is an
4 amazing example of that, where they have taken and
5 said that they're going to shut down all their nuclear
6 power plants. It's incredible.

7 So, we have the use of OE that we have
8 also incorporated into our design and we'll
9 incorporate into our training, to make sure that folks
10 understand those important aspects of nuclear power.

11 Then, of course, we have the regulator
12 that essentially enforces that, to make sure that we
13 have programs that do incorporate operating experience
14 and the training programs are accredited, and we have
15 the operators who are licensed and have to go through
16 that process. So, there's a lot of checks and
17 balances to make sure that, as NuScale grows up and
18 actually starts to operate, that we do incorporate the
19 respect for nuclear and make sure that we don't become
20 complacent.

21 The fact that we have six licensed
22 operators and the oversight from a shift technical
23 advisor, the concurrence advisor, shift manager, all
24 in the control room watching these folks as they
25 control the reactors also is very similar to a current

1 control room. And I'm sure we'll carry on that
2 "nuclear is special and deserves respect" mentality.

3 MEMBER SKILLMAN: I appreciate the
4 explanation. Let me kind of hang onto this topic and
5 pull one more string. And I don't think this is
6 proprietary. If it is, then I'll wait for later.

7 It appears as though the whole conduct of
8 operations is designed around three critical safety
9 functions: reactivity, decay heat removal, protection
10 of the containment, those three. Is there room for
11 any others? If I look at your PRA, if I look at your
12 Chapter 15, if I look at your Chapter 18 and your
13 Chapter 13, my view is there's something missing.

14 And here's what I think it is: if you
15 have knowledge of Millstone, what got Millstone into
16 trouble was that they were moving fuel before 96
17 hours. Remember that? They had not allowed that fuel
18 to decay.

19 I know of no other facility where you can
20 have a live reactor and you can be moving 36
21 assemblies 25 or 30 feet away from that live reactor.
22 And you do that with a 734-ton module. You can be
23 actually emplacing a new one that's fresh or removing
24 one that is decaying to your maintenance stand.

25 Doesn't that create a different type of

1 safety function independent of your Chapter 19 that
2 says it can't happen? Isn't that a different, a
3 fundamentally different environment?

4 Think about it. You're on watch at Byron.
5 When you move fuel, the head's off or the head's on.
6 The fuel is in the pool. And you're back to Ops.
7 That fuel is being handled by someone else. It's not
8 your operators. Or, if it is, they're not on shift
9 for the reactor. They are working with maintenance or
10 they're working with other crews.

11 Here you're actually moving a module
12 adjacent to one, two, five live modules. Is there
13 another critical safety function beyond reactivity,
14 decay heat removal, and containment that deserves a
15 different level of attention and perhaps a different
16 piece of staffing?

17 MR. TOVAR: I believe I understand your
18 question. I think the answer is, no, that there's not
19 another critical safety function. I think it's an
20 important aspect of our design that needs to be
21 understood and controlled. I think that any
22 technology has risks associated with it. When you are
23 refueling a reactor and lifting the head over that
24 vessel, there's inherent risks that go with that.

25 MEMBER SKILLMAN: But you're not lifting

1 over a vessel here. You've got four or five or six or
2 11 living, breathing, 160-megawatt plants, cores, and
3 you're moving a 734-ton machine 25-30 feet away. And
4 the protection for that is your crane, your super
5 single-failure-proof crane.

6 MR. TOVAR: Well, we have training,
7 qualifications, and our NAV1 crane.

8 MEMBER SKILLMAN: And I'll bet if one of
9 you had been at ANO-1, you might be thinking twice
10 about the answer to my question. I think the crane
11 issue and module handling may have a requirement for
12 a CSF, in addition to the three upon which you have
13 your staffing. Let me ask you to consider that before
14 you reject it.

15 MR. TOVAR: I struggle to differentiate
16 too much between a current operating plant and the
17 actions that they take when refueling and lifting a
18 heavy load over the core, and certainly we've had --

19 MEMBER SKILLMAN: Is that core at power?

20 MR. TOVAR: No, sir.

21 MEMBER SKILLMAN: I didn't think so.

22 MR. FLAMAND: I think it's a great
23 question and it's very thought-provoking. One thing
24 I would say is, to put it in perspective as well,
25 those three safety functions -- and maybe this doesn't

1 apply to the question -- do apply to each of the
2 individual operating units. So, it's not that there's
3 three safety functions as a site. So, if something
4 were to happen and that crane affected one of the
5 other units, those have independent three safety
6 functions. So, if it affected containment or if it
7 affected reactivity, that would be shown for that
8 unit's safety function.

9 The other piece I guess I'd like to just
10 bring up is, because we've had discussions on how to
11 generate three -- again, that's different from other
12 designs. Some aspects of what would be traditional
13 safety functions have been incorporated.

14 So, for instance, what came to mind when
15 you were talking about refueling is water level and
16 how much water is there while I'm doing this refueling
17 activity, so that I have shielding for the folks
18 above, and all that. There's tech specs for that
19 ultimate heat sink level. And the ultimate heat sink
20 is incorporated into the core heat removal safety
21 function.

22 So, sometimes our simplification of three
23 safety functions -- and I don't know how much you've
24 had a chance to look at it, but it might include
25 things that might traditionally be -- like at my

1 plant, it would have been an ultimate heat sink kind
2 of safety function on its own, where that's part of
3 heat removal for us. I don't know if that helps.

4 MEMBER SKILLMAN: No, I agree with you.
5 The CSFs are applied to each core. I got that. I'm
6 kind of saying, what happens when your crane doesn't
7 perform the way it should and you end up with a
8 dropped module that might affect two or three
9 operating modules? That's where I'm really going with
10 this.

11 Let me stop here because all my homework
12 is really kind of peeling back on this one issue, not
13 to give you the raspberries, but just to raise this
14 one issue. The NuScale design is unique in the whole
15 world because you're moving a 734-ton machine near
16 operating cores contemporaneously. And I don't think
17 there's anything fundamentally wrong with that, but I
18 believe that that develops perhaps some scenarios that
19 have not been addressed in staffing, have not been
20 addressed in Chapter 18.

21 So, I'm raising it here on Chapter 13
22 because you might say, as head of Ops, you know what,
23 we might peel out special teams to do those movements,
24 and we might consider the single-failure-proof crane
25 from a different perspective. It might have some

1 safety functions that the NUREGs really might not have
2 explored for operating plants.

3 I can tell you for a fact the TMI-2
4 cleanup was stopped for three months because we
5 couldn't get the crane qualified. I can tell you for
6 a fact that TMI-1 refueling was halted because the
7 brakes didn't set on the puller crane and it was
8 inching down one inch at a time, and we didn't have a
9 safe place to put that head, 160 tons.

10 So, I've been through a number of these
11 events at Three Mile and in the consulting that I did
12 for 10 years at other plants. It's almost as if the
13 crane issues are kind of aux operators take care of
14 that; contractors take care of that.

15 But, in the NuScale design, the crane is
16 front and center of the operating units. And I
17 believe that's different, and it might require a
18 thicker magnifying glass as you put together your
19 staffing plan and as you look at Chapter 18.

20 MR. TOVAR: One thing I will mention is
21 that NuScale does envision having a dedicated
22 refueling team assigned to it with a licensed operator
23 on that team.

24 MR. BOWMAN: That was going to be my
25 mention, too. We right now in our staffing plan

1 envision a Senior Reactor Operator, either fully
2 licensed or a limited fuel handling license, in charge
3 of any module movement. So, indeed, Operations will
4 be, at a minimum, supervising that activity.

5 In the current fleet, if they did an
6 activity like that -- and I don't believe this would
7 change for us -- you would put together a team to do
8 that activity. They would be briefed. They would be
9 high-level to management oversight to ensure that that
10 activity went properly and that appropriate
11 contingency actions were put in place.

12 But it is a normal activity to happen.
13 But all those pieces have to be in place for that to
14 go on. So, there's a great deal of oversight that I
15 would anticipate in place for any module movement that
16 went on at a NuScale plant.

17 MEMBER SKILLMAN: But let me make my final
18 point. And that is, what's different here is you're
19 moving adjacent to live cores at power. When we did
20 it, the reactor was shut down. We would be on decay
21 heat for two weeks. We had all of the protections and
22 all of the admin that you just mentioned, Doug. So,
23 I fully understand that.

24 What I'm saying is, in this design, there
25 is a unique feature that may need a different level of

1 attention. It isn't going to be normal ops when
2 you've got 11 machines that are at power and you're
3 dragging this 734-ton machine 25 feet away from all 11
4 of them.

5 So, let's pick it up in the proprietary
6 session when I can refer to the documents. But I
7 really challenge you on that.

8 Thank you.

9 MR. TOVAR: Thank you.

10 MEMBER MARCH-LEUBA: Don't go so fast.

11 Mr. Chairman, I noticed he has some
12 questions for the closed session. I have some
13 questions for the closed session. And I noticed that
14 we have half an hour scheduled for the whole thing.
15 So, we may want to be flexible.

16 CO-CHAIR BLEY: We have to control things
17 a bit. So, let's see what happens.

18 MEMBER MARCH-LEUBA: Well, I mean, I think
19 the closed session would probably be more important
20 than the open session.

21 CO-CHAIR BLEY: Thank you.

22 MEMBER MARCH-LEUBA: But, that said, I
23 have an open session question, too.

24 CO-CHAIR BLEY: He's only got like two
25 more slides for the open session.

1 Go ahead.

2 MEMBER MARCH-LEUBA: So, don't get me
3 wrong, I'm a computer guy. I love computer
4 procedures. Data cycles is something I admire. I
5 mean, once I was in a 767 flight simulator in the
6 lounge in the Rome Airport, and they let you go and
7 play with it. And they let me land the 767 on the
8 Venice Airport, and I accomplished it. All you have
9 to do is push one button and extend the flaps. That's
10 all you have to do to land a 767. And I messed up 50
11 percent of the thing; I pulled the flaps too fast.

12 (Laughter.)

13 But, with that said, in your training, the
14 problem I'm having is these computer procedures are
15 great, but we claim, I think, to minus 25 failure
16 probability, which is really currently low. And when
17 you claim those low probabilities, you have to worry
18 about -- and I'm going to raise Charlie's blood
19 pressure right here -- you're letting the computer run
20 your facility. They exercise a computer that knows
21 all the signals, knows all the procedures, and tells
22 you what to do.

23 In the training, who gets precedent, the
24 computer or the pilot or the operator and the paper
25 procedures? If the operator with the paper procedures

1 sees, hey, the computer is telling me something is
2 wrong, and I don't believe you, when you're training
3 who takes precedent?

4 MR. BOWMAN: So, I can try to answer part
5 of that. In the Generic Technical Guidelines, we
6 have, obviously, the -- I'm going to be careful here
7 not to pass into the proprietary realm -- the HSI
8 evaluates the critical safety functions we've
9 discussed and determines if one is being challenged,
10 and provides the operator with that information. And
11 then, he has to go take action.

12 Also, he's basing all that information
13 off of our best qualified instrumentation; the
14 computer is. And then, right now, right now the role
15 of the STA is the STA backs that up. So, it provides
16 an independent, the STA provides an independent check
17 of the human-system interface to ensure that the
18 correct decision is being made within the EOPs.

19 So, he is independently looking at his
20 best indications in a different manner than how the
21 HSI is looking at them to back it up. And that's one
22 example I can give you where we have the human built
23 in to back up the computer in this case.

24 MEMBER MARCH-LEUBA: But is that part of
25 the training?

1 MR. BOWMAN: Yes.

2 MEMBER MARCH-LEUBA: Do you emphasize,
3 "Don't believe the computer; rely on it, but don't
4 believe it."?

5 MR. BOWMAN: Correct. So, any training
6 program I've been involved with, you have to believe
7 your indications, unless you can be shown that they
8 are wrong. But you have to question your indications
9 all the time to ensure they're working properly.

10 MEMBER MARCH-LEUBA: It's different to
11 read a needle with what the pressure is and having a
12 complex computer algorithm --

13 MR. BOWMAN: Right.

14 MEMBER MARCH-LEUBA: -- running on God
15 knows what platform, that can be on a blue screen of
16 death anytime. If you claim only 10 to the minus 3
17 probability of failure, I'll give you that, but when
18 you claim 10 to the minus 25, nothing has that
19 probability of failure.

20 And while you're thinking, let me give you
21 an example of that Air France flight that was going
22 over there in the Atlantic. And they were going at
23 40,000 feet and 600 miles per hour. And the computer
24 decided that they were stalling. And the computer and
25 the pilot, they started fighting with each other, and

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1 at the end the plane ended up on the bottom of the
2 Atlantic.

3 MR. BOWMAN: So, I'll go back. I'll try
4 to do a better explanation. What the STA is looking
5 at is, physically, not a computer per se; it is part
6 of our fuel programmable gate array system, part of
7 our safety system. He's looking at those indications
8 that are the best qualification that he can see in the
9 control room. The computer algorithm is taking that
10 information separately and doing an assessment.

11 MEMBER MARCH-LEUBA: But the problem I'm
12 having --

13 MR. BOWMAN: But that's the safety, that's
14 the safety aspect of it.

15 MEMBER MARCH-LEUBA: For the last 15
16 years, I've been an operator in this plant, and the
17 computer has always been right. And suddenly, the
18 computer gets a wrong indication because a mouse chews
19 through a cable, or something.

20 MR. BOWMAN: Sure.

21 MEMBER MARCH-LEUBA: That's going to be
22 part of the training. Say, "Rely on the computer, but
23 always verify." And I get the idea that maybe we have
24 too much overreliance on the computer.

25 MR. TOVAR: I'll say that Chapter 13 has

1 COL action items for the development of the training
2 program. But, because we completed the Integrated
3 System Validation, we had the opportunity to develop
4 quite extensive training for the Integrated System
5 Validation operators. We hired 22 contract operators
6 and put them through a training class that was,
7 roughly, seven months long -- five and a half months
8 long. Trained them on the NuScale design. They had,
9 most of them, all except for two had no background in
10 the NuScale design. So, we trained those folks.

11 And one of the things that the NRC staff
12 expressed during our pre-application engagements was
13 exactly that, a concern over failure of the I&C
14 system, and so forth. So, during that training, we
15 did train them on failures of the I&C system. And we
16 understand the importance of the operators to be able
17 to function and keep the core safe, even in the worse-
18 case I&C failures. And in some cases, we took,
19 essentially, the entire control room and took that
20 out.

21 To me, it's very confusing, as an
22 operator, to have those displays up and displaying,
23 but you know that the system has failed. And what
24 it's showing you is a frozen screen from 10 minutes
25 ago. So, to me, that's very disorienting, as an

1 operator.

2 But the crews that we put through that,
3 the training and the actual testing performed those
4 actions well.

5 CO-CHAIR BLEY: Let me follow that up just
6 a second. I'll get right back to you.

7 If you fail the whole computer system all
8 at once and it goes black, that's really not the worst
9 thing.

10 MR. TOVAR: Yes.

11 CO-CHAIR BLEY: The worst thing is when
12 you get something in between. Some things are right;
13 some things are wrong.

14 MR. TOVAR: Sure.

15 CO-CHAIR BLEY: Did you do any of that
16 kind of testing?

17 MR. FLAMAND: So, we did do -- and I don't
18 know if we're going to talk about this in one of the
19 slides -- but you might back up a little bit. The
20 control room has multiple different computer systems.
21 That's the first time I've heard the low probability
22 number and it's pretty good. But it's probably
23 because each unit has what's called module control, a
24 non-safety computer system with redundant components
25 within it and redundant servers. So, there is

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1 failover and redundancy there.

2 To get to your question, during this ISV
3 testing and previous staffing testing, we did do where
4 we took a workstation down or we took one of the
5 servers down to see what would happen. The effect and
6 how we showed it wasn't much because it goes over to
7 the failover. And then, we also showed, if you take
8 everything down, and that, basically, as you kind of
9 alluded to, isn't as hard.

10 We also showed -- and I think this was
11 just probably from not the official OE, but just
12 operator daily OE. I'm used to, hey, this valve
13 didn't move because it's been in the same position for
14 the last year, and now it gets a demand signal. So,
15 we tried to show those kinds of failures. So, hey, if
16 an automation expects a valve to respond when it
17 didn't, you know, there's ways of timing, or whatnot,
18 that the automation can help the operator.

19 And then, if you're out of bounds, again,
20 these computer-based procedures are non-safety, and
21 the safety systems are separate and --

22 MEMBER MARCH-LEUBA: The problem I'm
23 having is that software has ways of taking you and
24 failing in the most unusual ways. Really, with
25 software, my car-driving software, I mean, it's great.

1 But --

2 MR. BOWMAN: But, you know, highlights of
3 the system that the STA is verifying is not software-
4 based. It does not use software. The system that the
5 STA is using to verify the indications is not
6 software-based. It is programmable gate arrays. So,
7 they do not run software. They're really running a
8 logic network. It's a very different technology than
9 a software-based computer.

10 MEMBER MARCH-LEUBA: If PGAs are software,
11 they cannot even modify this thing.

12 MR. BOWMAN: Right, but they're burnt in
13 and they can't be subject to code. They can't be
14 modified once they've been tested and verified.

15 MEMBER MARCH-LEUBA: Yes, but there is a
16 combination of variables that makes the logic give you
17 the wrong answer.

18 MR. BOWMAN: Right. But, again, I can't
19 overstate the fact that the STA is independently
20 assessing those variables and looking at them in an
21 entirely different way than the software is.

22 MEMBER MARCH-LEUBA: And to the 10 to the
23 minus 3, I'll give you that anytime. We don't even
24 have to justify it. But 10 to the minus 25, no.

25 MEMBER BALLINGER: I would suggest that

1 somebody on your staff get a hold of a book called The
2 Glass Cage.

3 CO-CHAIR BLEY: Either way, just for the
4 Committee members, Jose was right; this meeting might
5 go to 8:00 or 9:00 tonight.

6 (Laughter.)

7 At least, let's not be repetitive, if we
8 can help it.

9 MEMBER MARCH-LEUBA: We haven't started
10 the tricky questions.

11 MR. BOWMAN: Ready to go on? Okay.

12 All right. So, Section 13.4 establishes
13 the operational programs necessary to safely support
14 the plant. There's a long list of those programs that
15 have been built in the current fleet, and this is our
16 COL action item to have the COL build those programs,
17 a large range of things from pre-in-service testing
18 down to the road to fire protection, security, and et
19 cetera. So, that list is in front of you.

20 And then, plant procedures and --

21 CO-CHAIR BLEY: Can I interrupt you as you
22 begin?

23 MR. BOWMAN: Sure.

24 CO-CHAIR BLEY: This one really bothers
25 me. As you've said, you've now got 18 formally-

1 licensed operators. You've spent a lot of time with
2 trying to come up with a display that would really
3 allow the operators to follow the 12 reactors well.
4 You did a lot of training. You've experimented with
5 procedures. You've tried different kinds of manning
6 things. And finally come up with something you think
7 is pretty good.

8 And then, instead of getting a set of
9 operating procedures that match exactly what you've
10 been doing, you put this on the COL applicant who's
11 never seen a plant like this before. That bothers me.
12 I don't know why the EOPs should be a COL action item.
13 Have you got EOPs you're going to give them?

14 MR. BOWMAN: Yes.

15 CO-CHAIR BLEY: And they might modify
16 them?

17 MR. BOWMAN: Well, we have Generic
18 Technical Guidelines, just like the existing industry
19 uses, you know, Westinghouse, ERG, or GERG. So, we
20 have the basis for the procedures, and we'll provide
21 them a writer's guide on how they'll be developed.

22 CO-CHAIR BLEY: You don't actually have
23 procedures your operators have been using?

24 MR. BOWMAN: Yes, and I will get into
25 that --

1 CO-CHAIR BLEY: Yes, you don't, or, yes,
2 you do?

3 MR. BOWMAN: Yes, we do. Yes,
4 absolutely --

5 CO-CHAIR BLEY: Okay. I'll wait for
6 closed session. That's good.

7 MR. BOWMAN: Yes, I would say that's a
8 good closed session question. We answer some of that
9 in the closed session.

10 CO-CHAIR BLEY: Okay. Because I didn't
11 find much help in most of what I read.

12 Go ahead.

13 MR. BOWMAN: Okay. So, there we go.
14 Okay.

15 So, part of Section 13.5 includes the COL
16 action item to ensure plant-specific emergency
17 operating procedures are developed. And the staff,
18 during the review of that, requested that we provide
19 them a set of Generic Technical Guidelines as part of
20 the DCA.

21 So, our goals for development of these
22 were that we provide an entirely symptom-based set of
23 procedures, unlike some of the current industry which
24 uses a mix of event-based and symptom-based
25 procedures. We wanted the status to be easily

1 assessed by the operator. Given the number of units
2 they had to look at, we needed a quick assessment
3 capability. And we wanted the OPs to be fully
4 integrated in the human-system interface. And I will
5 show you that in the closed session. I think we do
6 that in the closed session.

7 And also, we wanted a single set of
8 procedures that would address all post-accident
9 actions. So, our Generic Technical Guidelines that
10 we've developed cover the legacy emergency operating
11 procedures, severe accident management guidelines,
12 LOLA or loss of large area, extended loss of AC power,
13 and extensive damage mitigation guidelines in the
14 current procedure set, which are typically broken out
15 in separate procedure sets that the operator has to
16 transition between based on conditions.

17 So, how did we start work on the
18 development of the Generic Technical Guidelines?
19 There are several pieces to this. One of them was the
20 critical safety functions that Mr. Skillman alluded
21 to. Another piece of it was, we had to go and find
22 all the actions that we had committed to in the DCA.

23 Now we present this as though we went and
24 looked for them. In all honesty, we were integrated
25 into the development of these actions the entire time

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1 they were being worked on as part of the DCA.

2 So, PRA, if they were proposing an action,
3 they would come and talk to us about what they thought
4 we should do, and we would provide a discussion and
5 some guidance on how to build that.

6 Anyway, so the places we went and looked
7 are Chapter 7, which Chapter 7 is the I&C failure
8 section where the defense-in-depth analysis is
9 contained. And there are no credited actions there.

10 FSAR Chapter 15, which is the plant design
11 basis for the design-basis events, and there are no
12 actions in there.

13 Chapter 18, human factors engineering task
14 analysis and associated reference. One of the things
15 that people probably don't highlight enough is Chapter
16 18 actually asks our subject matter experts to develop
17 actions to see if they believe there are actions that
18 need to be taken. So, we used our SMEs as well.
19 However, there are no credited actions there. We did
20 develop actions there.

21 CO-CHAIR BLEY: I'm sorry, I was saving
22 this until later. Between Chapter 13 and Chapter 18,
23 and maybe more in the SERs, if it weren't for the I&C
24 guys, I would say these reports were the most
25 cluttered with acronyms I've ever tried to find.

1 (Laughter.)

2 So, what was that last acronym you said?

3 S-E --

4 MR. BOWMAN: Subject matter experts, SMEs.

5 So, in our case, our subject matter
6 experts were the people I alluded to at the beginning
7 of the presentation, the 18 operators, former licensed
8 operators we had which developed our Chapter 18 task
9 analysis, which you can say task analysis and
10 procedures in the same breath for us. They're one and
11 the same to us.

12 So, FSAR Chapter 19, which is the PRA
13 actions, those actions assumed in beyond-design-basis
14 events. In that case, there are seven actions there.

15 And then, Chapter 20, which are the --
16 again, it is called beyond design basis, but Chapter
17 19 is the PRA evaluation; Chapter 20 is the chapter
18 where we have taken those -- for example, ELAP,
19 extended loss of AC power, and extensive damage
20 mitigation guideline actions are in there. So,
21 there's two actions in there.

22 Chapter 21 is the multi-unit design
23 considerations, and there are none. And then, system
24 requirements and limitations, as defined in the system
25 description documents, which is our own engineering

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1 documents. We also found --

2 MEMBER SKILLMAN: Let me just offer an
3 insight here. And neither of these two citations that
4 I will make are proprietary.

5 From your Chapter 19, it is 19.1.6.2 on
6 page 19.1-102. "Key insights. Key insights from
7 LPSD, low power shutdown events. Module drop
8 accidents are the dominant contributors to core
9 damage."

10 Then, you write, "The calculated
11 probability of such events is low, and a large release
12 does not occur from a dropped module, even if the
13 containment is damaged due to radionuclide scrubbing
14 by the pool." That's dandy as long as your pool
15 hasn't been damaged by the module drop.

16 The second citation from your Chapter 15,
17 and this is what really got me going on this question.
18 "NuScale Power Module Drop Accident is 15.7.6 in your
19 Chapter 15. "The use of this single-failure-proof
20 crane precludes the need to perform low drop
21 evaluations. As a result, no design basis accident
22 analysis has been performed to assess the radiological
23 consequences of a nuclear power module drop accident."

24 So, at least as I see it, your critical
25 safety functions screen out this whole topic because

1 of the dependence on that single-failure-proof crane,
2 or the reliability, your assumed reliability of that
3 crane, and the assumption that you'll get enough
4 scrubbing that, even if you drop the module, it's not
5 a problem.

6 But the real issue for me is not just a
7 dropped module; it's the consequence. If that crane
8 fails or if the reeving fails or the brakes fail, you
9 can have a module, 734 tons, bump into one, two, or
10 three other modules. And it seems to me that that
11 raises the bar. I think that's a different deal, and
12 I think we ought to be talking about it. I think your
13 own documentation, if you weave it together a little
14 differently than the way you have woven it together,
15 you might come to that same conclusion.

16 So, let me stop there until we get to the
17 proprietary session.

18 MR. BOWMAN: Right. So, that's a great
19 segue because the next thing we're going to do is
20 -- my presentation for the open part is done. And we
21 give a list of acronyms as our last slide.

22 CO-CHAIR BLEY: Okay. We don't have your
23 slides for the closed session yet. How many slides
24 are there and how long were you expecting it to take?

25 MEMBER MARCH-LEUBA: It's only five

1 slides. Only five or six slides, right?

2 MR. BOWMAN: Yes. I don't think there's
3 even 25 in the closed session.

4 So, the closed session is not on this
5 computer right now?

6 MEMBER CORRADINI: We're going to have to
7 make sure.

8 MR. BOWMAN: Okay. Really, the discussion
9 will go into more detail about the Generic Technical
10 Guidelines, is what the closed session discussion is
11 about.

12 CO-CHAIR BLEY: Maybe that will help us
13 later.

14 Mike, let's set up for the closed session.
15 We're going to go well beyond where we thought we
16 would in time.

17 MR. SNODDERLY: Okay. I think that's a
18 good idea.

19 CO-CHAIR BLEY: And maybe you can talk
20 with the staff and the NuScale folks --

21 MR. SNODDERLY: Yes.

22 CO-CHAIR BLEY: -- in between about us
23 hanging around later tonight.

24 MR. SNODDERLY: Yes. Okay. So, what I'd
25 like to do is to ask Prosanta and Steven Pope to look

1 around the room, and if you identify anyone that
2 doesn't have a need to know -- all members of the
3 public or anyone from the staff that doesn't have a
4 need to know, I need you to leave the room.

5 MEMBER MARCH-LEUBA: Are we on the record
6 still? You should close the open session.

7 (Whereupon, at 11:46 a.m., the foregoing
8 matter recessed from open session and went into closed
9 session until 1:15 p.m.)

10 CO-CHAIR BLEY: The meeting will come back
11 to order and at this time we'll hear from the staff
12 about Chapter 13.

13 Prosanta, are you going to start?

14 MR. CHOWDHURY: Yes. Good afternoon. My
15 name is Prosanta Chowdhury. I'm the project manager
16 for Chapter 13 of the NuScale design certification
17 application review by the staff, by the NRC staff.
18 And with me I have Amanda Marshall for Nuclear
19 Security and Incident Response Office, and also Maurin
20 Scheetz from Nuclear Reactor Regulation Office.

21 As for my credentials I have been a
22 project manager at NRO since 2008 and I have gone
23 through several projects including an site permit in
24 2015. I have also been as a PM involved in the review
25 of EPR design certification application in the past.

1 So as part of my background I have a
2 nuclear engineering master's degree and also a
3 master's degree in electrical engineering. I have in
4 the past worked for the Louisiana State government for
5 18 years as a radiation protection specialist. I have
6 joined the NRC in 2005.

7 And Amanda and Maurin will talk about
8 their credentials.

9 MS. MARSHALL: Yes, good afternoon. My
10 name is Amanda Marshall. As Prosanta said, I work in
11 the Office of Nuclear Security and Incident Response
12 as an emergency preparedness specialist. I reviewed
13 Section 13.3 of the NuScale design certification
14 application. I've been with the NRC for 13 years
15 working in emergency planning for the past 5 or years.
16 And prior to that I was on the security side of NSIR
17 focused on law enforcement response to nuclear power
18 plants.

19 MS. SCHEETZ: All right. Good afternoon.
20 My name is Maurin Scheetz. I have been with the NRC
21 for the past five years predominantly in operator
22 licensing as an examiner, and I've also done some time
23 in the Office of New Reactors as part of this review.
24 We've since merged back with the Office of Nuclear
25 Reactor Regulation. So five years with the NRC

1 predominantly in operator licensing.

2 Before my time at the NRC I did work in
3 re-qualification training at the San Onofre Generating
4 Station. And prior to that I was in the Nuclear Navy
5 as an officer on an aircraft carrier.

6 So I -- as far as Chapter 13 goes, I
7 looked at the organizational structure, the training
8 and the procedure sections of Chapter 13. So I'm
9 going to roll right into that.

10 MR. CHOWDHURY: Yes.

11 MS. SCHEETZ: So next --

12 MR. CHOWDHURY: One second. So the staff
13 is going to present Chapter 13 to the members of the
14 Committee. And also this is the agenda we have. The
15 staff -- I already introduced the review team. The
16 purpose and scope will be covered, review activities
17 and timeline, focus areas, open items and conclusions.

18 So as far as project managers go, Greg
19 Cranston is the lead project manager in LB1, Licensing
20 Branch 1 in NRO.

21 So with that I think we're going to --
22 overview of Chapter 13 we have these sections that
23 will be covered: 13.1, 13.2, 13.3, 13.4 and 13.5.
24 You already heard 13.6, Security, and we are not
25 presenting that. However, based on a comment from one

1 of the members is that the staff indeed reviewed 13.6.
2 Staff indeed issued a request for additional
3 information, received responses and disposition
4 responses. Staff also had an audit conducted, a demi
5 -- half-audit conducted back in December 2017.

6 So with that I'll turn it over to Maurin
7 to cover 13.1 and 13.2.

8 MS. SCHEETZ: Thank you, Prosanta.
9 Regulations require a COL applicant referencing a
10 standard design to describe their corporate level
11 management and technical support organization and the
12 on-site operating organization. Therefore, we
13 reviewed the application Section 13.1, Organizational
14 Structure, for acceptable COL information items for
15 the COL applicant to provide descriptions of the
16 corporate-level management, technical support
17 organization and on-site operating organization to
18 include a description of the training and
19 qualification requirements for personnel in these
20 organizations.

21 The staff finds that the three COL items
22 that -- provided in this section of the application
23 addressed the applicable requirements for these
24 descriptions of the COL's organizational structure.
25 That's all I have for this section.

1 Next slide, please? The COL applicant is
2 also responsible for describing the training programs
3 and to provide a schedule for training plant staff.
4 The staff reviewed the application section 13.2,
5 Training, to verify COL information items exist for
6 descriptions of the training programs for licensed
7 operator initial and re-qualification training and
8 non-licensed operator -- or correction, non-licensed
9 plant staff initial training and periodic retraining.

10 The staff also verified COL information
11 items include information about the qualifications for
12 non-licensed staff enrolled in these training
13 programs. For example, that would be non-licensed
14 operators, STAs, instrument and control technicians,
15 chemistry technicians, maintenance technicians and
16 other engineering support staff.

17 The staff finds that the two COL
18 information items provided by the applicant address
19 the training program description requirements and
20 therefore are acceptable.

21 CO-CHAIR BLEY: You didn't say STA, did
22 you?

23 MS. SCHEETZ: I did say STA. So --

24 CO-CHAIR BLEY: They're licensed SROs.

25 MS. SCHEETZ: Correct. So in the NuScale

1 model they intend them to be licensed SROs. They
2 don't -- regulations don't require for them to hold an
3 SRO license, though most of the fleet -- or most of
4 the operating plants do that.

5 CO-CHAIR BLEY: Yes.

6 MS. SCHEETZ: Yes.

7 MEMBER SKILLMAN: Maurin, what attention
8 did you give to training of those who will handle the
9 modules?

10 MS. SCHEETZ: Do you mean fuel handling?
11 Is that what you mean?

12 MEMBER SKILLMAN: Well, I'm afraid if I
13 say yes to that, it narrows the question I'm really
14 asking.

15 (Laughter.)

16 MEMBER SKILLMAN: You know, a fuel
17 assembly weighs as much as a Volkswagen. These are
18 half-size. So they weigh as much as a Fiat. Okay?
19 The modules are 732 tons. This is not a trivial load.
20 Is there any specific attention given to handling
21 those modules, training-wise?

22 MS. SCHEETZ: So I hear what you're
23 saying. I understand the question. So for our
24 review, because we looked at COL information items,
25 because that's what's required at this stage for the

1 design certification application, we didn't look at
2 the details of what the training program -- the
3 content of the training program. That would be looked
4 at when the COL application comes in, to look into the
5 actual topics and how it's organized. Is that going
6 to be a licensed operator training program requirement
7 or is that going to fall into a different training
8 program for anomalies and stuff on those.

9 MEMBER SKILLMAN: Fair enough. Thank you.

10 MEMBER MARCH-LEUBA: Since we're on the
11 training, you heard us this morning talking about the
12 training, about HSI, human system interface failures
13 due to software or computer hardware. Did you
14 consider any of those in your review?

15 MS. SCHEETZ: So your question is did we
16 look at where HSI training would come into a training
17 program?

18 MEMBER MARCH-LEUBA: Yes.

19 MS. SCHEETZ: Did we review that?

20 MEMBER MARCH-LEUBA: Assuming that
21 software fails most of the time, maybe once every 100
22 years, but it does fail.

23 MS. SCHEETZ: So for this review again we
24 looked at COL information items, so I would expect the
25 NRC staff to review HSI degradations or malfunctions

1 and how operators in the control room and outside the
2 control room are trained on that in the FSCOLCs.

3 MEMBER MARCH-LEUBA: And for the record I
4 love HSI approach, I love computer-aided procedures.
5 I -- in the example I gave this morning I love being
6 able to land a 767 without any training. Okay? But
7 the operator must have a healthy respect for failures
8 and there is over-reliance. The computer is telling
9 me there's been an issue. It will be okay. You
10 should always look at the other two. And that's part
11 of training and part of the philosophy of doing
12 things. Thank you.

13 MS. SCHEETZ: I agree. I totally agree.
14 And I could say that from an operator licensing
15 standpoint in Part 55 we have requirements that would
16 essentially require that kind of training for operator
17 staff. So that's where I would -- from a regulator I
18 would expect to see it in the Part 55 sections.

19 Any other questions?

20 (No audible response.)

21 MS. SCHEETZ: Okay. So now I'm going to
22 pass it to Amanda Marshall.

23 MS. MARSHALL: Yes, good afternoon. For
24 a design certification review Section 13.3 is intended
25 to address those design features, facilities,

1 functions and equipment that are technically relevant
2 to the design that are not site-specific and that
3 affect some aspect of emergency planning or the
4 capability of a licensee to cope with plant
5 emergencies.

6 The applicant may choose the extent to
7 which the application includes EP information to be
8 reviewed as part of the design certification and
9 there's no minimum amount of information that they
10 must include.

11 NuScale chose to include in the DCA and
12 the staff reviewed emergency planning design
13 information related to a technical support center,
14 emergency response data system, TSC engineering work
15 stations, decontamination facilities, the process
16 sampling system, specifically the post-accident
17 sampling function of which there's an associated open
18 item, and four COL information items related to the
19 operation support center, an emergency operations
20 facility, a comprehensive emergency plan and EP ITAAC,
21 which is actually in Chapter 14.

22 MEMBER MARCH-LEUBA: So you addressed the
23 emergency procedures, how the evacuation would be
24 done, things like that, but did not address the
25 emergency planning zone, the size of these zones.

1 MS. MARSHALL: That's correct.

2 MEMBER MARCH-LEUBA: That's correct?

3 MS. MARSHALL: That's outside the scope of
4 this particular review.

5 MEMBER MARCH-LEUBA: Because we keep
6 saying that we really to see the -- how the source
7 terms are calculated.

8 MEMBER CORRADINI: The source term is
9 going to be used for multiple things, but I think the
10 staff's point is that the emergency planning zone is
11 not part of the DCA.

12 MS. MARSHALL: That's correct.

13 MEMBER MARCH-LEUBA: It's not on any DCAs?

14 MEMBER CORRADINI: Not any DCA. Not just
15 this one. Not any DCA.

16 MEMBER MARCH-LEUBA: But last -- in
17 December we had some kind of talk about the LPZ, the
18 low population zone. They said at a minimum it has to
19 be the size of the exclusion ridge.

20 MEMBER CORRADINI: That's for accident --
21 I'm --

22 MEMBER MARCH-LEUBA: Okay.

23 MEMBER CORRADINI: -- not sure exactly
24 what you're talking about, but --

25 MEMBER MARCH-LEUBA: You did not consider

1 EPZ as --

2 (Simultaneous speaking.)

3 MS. MARSHALL: Yes, that's correct, sir.
4 You may be referring -- there's a few technical
5 reports out as well as an SMR rulemaking, which are a
6 little more focused on the EPZ size.

7 MEMBER MARCH-LEUBA: Now remind me again;
8 I mean, in the Clinch River Breeder reactor site where
9 we have licensed or have an approval --

10 MEMBER CORRADINI: That was the ESP that
11 we looked at. That's unrelated to whatever technology
12 is there.

13 MEMBER MARCH-LEUBA: Correct. The early
14 site permit. But they do have some recommendations
15 from NuScale about the size of their emergency
16 planning zone, if I remember correctly.

17 MEMBER CORRADINI: Well, they used --
18 we're a little off topic, but just to be clear, they
19 used four different potential SMRs that would fit, and
20 then when they decided the size of their emergency
21 planning -- when they made the recommendation for the
22 acceptability of the emergency planning zone, they
23 used an 800-megawatt thermal machine --

24 MEMBER MARCH-LEUBA: Yes.

25 MEMBER CORRADINI: -- and an associated

1 scale source term for 800 megawatts.

2 MEMBER MARCH-LEUBA: Okay. But my
3 impression is that they were using some numbers
4 directly from the NuScale report. That's what I
5 thought they said.

6 MEMBER CORRADINI: I think not.

7 MEMBER MARCH-LEUBA: Okay.

8 MEMBER CORRADINI: I think they scaled
9 everything to a canonical 800-megawatt thermal. Which
10 is in the open session, so we can talk about that?

11 CO-CHAIR BLEY: Yes.

12 MEMBER CORRADINI: Okay.

13 MS. MARSHALL: Okay. NUREG-0800
14 identifies various emergency planning reviewer
15 interface areas which support the review of Section
16 13.3 which are not the specific focus of this meeting
17 nor of the staff's evaluation contained in SER Section
18 13.3.

19 Primary SER interface areas for EP
20 include: SER Section 6.4, which provides information
21 regarding the protection of main control room
22 personnel during an emergency; SER Section 7.2.13.7,
23 which provides information related to TSC data
24 retrieval capabilities; SER Section 9.3.2, which
25 provides information pertaining to the process

1 sampling system; SER Section 9.4.1, which provides the
2 staff's determination of the acceptability of the HVAC
3 system that supplies the main control room and the
4 TSC; SER Section 9.5.2, which discusses voice and data
5 communications equipment; SER Section 12.1.2.3, which
6 provides the staff's determination of the
7 acceptability of the on-site decontamination
8 facilities proposed by the applicant; and finally SER
9 Section 15.3, which contains information related to
10 TSC radiological habitability. So as you can see,
11 there's a lot of tentacles to other SER sections.

12 Next slide, please? This slide identifies
13 that there is one open item associated with Section
14 13.3 EP review related to the post-accident sampling
15 function of the process sampling system. And the DCA
16 itself, DCA Part 2, Tier 2, Section 9.3.2 states that
17 the function of the process sampling system, or PSS,
18 is to provide the means to obtain representative
19 liquid and gaseous samples from various primary and
20 secondary process streams and components for
21 monitoring and analyzing the chemical and
22 radiochemical conditions. The PSS capability is used
23 during normal plant operations and following accident
24 conditions without the need for a dedicated post-
25 accident sampling system.

1 As I mentioned earlier, the capability to
2 obtain a post-accident sample is an interface item
3 with Section 9.3.2. And in EP space Planning Standard
4 B-9 of 10 CFR 50.47 requires adequate method systems
5 and equipment for assessing and monitoring actual
6 potential off-site consequences of a radiological
7 emergency condition are in use. And the guidance in
8 NUREG-0654, Evaluation Criteria, (I)(2) identifies a
9 post-accident sampling capability as an acceptable
10 means of meeting this requirement.

11 As you see on the slide the resolution of
12 this open item is ongoing, and if the process sampling
13 system is determined to be acceptable as a means for
14 obtaining a post-accident sample in accordance with 10
15 CFR 50.34(f)(2)(D)(ii) and (B)(iii), then this open
16 item will be resolved.

17 And that's all I have. Oh, excuse me.
18 Except for my conclusion.

19 With the exception of that open item
20 concerning the capability to obtain a post-accident
21 sample, the staff concluded on the basis of its review
22 that the EP design-related features included in the
23 DCA that the applicant met the applicable regulatory
24 requirements. When the process sampling system review
25 is complete the NRC staff will update its conclusion

1 to reflect the disposition of this open item.

2 That's all I have. Thank you.

3 MR. CHOWDHURY: Section 13.4, Operational
4 Programs. This is a COL item. The COL applicants
5 are required by 10 CFR 52.79 to describe operational
6 programs, but similar requirements do not exist for
7 DCAs.

8 NuScale did provide COL Item 13.4-1
9 stating that a COL applicant that references the
10 NuScale design certification will provide site-
11 specific information including an implementation
12 schedule, operation programs -- operational programs.

13 So the staff has reviewed this COL item
14 and then compared with the Standard Review Plan
15 Section 13.4, Draft Revision 4, September 2018, and
16 find it to be acceptable.

17 MS. SCHEETZ: Section 13.5 is Plant
18 Procedures. Plant procedures include administrative
19 procedures, operating procedures, emergency operating
20 procedures, as well as maintenance and other
21 procedures for safety-related activities. COL
22 applicants are required to develop these type of
23 procedures that are plant-specific, thus the staff
24 reviewed the COL information items in Application
25 Section 13.5, Plant Procedures, for a COL to provide

1 procedure description and information about procedure
2 program development and implementation.

3 CO-CHAIR BLEY: You actually review the
4 procedures or just --

5 MS. SCHEETZ: Just --

6 CO-CHAIR BLEY: -- review the plan?

7 MS. SCHEETZ: We review that the
8 application, the design certification application has
9 COL information items that would then have a
10 description of these --

11 (Simultaneous speaking.)

12 CO-CHAIR BLEY: When the COL comes up and
13 they have their procedure, do you review the
14 procedures or just ensure they have procedures?

15 MS. MARSHALL: The COL applicant review
16 stage, descriptions of the procedures, and then I do
17 think the SRP does into procedure review, especially
18 for --

19 (Simultaneous speaking.)

20 CO-CHAIR BLEY: The reason I'm asking
21 is --

22 MR. CHOWDHURY: Maybe for fuel loading.
23 Maybe.

24 MS. SCHEETZ: Yes, as part of operational
25 programs for fuel.

1 CO-CHAIR BLEY: I couldn't hear, Prosanta.

2 MS. SCHEETZ: I'm saying it may be right
3 before fuel loading that the actual procedures would
4 be looked at, but I'm not sure about that.

5 CO-CHAIR BLEY: Who would know?

6 MS. SCHEETZ: It's in our SRP. I thought
7 you --

8 MR. CHOWDHURY: I don't have --

9 MS. SCHEETZ: We can get back to you on
10 that.

11 CO-CHAIR BLEY: I'd like to know. And, I
12 don't know, were you here all morning?

13 MS. SCHEETZ: I was here all morning.

14 CO-CHAIR BLEY: NuScale has prepared
15 guidelines that are essentially the emergency
16 procedures that are going to be used and I don't know
17 why you're not looking at those now.

18 MS. SCHEETZ: So I am, and I'm going to
19 get into that. That's --

20 CO-CHAIR BLEY: Where? Okay.

21 MS. SCHEETZ: In this section. So this
22 section has essentially two parts because there are
23 COL information items to actually provide descriptions
24 of these procedures in the implementation program.
25 And we did -- the DC applicant is required to provide

1 generic technical guidelines which are reviewed at
2 this stage. And so that was part of my review in this
3 section. So I'll get into that.

4 The seven COL information items provided
5 we found to be acceptable because they addressed the
6 requirements for procedures. And then additionally
7 the staff reviewed the applicant's generic technical
8 guidelines, or GTGs, and those are used by the COL
9 applicant to develop plant-specific technical
10 guidelines that then form the basis for plant-specific
11 emergency operating procedures. The GTGs are the
12 responsibility of the DC applicant and NuScale
13 provided them as part of the application.

14 As a reminder, a lot of the detail in the
15 50 --

16 CO-CHAIR BLEY: I'm sorry. If you
17 reviewed them, do they look like guidelines or do they
18 look like actual procedures that you'll work from?

19 MS. SCHEETZ: They -- the GTGs themselves
20 is a -- it's a large package of both. I would say you
21 could use those as procedures right now, but they also
22 have a lot of basis information and implementation
23 strategy and other stuff. And they do contain a lot
24 of proprietary information, so I think a lot of the
25 discussion on the GTGs we might have to hold off for

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1 the closed session. I just want to caution that.

2 CO-CHAIR BLEY: I understand that. So we
3 might revisit this section in the Chapter 18 closed
4 session, if I remember. Go ahead.

5 MS. SCHEETZ: Yes, I think we can
6 definitely cover -- I'll be here for the closed
7 session for Chapter 18.

8 CO-CHAIR BLEY: Okay. Good.

9 MS. SCHEETZ: So, but I'm --

10 MEMBER MARCH-LEUBA: This morning, I don't
11 know if it was the open or the closed session, I don't
12 remember, but we were shown some graphic diagram of
13 decision making. There are five or six of those and
14 the GTGs, which are basically the procedures, but
15 they're not written as a procedure. It's a graphical
16 procedure. Yes, a flow chart.

17 CO-CHAIR BLEY: Well, that was in the
18 closed session.

19 MEMBER MARCH-LEUBA: Oh, was it?

20 MS. SCHEETZ: Yes.

21 MEMBER MARCH-LEUBA: Okay. So we
22 didn't --

23 (Simultaneous speaking.)

24 CO-CHAIR BLEY: -- closed session.

25 (Simultaneous speaking.)

1 MEMBER MARCH-LEUBA: -- that's in it?

2 CO-CHAIR BLEY: And as I understand it,
3 those are part of the general guideline document you
4 talked about --

5 MEMBER MARCH-LEUBA: That is correct.

6 CO-CHAIR BLEY: -- that's now on our
7 SharePoint site.

8 MEMBER MARCH-LEUBA: That is correct.

9 CO-CHAIR BLEY: Members can access that.

10 MEMBER MARCH-LEUBA: And they're actually
11 full PDF. You can blow up those charts and you
12 actually read what it says, whereas the slide we saw
13 this morning you cannot. It's a big chart.

14 CO-CHAIR BLEY: I'm sorry for the
15 diversion. Go ahead.

16 MS. SCHEETZ: That's okay. I can speak
17 about the staff's review of the GTGs. So the NuScale
18 GTGs contain generic guidance for procedure writers to
19 develop procedures that will be used by plant
20 operators to ensure plant safety during an accident.
21 The guidance covers the content for emergency
22 operating procedures, severe accident management
23 guidelines, and guidance for extended loss of AC power
24 and loss or large-area events.

25 The staff evaluated the technical adequacy

1 of the NuScale GTGs to determine if they are
2 acceptable for use in the development of a COL
3 applicant's plant-specific technical guidelines. In
4 our review the staff focused on three areas: We
5 looked at the design-specific critical safety
6 functions that the applicant identified and described,
7 we looked at what methods the applicant used to
8 identify operator actions, and the operator actions
9 necessary to assess and maintain the critical safety
10 functions including the basis for this information.

11 Also, as part of this review we looked at
12 the use of type B post-accident monitoring variables
13 in the GTGs. Type B post-accident monitoring
14 variables are defined as variables that provide
15 primary information to control room operators to
16 assess critical safety functions during an accident.
17 The applicant provided a list of the type B post-
18 accident monitoring variables in the application. The
19 staff found some differences between the type B post-
20 accident monitoring variables in the application and
21 those presented in the GTGs for operators to use for
22 assessing the critical safety functions.

23 In response to requests for additional
24 information about this item, about this inconsistency
25 the applicant informed us that it planned to validate

1 the GTGs using the Human Factors Engineering
2 Integrated System or ISV testing and validation
3 methods and then make changes to the GTGs.

4 Therefore, there's one open item in this
5 SER for the applicant to provide updated GTGs as
6 necessary and to resolve the PAM -- post-accident
7 monitoring variable inconsistencies and account for
8 any necessary changes resulting from those
9 validations.

10 MEMBER CORRADINI: So just to -- in short,
11 when they submit their report for their ISV, whatever
12 that is --

13 MS. SCHEETZ: Yes.

14 MEMBER CORRADINI: -- that's what you will
15 review to make sure this open item is satisfied?

16 MS. MARSHALL: I would expect either if it
17 comes in the Integrated System Validation Report or
18 another way of NuScale informing the staff that
19 they've completed the validation activities of the
20 generic technical guidelines, and then I guess a new
21 revision of the GTGs.

22 CO-CHAIR BLEY: And --

23 MS. SCHEETZ: I'm sure NuScale can answer
24 how --

25 CO-CHAIR BLEY: -- it would be okay if you

1 gave up using acronyms.

2 MS. SCHEETZ: Okay. I can, yes.

3 CO-CHAIR BLEY: GTG is?

4 MS. SCHEETZ: GTG, PAM. I can use --

5 CO-CHAIR BLEY: No.

6 MEMBER CORRADINI: No, I think he wants --

7 MS. SCHEETZ: Do you want me to --

8 MEMBER CORRADINI: -- you to say it out
9 loud.

10 MS. SCHEETZ: Okay.

11 CO-CHAIR BLEY: Say what the words are.

12 MS. SCHEETZ: So you want me to say
13 generic technical guidelines?

14 CO-CHAIR BLEY: I do. Thank you.

15 MS. SCHEETZ: I will.

16 (Laughter.)

17 MR. BOWMAN: Dennis?

18 MS. SCHEETZ: Doug, did you want to --

19 MR. BOWMAN: Hey, Dennis? One comment.

20 We will be submitting a revised set of generic
21 technical guidelines once we have completed the work
22 associating with getting -- we have to get the ISV
23 Report done.

24 CO-CHAIR BLEY: That will be before the
25 design cert is complete?

1 MR. BOWMAN: Yes.

2 CO-CHAIR BLEY: Okay. So we'll see you
3 again on this when there are no open items remaining.

4 MR. BOWMAN: Yes.

5 MS. SCHEETZ: That's correct.

6 MEMBER MARCH-LEUBA: And --

7 MEMBER SKILLMAN: Maurin, what
8 challenge --

9 CO-CHAIR BLEY: Thanks.

10 MEMBER SKILLMAN: did you give -- I'm
11 sorry, Jose.

12 MEMBER MARCH-LEUBA: Oh, no. Go ahead.

13 MEMBER SKILLMAN: Maurin, what challenge
14 did the staff give to the adequacy of the critical
15 safety function? There are only three and they become
16 the -- they have become the foundation for almost
17 everything. What consideration did the staff give to
18 challenging whether or not something has been
19 orphaned, something has been overlooked?

20 MS. SCHEETZ: Okay. So we did challenge
21 the applicant on the critical safety functions.
22 There's not -- in the SRP there's not clear, hey, this
23 is how you review critical safety functions. We had
24 to go into a lot of the background information of TMI
25 action plan items and look at where these critical

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1 safety functions came from in the beginning and the
2 background information for them and kind of come up
3 with a plan of what -- how we would do this review.

4 So the first thing we did was -- you know,
5 what do the other PWRs have for critical safety
6 functions? So we did a comparison of NuScale critical
7 safety functions to traditional -- or large light
8 water reactor critical safety functions for PWR. And
9 when we found -- okay, why don't they have several of
10 those safety functions? Then we issued a request for
11 additional information to NuScale asking about --
12 asking more information about why these critical
13 safety functions and not these other ones.

14 So, and NuScale did provide a response
15 which we found acceptable basically explaining that
16 those other safety function -- critical safety
17 functions that we're used to seeing are inherent to
18 the three critical safety functions that they present,
19 which we found acceptable. We agreed with them on
20 that.

21 MEMBER SKILLMAN: Would you give
22 consideration to taking one more look recognizing that
23 the critical safety functions that have been developed
24 are common for PWRs? And they certainly address fuel
25 in terms of reactivity, decay heat and containment,

1 but they don't look at the unique features of this
2 plant independent from the fact that there are 12
3 smaller-sized pressurized water reactors. There are
4 other features of this plant I think that need -- that
5 deserve to be at least challenged in terms of whether
6 those unique features might in fact constitute the
7 basis for an additional or different safety function
8 in addition to the three that are focused on the fuel.

9 MS. SCHEETZ: I agree. So I can also say
10 that because of -- in part of the Chapter 18 human
11 factors engineering review we've also incorporated --
12 okay, what are the important human actions? We've
13 looked at that part of the review to understand what
14 is known about the NuScale design at this time and how
15 that factors into plant safety functions, safety
16 functions and critical safety functions. So that is
17 part of the human factors engineering process the
18 staff does, and we'll -- I think we'll get into this
19 in Chapter 18.

20 We do have some questions on fuel
21 operations for NuScale, and I do believe we have an
22 open item in Chapter 18 reserved for what important
23 human actions might come out of what we know at a
24 later time about fuel handling and module movement.
25 So using the human factors engineering process, that

1 information would get fed back into the process and
2 the staff would have an opportunity to assess plant
3 safety functions and understand if there is something
4 missing there.

5 MEMBER SKILLMAN: Thank you.

6 MEMBER MARCH-LEUBA: Don't go too fast.
7 He stole my time.

8 NuScale has finally learned how -- they're
9 trying to implement what we've always been saying,
10 that you should have a generic design and then make
11 cookie cutter reactors, make them all the same. And
12 I applaud them for that. This is what everybody has
13 been trying to do, which means that these generic
14 guidelines, the GTGs, are not really generic. They're
15 plant-specific because all plant are the same. And
16 that's what I believe NuScale intends.

17 So I sense a little gap on the review.
18 You're reviewing the point of view of the operator
19 actions. I missed the Chapter 15 reviewer's reviewing
20 them for technical contents. Is this operator action
21 the appropriate one to do at this condition, or is it
22 a better one, or is it a bad one? And I've reserved
23 some time for the closed session to give you some
24 examples about that.

25 MS. SCHEETZ: Okay. I can say that as

1 part of this review we did interface with the Chapter
2 15 technical reviewers, Chapter 19 technical
3 reviewers, 20 and 21 to understand what operator
4 actions were or were not required and how they -- if
5 they appeared in the generic technical guidelines. So
6 that's -- when I talk about we looked at the
7 methodology that NuScale used to identify operator
8 actions, we looked at across other chapters.

9 MEMBER MARCH-LEUBA: Before we close open
10 item 13.5-1 -- I will not just review a document that
11 NuScale sent. I would love to see all technical
12 experts from all branches in NRR and NRO get together
13 and look at -- there are not many. There is only five
14 screens with some flow charts. I mean, there aren't
15 that many. And you can review them in an afternoon.
16 If I was the king of the world and I was organizing
17 this, I would make a workshop, internal workshop in
18 NRO, say everybody come here, we're going to go
19 through the procedures for NuScale. Let's see what
20 you think. And that would be very valuable. As I
21 say, I reserve some examples that are proprietary for
22 later on.

23 MS. SCHEETZ: Okay. Thank you.

24 CO-CHAIR RAY: Dennis?

25 CO-CHAIR BLEY: Yes, sir? Go ahead,

1 Harold.

2 CO-CHAIR RAY: I understood that you were
3 advised we will revisit this area after the two items
4 are closed in the exchange you had a few minutes ago.

5 CO-CHAIR BLEY: That's right.

6 CO-CHAIR RAY: I just wanted us to see if
7 we make note, either our staff or somehow, that will
8 bring it back to our attention so we don't miss that.
9 I think --

10 MEMBER CORRADINI: Well, we're
11 automatically going to see it, Harold, when they close
12 the open items. We have to make sure we're satisfied
13 with it.

14 CO-CHAIR BLEY: We'll have an open --
15 we'll have meetings on I believe each chapter again
16 with no open items.

17 MEMBER CORRADINI: In Phase 5.

18 CO-CHAIR BLEY: Phase 5.

19 CO-CHAIR RAY: I just -- I didn't want it
20 to go past us somehow because we didn't recognize it.
21 That's all.

22 CO-CHAIR BLEY: We'll have to remember we
23 want to look for it, though. Keep a note.

24 CO-CHAIR RAY: Help me do that, will you?

25 CO-CHAIR BLEY: I'm not the right one to

1 ask.

2 CO-CHAIR RAY: Well, I'll ask --

3 MEMBER CORRADINI: I'll -- we'll remember.

4 CO-CHAIR RAY: Mr. Snodderly can take note
5 of it. That's fine.

6 CO-CHAIR BLEY: Mike Snodderly's got it.

7 MEMBER MARCH-LEUBA: We're on Chapter --
8 Section 13.5. I will address this in the closed
9 session with more detail, but there is a section under
10 reactivity control, 13.5.4.17 -- pardon me, that has
11 all that number -- in which you quote verbatim what
12 NuScale said about the ATWS transit. So have you seen
13 this ATWS transit? Have they documented the ATWS
14 transit? Has the staff seen this document anywhere,
15 because Chapter 15 says we don't need to give you an
16 ATWS result because we're so good that we don't need
17 one.

18 MS. SCHEETZ: So, no, I have not looked at
19 the specific documentation for ATWS.

20 MEMBER MARCH-LEUBA: We'll go into a
21 little more detail later on this afternoon, but I am
22 convinced that if you give me the ATWS transit I can
23 make that thing go straight widely on flow, and I will
24 read from NuScale's own report that says so. So I
25 would please ask you to -- even if we don't resolve

1 it, that don't have that quote on the SER on page 13
2 of 34.

3 MS. SCHEETZ: I know what -- yes.

4 MEMBER MARCH-LEUBA: Because it feels like
5 an implicit approval of what they're saying. And I
6 don't think we have reviewed it aggressively enough.

7 MS. SCHEETZ: Okay. So what I can say
8 about the generic technical guidelines is that so far
9 we believe that they are logically structured, they
10 appropriately have prioritized safety and defense-in-
11 depth functions, they adequately describe initial and
12 follow-up evaluation when critical safety functions
13 are challenged or not met, they can be practically
14 implemented and they provide adequate design-specific
15 information for a COL applicant to use in the
16 development of plant-specific guidelines, and then the
17 b subsequently emergency operating procedures.

18 The staff plans to review the results of
19 generic technical guideline validation to understand
20 if operators were successful in using the generic
21 technical guidelines during simulated accident
22 scenarios and to understand what if any changes the
23 applicant has identified for the generic technical
24 guidelines or the application.

25 MEMBER SKILLMAN: Maurin, I would like to

1 ask a specific question. This is in the Safety
2 Evaluation, Chapter 13. It is in Section 13.5.4.2.1,
3 13,5.4.2.1, Critical Safety Functions. And the text
4 is describing the low temperature over-pressurization
5 protection system. And there's one statement here:
6 "The NuScale reactor pressure vessel is designed to
7 withstand the maximum passive system cool-down rate."
8 And you will find that on PDF page 13-29.

9 And my question is has that -- has the
10 staff verified the accuracy of that statement? And
11 this is important because when the plant goes into
12 ECCS mode, they actually add cool water to the reactor
13 vessel. So I -- the reason I'm raising this is part
14 of the TMI accident was the operators' fear of over-
15 pressurizing. If you talk to those operators, they
16 were afraid of fracturing the reactor coolant system.
17 So I'm really asking have you verified, has staff
18 verified the NuScale statement?

19 MS. SCHEETZ: So a predecessor did this
20 specific part of the review before I took it over, so
21 I'd have to check with him about who in Chapter 15 you
22 talked about -- he talked to you about this. My
23 understanding was that Chapter 15 was a large
24 interface in this review as far as verifying these
25 requests for additional information responses from the

1 applicant. So I believe that we have verified that
2 through Chapter 15 and all.

3 MEMBER SKILLMAN: This is in Chapter 13,
4 the statements in Chapter 13.

5 MS. SCHEETZ: The Chapter -- the statement
6 is in Chapter 13 because we were explaining about why
7 other critical safety functions didn't need to be
8 specified because they were inherent to the critical
9 safety functions that NuScale had outlined, so this
10 kind of explains that basis for that decision.

11 MEMBER SKILLMAN: Thank you.

12 MS. SCHEETZ: That's all I have.

13 CO-CHAIR BLEY: Yes, we are. That's it.
14 I'm just curious; and I don't know if you can answer
15 this, given that you have reviewed the guidelines at
16 this point, when a COL -- should a COL come forward
17 and they say we have no changes with respect to the
18 design cert, what will you be looking for them to do
19 on this COL item, 13.5-2 through 7? Will you expect
20 anything or will you just say, well, if you use those
21 as your procedures, that's great? We've already --

22 MS. SCHEETZ: No, I think we would -- I
23 would expect that the staff would do a new review of
24 the design-specific emergency operating procedures,
25 whether or not they --

1 CO-CHAIR BLEY: Even if they're the same?

2 MS. SCHEETZ: Even if they're the same,
3 yes.

4 CO-CHAIR BLEY: Thank you.

5 MS. SCHEETZ: We would follow our review
6 procedures.

7 MEMBER MARCH-LEUBA: Yes, but I think it
8 would be more efficient if we do it once instead of
9 every time a new module gets built. I mean, if you
10 have 12 modules, you just pick 12 reviews of the GTGs?
11 I mean, every time you put a new --

12 CO-CHAIR BLEY: Well, wait.

13 MEMBER MARCH-LEUBA: -- module into
14 effect, will you expect it to --

15 CO-CHAIR BLEY: The procedures will not
16 change dependent on whether there's 1, 2, 3 or 12
17 modules, I don't think.

18 MEMBER MARCH-LEUBA: They're not going to
19 change with respect to the GTGs that already exist.

20 CO-CHAIR BLEY: Yes.

21 MEMBER MARCH-LEUBA: It would be more
22 efficient to do it once and --

23 (Simultaneous speaking.)

24 CO-CHAIR BLEY: Well, the way it was just
25 explained it would be done once on the first COLA.

1 The rest of the COLAs could refer to that one. But I
2 don't know why it couldn't be done now myself, which
3 is why I was asking it, too. I agree with you.

4 Anything from the Committee?

5 (No audible response.)

6 CO-CHAIR BLEY: All right. At this time
7 -- no, we're going to go to Chapter 18, open session.

8 Thank you so much. The same people will
9 be back for Chapter 18?

10 MR. CHOWDHURY: Correct.

11 CO-CHAIR BLEY: Okay. Thanks, Prosanta.

12 MR. CHOWDHURY: Well, we have more people.

13 CO-CHAIR BLEY: And more? Okay.

14 (Laughter.)

15 CO-CHAIR BLEY: Let's stand them up in the
16 center of this dome.

17 (Pause.)

18 CO-CHAIR BLEY: All right. Is there any
19 reason for us to delay or can we go ahead?

20 Okay. Dough, you're up.

21 MR. BOWMAN: All right. Good afternoon,
22 everybody. We're going to present on Chapter 18 now.

23 NuScale recognizes some unique goals in
24 Chapter 18. We went through a little bit of this in
25 Chapter 13. But given the unique nature of the

1 control room in terms of -- especially U.S. plants,
2 with 12 units being operated from a single control
3 room, this was our vision. We knew -- and the fact
4 that the design was so simple, we knew there were some
5 unique things that we were going to be faced with.

6 So we set some goals early on. We wanted
7 to integrate human factors engineering into the
8 development, design and evaluation of the plant. And
9 what that really resulted in is deliberate elimination
10 of operator actions in the design-basis. We as
11 operators certainly were staunch advocates of that
12 position. We also wanted to provide an HFE design
13 that facilitated safe and reliable operation,
14 maintenance testing, inspections around the plant.
15 Really what resulted from that was we wanted to allow
16 an operator to be able to quickly assess the status of
17 all 12 units. We're going to show you some examples
18 of the human system interface that we designed to
19 allow that to happen.

20 And we wanted to provide a state-of-the-
21 art human factors design that satisfied the regulatory
22 requirements, and out of that we really wanted to
23 expand the use of automation. I know we've talked
24 about this extensively in 13. For routine normal
25 tasks to limit operator workload really do the things

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1 that computers are doing now.

2 So in light of that I'm going to -- this
3 presentation is going to -- I'm not going to walk
4 through every single section of Chapter 18, but I'm
5 going to walk through the areas that we felt were very
6 important to our development, and we're going to talk
7 about how we developed our Concept of Operations, and
8 really that Concept of Operations leads up to the
9 staffing plan validation for the first major event we
10 did in human factors engineering. So we'll discuss
11 that. We'll follow that up with the integrated system
12 validation and how all of those two items flange
13 together. And that's really what this presentation is
14 going to be about.

15 So we did an extensive operating
16 experience review. It is the first area I'm going to
17 talk about. And we reviewed the operating experience
18 in the following industries: Currently operating
19 nuclear power plants; that was an obvious choice for
20 us, nuclear facilities that do not produce power, non-
21 nuclear power plants, a U.S. military platform. And
22 we also went into the health care industry. We looked
23 at a neonatal care intensive unit where they monitor
24 multiple babies over the course of -- or children as
25 part of that exercise. Electrical distribution and

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1 the airline industry. And our purpose was to review
2 -- was to identify human factors engineering safety
3 issues and incorporate identified positive features in
4 the NuScale plant design.

5 CO-CHAIR BLEY: When you said "non-
6 nuclear," that could be almost anything in the world.
7 What kind of things are you talking about?

8 MR. BOWMAN: Well, in this case it was a
9 non-nuclear power plant, right?

10 CO-CHAIR BLEY: Oh, it was a power plant?

11 MR. BOWMAN: So we are -- I'm going to
12 talk about the specific -- because that's one very
13 specific -- we --

14 (Simultaneous speaking.)

15 CO-CHAIR BLEY: But not chemical
16 processing plants, that kind of stuff?

17 MR. BOWMAN: I don't believe we did any
18 chemical plants at all.

19 CO-CHAIR BLEY: Okay. Just curious.

20 MR. BOWMAN: So the things we were worried
21 about. From the current industry inside of a nuclear
22 -- inside of the current commercial nuclear area we
23 were worried about alarm avalanche. That idea that at
24 the time that an event occurs, especially a reactor
25 trip or a major accident, the operator is inundated

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1 with alarms. And many of these alarms are essentially
2 not applicable to the situation he's looking at. He
3 has to know what alarms are just normal that are going
4 to come into the situation, then he has to look for
5 those alarms that are actually pertinent to his
6 situation.

7 So we established a tiered alarm system.
8 Now this isn't unusual to use a tiered alarm system.
9 Ours is set up with three levels of alarm
10 notification: alarm, caution and notice. And I will
11 provide you at least some visual examples of how we'd
12 do that, but a brief explanation. Alarm -- go ahead.

13 CO-CHAIR BLEY: Before you do that, you
14 now have 18 former licensed operators with you. How
15 many did you have back when you were doing this work?
16 Were there operators involved in deciding how these
17 alarms ought to be displayed?

18 MR. BOWMAN: There's been other people
19 involved despite the ones the we have now. I couldn't
20 tell you exactly how many, but yes, we've had other
21 people who've come and gone out of our project.

22 CO-CHAIR BLEY: Not just people, but
23 operators?

24 MR. BOWMAN: Operators, yes. Absolutely.

25 CO-CHAIR BLEY: Go ahead.

1 MR. BOWMAN: All right. So a tiered alarm
2 system. The alarm is -- operates as we're all used
3 to. There's a continuous alarm sound and a flashing
4 indication that stays in until you acknowledge the
5 alarm. And we expect those alarms to be used on a
6 very limited basis for those things that actually
7 require an operator to take action in our safety
8 concern.

9 The caution behaves differently. It comes
10 in. It provides a single tone to the operator and
11 then it stops. There's no continuous alarm function.
12 On the human system interface you can see how many
13 cautions you have in at a given time. There's a
14 yellow icon that shows you how many cautions you have
15 in.

16 And then the final one is a notice, and
17 the notice is essentially kind of like getting an
18 email. Essentially it's a way for the human system
19 interface to provide the operator with information
20 that's not critical in nature, but he needs to provide
21 the operator that information. There's a lot of
22 alarms today in the industry that are like that that
23 are currently -- they're all one tier and you don't
24 know the difference.

25 So an example of this would be we do have

1 an automation that covers -- that monitors all 12
2 units and looks for whether or not a dilution needs to
3 be performed. And if that automation decides that
4 it's ready for a dilution, it will provide a notice to
5 the operator that it wants to dilute for example Unit
6 8. Then the operator would go and review that
7 information and decide whether or not he wanted to
8 allow that automation to continue. That's an example
9 of a notice.

10 CO-CHAIR BLEY: Does a notice tell him
11 why?

12 MR. BOWMAN: Yes, absolutely. When he
13 brings up that screen, it's going to show him all the
14 parameters on that unit and why it thinks it's time
15 for it to go dilute. And he can review all that and
16 decide if he wants to move on with that or not.

17 And again, a dilution is not a time-critical --
18 there's nothing critical about the operator performing
19 a dilution. It's a thing to maintain your power is
20 all it really is. So that's one piece of what we did.

21 Operating multiple units from a single
22 control room. Obviously given the lack of information
23 about that in the industry, we -- especially the
24 American industry, we started looking outside of the
25 American industry. So obviously we started with our

1 on subject matter experts and they provided us some
2 initial ideas about what our staffing level should be
3 and what our basis should be.

4 But then we went to Bruce Power, and Bruce
5 Power, the Canadian plants, they operate four units
6 from a single control room. And from this
7 benchmarking trip we took a concept they use where
8 they have a control room supervisor -- although we've
9 kind of talked about him as being in a traditional
10 role, and he does serve that traditional role. He is
11 a bit step-backed in his oversight because he's much
12 more of a resource manager in the control room than he
13 is direct oversight of a reactor operator performing
14 a duty. So we took that idea from Bruce Power.

15 And also at Bruce Power they'll have
16 operators who are operating at the controls, but they
17 also have additional operators in the control room
18 that are basically resources for those operators at
19 the controls to perform various activities. So we
20 also took that concept, and that's a part of how we
21 got to our operations concept.

22 Then the other major one was -- we did
23 benchmarking at the T.H. Wharton Gas Turbine
24 Generating Station. So this -- at this plant they
25 have a total of 17 different turbines operating, both

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1 gas generation and steam turbine units, and they both
2 operate in both simple and combined cycle and they're
3 all operated by a single operator in a single control
4 room. So 17 individual units. One operator is
5 monitoring them all. Different designs, different
6 design features, different eras. So there's a wide
7 variety of what he has to take in.

8 CO-CHAIR BLEY: Were you able to see
9 anything about their operating history and what kind
10 of problems occurred?

11 MR. BOWMAN: Some. We did use some of it.
12 I didn't personally go on this trip, but I can tell
13 you that for example they had a lot of problems where
14 they didn't understand --

15 CO-CHAIR BLEY: "They" being the
16 operators?

17 MR. BOWMAN: The operators at this gas
18 plant didn't understand their I&C system well enough.
19 So they didn't understand the effects of failures. So
20 we within our design certainly looked at that. We
21 provide the operators with backup control stations.
22 We have a procedure built already -- a draft
23 procedure; we don't have real procedures yet for this
24 kind of thing -- a draft procedure that describes what
25 the operator does in various failure states on the I&C

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1 system, depending on which portion of the system is
2 broken or failed. So we've developed some of that
3 work already.

4 But also the concept of a single operator
5 operating multiple units evolved. So what we wound up
6 with for the three reactor operators that you talked
7 a little bit about earlier is we have RO-1 as
8 described. He is operator at controls for 12 units.
9 He's monitoring 12 units. And he has two other
10 operators that are resources for him to use depending
11 on what's going on, are resources for him to help.
12 And that allows the maximum amount of flexibility with
13 addressing problems as they come up for that crew.

14 Instead of for example having an operator
15 -- three operators each describing -- covering four
16 units, they can only cover those four units and how
17 much further can they extend their use? For the
18 single operator, he's in passive control, what we term
19 passive control, as the plants are operating in normal
20 conditions.

21 CO-CHAIR BLEY: Can I ask you a question?

22 MR. BOWMAN: Sure.

23 CO-CHAIR BLEY: I had to take -- I saw it
24 there five, six -- four years ago, whenever that was,
25 but I read through the DCD, I read through the SER.

1 I didn't find anything. I went to the staffing and
2 whatever it is final report. Didn't find anything
3 there except a reference to the Concept of Operations
4 report where I found either specific details or at
5 least close-to-specific details with hints of the rest
6 of what you've described.

7 I think this material is very important to
8 support your philosophy of how to operate these
9 plants, yet from a regulatory point of view; at least
10 my regulatory point of view, it's in a tertiary
11 document. I don't know why you didn't recommend and
12 the staff didn't say that that document ought to be --
13 I forget the words they used -- picked up by
14 reference --

15 MR. BOWMAN: So the --

16 CO-CHAIR BLEY: -- for the design.

17 MEMBER SKILLMAN: Incorporated by
18 reference.

19 CO-CHAIR BLEY: Incorporated by reference.

20 MEMBER SKILLMAN: IBR.

21 MR. BOWMAN: So the Concept of Operations
22 is actually required by NUREG-1711 and is submitted
23 and on the docket as part of our application.

24 MR. TOVAR: There's two different
25 documents that we have: One is the Concept of

1 Operations, which is a higher-level document that
2 describes at a high level roles and responsibilities
3 and the staffing. We have a Conduct of Operations,
4 which I think your -- is really where your interest
5 lies -- is a much more detailed document that
6 describes the conduct of the operators within the
7 control room, different human error prevention
8 techniques and so forth, what is the requirements for
9 peer checking and so forth. That was not incorporated
10 by reference or docketed. As they are not in
11 commercial plants today it doesn't make sense to have
12 that type of controls on a document like that because
13 that makes it much more difficult for --

14 MEMBER CORRADINI: Was the overview
15 document explained, the process that we observed back
16 in -- when we were physically there, because you guys
17 took us through at least -- I can't remember who else
18 in the room was there.

19 CO-CHAIR BLEY: Just me, I think.

20 MEMBER CORRADINI: No, you and I.

21 CO-CHAIR BLEY: Of the people who were
22 still on -- were you there, Ron?

23 MEMBER BALLINGER: Oh, yes, I was there.

24 CO-CHAIR BLEY: Okay.

25 MEMBER CORRADINI: That you took us

1 through the what-ifs about if one plant went to some
2 sort of --

3 CO-CHAIR BLEY: Well, they actually ran a
4 drill --

5 (Simultaneous speaking.)

6 MEMBER CORRADINI: They ran the drill.

7 CO-CHAIR BLEY: I need to come back. The
8 document I'm looking at is -- wow, that's a different
9 number than -- oh, no. RP0215-10815-P, and it's
10 called Concepts, with an S, of Operations.

11 MR. BOWMAN: But that does describe the
12 role of --

13 (Simultaneous speaking.)

14 CO-CHAIR BLEY: It does.

15 MR. BOWMAN: Yes.

16 CO-CHAIR BLEY: It does. And that's the
17 one I was talking about. The other one I haven't
18 seen, so I'm going to have to go look for that.

19 (Laughter.)

20 CO-CHAIR BLEY: Conduct of Operations.

21 MR. BOWMAN: So the Concept of Operations,
22 the document you referenced, is incorporated by
23 reference and was --

24 (Simultaneous speaking.)

25 CO-CHAIR BLEY: No, it's not. Nowhere I

1 saw in either the DCD or the SER. If it is, please
2 show us. Not this instant, but fill us in. That one
3 I would like -- I think that would be a good idea.
4 The Conduct of Operations one, if you can give us a
5 report on that, that would be of interest, because I
6 didn't see that referenced anywhere.

7 MR. BOWMAN: But to echo Tim's comment, I
8 don't believe the Conduct of Operations is
9 appropriate. I mean, mind you, we're reviewing it,
10 obviously. I don't believe it's appropriate to bring
11 into a DCA application, but --

12 CO-CHAIR BLEY: Well, that might be. It's
13 the other one that I was --

14 MR. BOWMAN: Right.

15 CO-CHAIR BLEY: -- thinking should be.

16 MR. BOWMAN: Okay.

17 CO-CHAIR BLEY: Because I didn't see
18 anywhere else where this was addressed.

19 MR. BOWMAN: Sure.

20 MR. TOVAR: And I just checked Chapter 18
21 of the design certification application and it is not
22 referenced directly, but if you --

23 CO-CHAIR BLEY: Yes.

24 MR. TOVAR: -- look into --

25 CO-CHAIR BLEY: It's true.

1 MR. TOVAR: -- I want to say the Staffing
2 and Qualification Results Summary Report --

3 CO-CHAIR BLEY: It references it.

4 MR. TOVAR: -- it will be referenced --
5 (Simultaneous speaking.)

6 CO-CHAIR BLEY: That is true. That's why
7 I called it a tertiary --

8 (Simultaneous speaking.)

9 MEMBER CORRADINI: That's how he found it.

10 MR. TOVAR: Right.

11 CO-CHAIR BLEY: That's how I found it. I
12 didn't --

13 MR. TOVAR: Okay.

14 CO-CHAIR BLEY: -- find it until like
15 Friday and didn't get a copy of it to look at until
16 Sunday.

17 MEMBER SKILLMAN: Doug, let me ask this
18 question: When I look at my RO license and my SRO
19 license, there's a blank. It gives my name and I'm
20 authorized to operate reactor with facility
21 designation, and there's the facility designation.
22 And for both my licenses there's just one reactor.
23 What is the vision that NuScale has and what is the
24 NRC's vision for how your reactor -- how the NuScale
25 reactor operators' licenses will be identified,

1 because one of the key facets of, at least the
2 licenses that most of us have held, is the issue of
3 accountability. If you are the OAC and you fail to
4 operate in accordance with procedure, you own it.

5 MR. BOWMAN: So --

6 MEMBER SKILLMAN: So here you are, an
7 individual perhaps with a license to operate sub 1,
8 sub 2, sub 3, sub 4, sub 5, sub 6, and it's good old
9 sub 7 that goes belly up in the night. You say, well,
10 really, I was just monitoring it. I wasn't operating.
11 He was operating.

12 MR. BOWMAN: So I'll try to answer that in
13 two parts. So I'll start off with -- both of my
14 licenses have two facilities on them because I was
15 licensed --

16 (Simultaneous speaking.)

17 MEMBER SKILLMAN: On both? Okay.

18 MR. BOWMAN: So we envision that first
19 part of that question to be answered with the docket.
20 I believe we're going to have individual dockets for
21 the units. So therefore, an operator would be
22 licensed on those 12 units.

23 No. 2, our -- I don't know how far I can
24 go in open session with this one in terms of
25 discretion of --

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1 PARTICIPANT: If it's displayed in a non-
2 proprietary simulator presentation, it's --

3 (Simultaneous speaking.)

4 MR. BOWMAN: Yes, we can do that. Okay.
5 We use a concept called passive and active control in
6 the Concept -- in the Conduct of Operations. So if
7 the Operator 1 -- I say one guy is in charge, RO-1,
8 and one person is -- he -- that person is monitoring
9 those 12 units and there's nothing displayed on the
10 HSI. So when somebody wants to go take action on the
11 unit, we go into a mode we call active control.

12 So if it's going to be RO-1, which on
13 certain cases, limited cases we roll out and take very
14 small actions, he would actually change the HSI to
15 show that he is in active control of that unit. And
16 that's a symbol that -- an icon that shows up. If he
17 were to do a bigger -- a bigger task needed to be
18 done, then for example RO-2 might do it. Well, when
19 RO-2 took over control of that unit, you would put his
20 icon up there and show that he's in control.

21 So our Concept of Operations; we like to
22 use this term a lot, is baked into our human system
23 interface. We have a very clear set of roles and
24 responsibilities. We know who's in charge of all the
25 units all the time and it's displayed for anybody who

1 walks into the control room to see.

2 MEMBER SKILLMAN: Thank you.

3 MR. BOWMAN: All right. So I'll move onto
4 task analysis. I'm leading up to -- to get back to
5 our summary, I'm leading up to the staffing plan
6 validation. We talked about operating experience and
7 how we developed our Concept of Operations. I'm going
8 to talk about task analysis.

9 This is really a brief slide, but task
10 analysis was important to us because much like the
11 question about the generic technical guidelines, the
12 task analysis we did for human factors engineering.
13 When you look at it, it looks like a procedure. I
14 mean, that's the way we wound up using it. We
15 developed task analysis to look like procedures.

16 This was done by our subject matter
17 experts, the 18-plus people, SROs, we've had working
18 on this project for four-plus years. More than that.
19 The five years I've been around. We actually put this
20 task analysis into the database that almost the entire
21 industry uses for training. That allows us to use
22 that task analysis as a training basis, too, in the
23 systematic approach to training. So our intention is
24 to build the entire operations program forward
25 starting with human factors engineering and keep

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1 developing the project as we move on.

2 Next slide. Treatment of Important Human
3 Actions. So we've talked about this in Chapter 13 a
4 bit, but we have two risk-important human actions. We
5 talked about the other seven actions we identified
6 during GTG -- or generic technical guideline
7 development, but these are the two important ones.
8 And we've discussed them before. We're adding water
9 to the reactor coolant system with a chemical and
10 volume control system and adding water to containment
11 with the containment flood and drain system.

12 We needed to develop these to know what
13 our staffing plan validation test was going to look
14 like. We had to understand them well. And recognize
15 there are no deterministic important human actions
16 identified in -- by transient max analysis or by the
17 diversity or defense-in-depth coping analysis.

18 CO-CHAIR BLEY: I don't know quite what
19 that means, but --

20 MR. BOWMAN: So I'll talk about it by
21 chapter then.

22 CO-CHAIR BLEY: Okay. That's fine.

23 MR. BOWMAN: We found our important human
24 actions in Chapter 19 like we discussed. These other
25 two, the major areas were the human factors

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1 engineering regulations tell you to look is in Chapter
2 7 in your diversity and defense-in-depth analysis, and
3 in Chapter 15 under your accident analysis to look for
4 operator actions.

5 CO-CHAIR BLEY: And we haven't reviewed
6 that yet. Chapter 15 --

7 MR. BOWMAN: Seven you've reviewed.

8 CO-CHAIR BLEY: -- we haven't. Seven we
9 have.

10 MR. BOWMAN: Yes.

11 MEMBER SKILLMAN: Doug, isn't that -- that
12 second bullet on that slide, the deterministic
13 important human actions were identified, so on and so
14 forth, based on your critical safety functions.
15 Because the real root of this and of these two highly
16 important actions come out of your critical safety
17 functions. They're driven by the CSFs.

18 MR. BOWMAN: Well, they're certainly
19 categorized under CSFs and put in that way, but we
20 were always looking for places where people were
21 trying to specify actions for operators. When I went
22 back to that early statement where I said we were a
23 staunch defenders of the position that we didn't want
24 any operators -- operator actions in the design. So
25 Chapter 15 and Chapter 7 we were -- I don't know how

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1 best to put it -- we defended that position strongly.

2 Any time somebody brought up -- an
3 engineer might bring up a solution to a problem we
4 were having with a design, they might say, yes, we can
5 put an operator action here. It's common in the
6 industry. We came back with, no, we need to come up
7 with a solution that doesn't require an operator
8 action.

9 MEMBER SKILLMAN: Okay.

10 CO-CHAIR BLEY: Okay. And this was in
11 Chapter 18 you talk about this for the important
12 actions. Or no, for the deficiencies? You looked
13 for --

14 MR. BOWMAN: No, no, no. This is back in
15 the design stage.

16 MEMBER SKILLMAN: This is your overall --

17 MR. BOWMAN: I'm sorry. I'm going back,
18 way back --

19 (Simultaneous speaking.)

20 MEMBER SKILLMAN: Yes, this is your
21 overarching design?

22 MR. BOWMAN: Right, this is how we -- this
23 is our design philosophy. We were strong about not
24 wanting operator action.

25 MEMBER SKILLMAN: So I'm going to agree

1 with you that that is the appropriate overarching
2 design intent, and I think you fulfilled that by and
3 large by being faithful to your CSFs. And I just
4 think there may be one or two more that need to be
5 elevated to CSF category, because I think they are so
6 important that they need attention. So I would
7 suggest that -- generally I agree with you, but I
8 think the lens needs to be opened a little wider.

9 MR. TOVAR: So I think that we've heard
10 that message very clearly --

11 MEMBER SKILLMAN: Yes, okay.

12 MR. TOVAR: -- and we need to go back and
13 make sure that we --

14 MEMBER SKILLMAN: I'll stop.

15 MR. TOVAR: -- take a look at that.

16 MEMBER SKILLMAN: I'll stop. It's just
17 really a chapter 18, but it's also a Chapter 13 issue.

18 MR. TOVAR: Sure, and I'm not asking --

19 CO-CHAIR BLEY: Can I put a little onus on
20 you?

21 MR. TOVAR: Sure.

22 CO-CHAIR BLEY: Earlier when you followed
23 this line you gave them at least the example of the
24 crane moving loads while the other plants are
25 operating. I didn't hear another one you offered

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1 them. Did you have another one? I don't think so.

2 MEMBER SKILLMAN: I -- well --

3 CO-CHAIR BLEY: I think it was just that
4 one.

5 MEMBER SKILLMAN: Only to the extent that
6 it's woven between Chapter 15 --

7 CO-CHAIR BLEY: Yes, but if --

8 MR. TOVAR: -- and 18.

9 CO-CHAIR BLEY: -- there are two or three
10 more important safety functions --

11 MEMBER SKILLMAN: No, I --

12 CO-CHAIR BLEY: -- we know about, we ought
13 to tell them why we think that's --

14 MEMBER SKILLMAN: I do not have --

15 CO-CHAIR BLEY: -- I kind of suspect I
16 could throw a couple in, but almost all of them could
17 be reduced to what they have except for the thing you
18 were talking about.

19 MEMBER SKILLMAN: Yes. No, I don't have
20 one beyond that, Dennis.

21 CO-CHAIR BLEY: Okay.

22 MEMBER SKILLMAN: Yes, I agree. I agree.

23 CO-CHAIR BLEY: I just didn't want to
24 leave them with an assignment that had no answer.

25 MEMBER SKILLMAN: No, and I'm not trying

1 to give --

2 CO-CHAIR BLEY: Not that we can give you
3 assignments --

4 (Simultaneous speaking.)

5 MEMBER SKILLMAN: Yes. No, but I'm not
6 trying to give them raspberries, either. I'm not
7 trying to hassle them. I am --

8 CO-CHAIR BLEY: No, I was just trying to
9 be --

10 (Simultaneous speaking.)

11 MEMBER SKILLMAN: Very sensitive to the
12 module and the crane, that coupling. Okay.

13 MR. BOWMAN: All right. So a little bit
14 of background about the important human actions.
15 We've talked about what they are, but I'm going to
16 tell you when we use them. This is a bit of a
17 simplification, but I'm an operator; I like simpler
18 answers better than more complex ones.

19 We categorized the important human actions
20 of the three major design -- beyond-design-basis
21 accident events. The first is a containment bypass
22 event, which is -- could either be a LOCA outside of
23 containment, un-isolable in either -- on CVCS, for
24 example, would be a great example, or you could have
25 a steam generator tube failure in combination with an

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1 un-isolable stem break, which would also force you to
2 lose inventory out of the -- outside of the module.
3 That's really what a containment bypass event is. And
4 in that case we need to add water using the CVCS
5 system to the reactor coolant system in order to
6 address that. Again, beyond-design-basis.

7 The second is a failure of ECCS where
8 either all of the reactor vent valves or all of the
9 reactor re-cert valves fail to open. So this isn't a
10 normal single-failure ECCS failure. This is a -- all
11 three -- there's three vent valves on top of the
12 system that are on top of the reactor coolant system
13 that are part of the ECCS system. All three of those
14 have to fail to open in this case.

15 MEMBER CORRADINI: And either that or --
16 (Simultaneous speaking.)

17 MR. BOWMAN: Or the reactor re-cert valve
18 -- both reactor re-cert valves have to fail. Again,
19 beyond-design-basis failure ECCS.

20 And the third is a complete failure of the
21 decay heat removal system. That means the whole
22 system, all trains are failed and both reactor safety
23 valves failed to open. In this case you have no way
24 to remove heat. So in that case you actually -- you
25 just use the containment flood system to add water

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1 outside of containment in order to provide a coupling
2 of the reactor coolant system with the open heat sync
3 to cool down the reactor.

4 So what's important about that --

5 MEMBER CORRADINI: Sorry, but for all
6 three of these you require -- back to the -- my
7 question about the two actions, either CFDS or CVCS
8 must be actuated to satisfy --

9 MR. BOWMAN: Right.

10 MEMBER CORRADINI: -- to get around it?

11 MR. BOWMAN: I'll go back to that. So
12 when -- and if you would bypass on that, you can
13 actually use either the containment flood action or
14 the CVCS action to address it.

15 In the ECCS failure the only thing that's
16 successful --

17 MEMBER CORRADINI: Is CVCS?

18 MR. BOWMAN: -- is the CVCS. And in the
19 last one I talked about, the failure of decay heat
20 removal and the reactor safety valves, only the
21 containment flood system is accessible.

22 So both of those important human actions
23 were sampled by the staffing plan validation. I'll
24 talk a little bit more about what staffing plan
25 validation was in a minute.

1 And then all of the human actions that
2 were performed from the main control room assumed in
3 the PRA were sampled during the integrative system
4 validation. That's the later testing which was
5 completed. We looked at all seven of those actions
6 and did those -- not all seven. We didn't do the
7 local action. All the one from the control room were
8 sampled during the integrated system validation.

9 CO-CHAIR BLEY: I want to ask you a
10 question because it wasn't transparent to me either in
11 the DCD or in the SER. To me. It might be clear to
12 everyone else. The ISV, the integrated system
13 validation, and the SPV, the staffing plan validation,
14 both seem to be key to many open items that I saw.
15 Can you explain the difference between those two?

16 MR. BOWMAN: I will get into those in just
17 a minute. Hopefully that will explain your -- answer
18 your question. In fact, we'll talk about it now.

19 So talking about staffing and
20 qualification --

21 MEMBER BROWN: If I could interrupt for a
22 second. Go back. Go back a page. You say the IHAS
23 are utilized in three major beyond-design-basis
24 accident conditions, yet in -- and I'm trying to
25 correlate this with some words in Chapter 18 that says

1 you only have two IHAS.

2 MR. BOWMAN: Correct.

3 MEMBER BROWN: Two risk-important. And
4 that is relative to the un-isolate and initiate
5 injection of the inventory of the vessel using CVS --
6 CVCS system. The second one is to un-isolate and
7 initiate injection of inventory to the containment.

8 MR. BOWMAN: Correct.

9 MEMBER BROWN: And yet --

10 MR. BOWMAN: Two actions will cover these
11 three beyond-design-basis --

12 MEMBER BROWN: Is that --

13 MR. BOWMAN: So I'll walk --

14 MEMBER BROWN: I'm trying to get -- that's
15 what I'm trying to get is what's the --

16 (Simultaneous speaking.)

17 MR. BOWMAN: All go through it again. So
18 the containment bypass event can be addressed by
19 either using the -- adding water to the reactor
20 coolant system with CVCS or by using the CFDS. Either
21 one of those will work, because in these cases the
22 ECCS valves are open and your -- the water can come in
23 either from containment or into the reactor coolant
24 system.

25 In the second case, the ECCS failure, you

1 have to put water into the reactor coolant system.
2 The containment flood and drain system is not
3 effective in this case to prevent core damage. So you
4 have to put containment -- CVCS into the reactor
5 coolant system to mitigate this event.

6 And the third one, the complete failure of
7 decay heat removal, basically all of your heat removal
8 systems, you have to put water outside of -- outside
9 of the reactor coolant system in the containment
10 vessel in order to couple the core -- reactor coolant
11 system to the ultimate heat sink to address it.

12 So there are three events and there are
13 two actions we use to address all of them, just in
14 different combinations depending on the event.

15 MEMBER BROWN: Okay.

16 MR. BOWMAN: And then if you go back and
17 look at the GTGs, we have direction that gives the
18 operator which one to use under which event. So
19 although they're not event-based, they are symptom-
20 based.

21 MEMBER BROWN: Okay. Thanks for the
22 connection.

23 MR. BOWMAN: Does that --

24 MEMBER BROWN: Yes. Yes. No, I --

25 MR. BOWMAN: Okay.

1 MEMBER BROWN: -- I've been listening.
2 That's what I have read and all of a sudden I -- my --
3 I had two and just with -- burned it in my brain,
4 which is a very small brain these days.

5 MR. BOWMAN: All right. So staffing
6 qualification, again our staffing qualification was
7 based on the fact that we have no operator actions
8 required for design-basis events. The HSI provides
9 at-a-glance assessment of the plant conditions and
10 facilitates protection of the creating conditions and
11 one operator can have primary focus on maintaining and
12 monitoring a role during normal, abnormal and
13 emergency conditions. And that's the role described
14 in the Concept of Operations for RO-1.

15 So the results of SPV, I'll start with.
16 SPV verified that a NuScale plant can be operated --

17 CO-CHAIR BLEY: Say the words.

18 MR. BOWMAN: Staffing Plan Validation --

19 CO-CHAIR BLEY: Thank you.

20 MR. BOWMAN: -- verified the NuScale plant
21 can be operated safely and reliably from a single
22 control room by a contingent of three reactor
23 operators, three licensed reactor operators and three
24 licensed senior reactor operators. We do have a COL
25 action item that will determine the non-licensed

1 operator staffing requirement.

2 CO-CHAIR BLEY: Okay. How are you going
3 at that?

4 MR. BOWMAN: We did model -- in both
5 staffing plan validation and integrated system
6 validation we modeled four non-licensed operators just
7 to allow those events to go on. We need to do a
8 separate assessment of some kind to determine how many
9 operators that will be, but that is a COL action. I
10 mean, they may ask us to do that for them, but --

11 CO-CHAIR BLEY: Okay.

12 MR. BOWMAN: -- that's something the need
13 to determine.

14 So our staffing plant validation was
15 performed in August of 2016. This -- I'm going to
16 talk about scope. This event, this staffing plan
17 validation consisted of two crews of five NuScale
18 operations staff. This is not a separate group. This
19 is a group of people we pulled from inside of our
20 organization, 10 people total. They were trained to
21 perform the tasks necessary to complete staffing plan
22 validation and they did not know the content or
23 sequence of any of the scenarios.

24 So the scenario tasks for staffing plan
25 validation were samples from the task analysis, which

1 is why I talked about it earlier, based on the
2 following attributes: We did task analysis and then
3 we evaluated them using human factors engineering
4 tools. So these are the attributes that we looked for
5 and sampled from. So it would be a high-risk task,
6 high-stress task. You can see the list there.

7 What we're after is -- a large workload
8 under a high-risk or high-stress condition is what we
9 were looking for when we did the sampling for staffing
10 plan validation.

11 CO-CHAIR BLEY: Just an aside, because I
12 was a little concerned about the human reliability
13 analysis so far down in the PRA. I'm trying to think
14 of when you did these different things. Did the
15 people doing the human reliability analysis in the PRA
16 have access to the thinking about what's high-stress,
17 all of the items on this list, as they did that work?
18 And if they didn't, I'm wondering if they shouldn't go
19 back and make sure they picked up things that the rest
20 of you thought of.

21 MR. BOWMAN: I'm not sure if one of our
22 PRA members are the line or not, but my understanding
23 of the HRA was -- consisted of is a very simple
24 model --

25 CO-CHAIR BLEY: Very simple?

1 MR. BOWMAN: -- that allows -- that says
2 the first time an action appears in an event tree,
3 there would be a one in a thousand chance the operator
4 would fail. And then it goes down to one in a hundred
5 for two and it progresses down until you always fail
6 them.

7 CO-CHAIR BLEY: Okay. So I don't -- I
8 didn't need an answer to this, but if somebody from
9 the PRA group is on the line, one day maybe when we
10 come back with no open items, you can tell me how this
11 is going to be done in a less-simplistic way for the
12 final PRA before fuel load. And I hope that won't
13 just be saying that's up to the COL applicant.

14 Go ahead.

15 MEMBER SKILLMAN: I've got to --

16 CO-CHAIR BLEY: It's a separate thing. I
17 don't think we need to talk about it.

18 MEMBER SKILLMAN: I got to ask this
19 question: High-stress. I operated with a guy who
20 when things were really coming apart at the seams, he
21 was so lazy his automatic watch would stop.

22 (Laughter.)

23 MEMBER SKILLMAN: He did not get stressed
24 under any circumstances. And his DNA was just flat-
25 lined. But he was a great operator. He never missed

1 a beat, but he did not stress.

2 CO-CHAIR BLEY: You may have worked with
3 a guy like one I worked with. When it was as simplest
4 thing like a startup, he was completely stressed,
5 right?

6 MEMBER SKILLMAN: But my only point is --

7 CO-CHAIR BLEY: You have both kinds.

8 MEMBER SKILLMAN: -- what might be very
9 high-stress for me might be a non-item for Dr.
10 Ballinger. How do you identify what's high-stress?

11 MR. BOWMAN: Well, for this juncture where
12 we were at in the design, it was the subject matter
13 expert's job to identify if he thought the task was
14 high-risk.

15 MEMBER SKILLMAN: Fair enough. Okay.

16 MR. BOWMAN: And that's really what we do.

17 CO-CHAIR BLEY: Did he do any checking --

18 MR. BOWMAN: I have a story for you about
19 a person --

20 (Simultaneous speaking.)

21 MR. BOWMAN: Yes, we found also during
22 ISV, integrated system validation --

23 (Simultaneous speaking.)

24 CO-CHAIR BLEY: Did you see any change to
25 that during your simulator exercises that might say we

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1 didn't think this was high-stress, but everybody's
2 having trouble with it, or vice-versa?

3 MR. BOWMAN: It was actually probably
4 likely more towards the other -- what -- so what we
5 traditionally felt was high-stress, for example
6 accident mitigation, especially within the design, is
7 essentially not really all that stressful in the
8 NuScale design. Not so much the other way.

9 I mean, so the tasks that we sampled are
10 fairly obvious to you. Major accidents, beyond-
11 design-basis accidents, fires. And the other side of
12 this is it wasn't just this sampling. They also had
13 to be not -- something you couldn't drop, right?
14 Something you couldn't stop doing. So you have to
15 respond to the fire. I can't stop responding to the
16 fire. A surveillance that's going on I might be able
17 to stop and move onto something else. So that really
18 shouldn't be part of our workload concerns. So we
19 look for fires. Medical conditions. A medical issue
20 in the plant. We sampled that.

21 CO-CHAIR BLEY: But that shouldn't be part
22 of our workload concern, but when you read lots of
23 incident reports --

24 MR. BOWMAN: Sure.

25 CO-CHAIR BLEY: -- people get tied up in

1 that sort of routine stuff and don't come around in
2 time sometimes.

3 MR. BOWMAN: I have personal experience,
4 so that was why we --

5 (Laughter.)

6 CO-CHAIR BLEY: Don't we all? Okay. So
7 you do have it? Okay.

8 MR. BOWMAN: Absolutely.

9 MEMBER CORRADINI: So must to make sure I
10 understand. So you went through all the Chapter 15
11 accidents at least --

12 MR. BOWMAN: Yes.

13 MEMBER CORRADINI: -- and see how they
14 kind of fell out relative to these attributes?

15 MR. BOWMAN: Correct. And we sampled
16 quite a few Chapter 15 accidents during the staffing
17 plan validation.

18 MEMBER CORRADINI: Okay. That's fine.

19 My next question is since this is an area
20 that we've been talking about that I have -- I am
21 learning; I'm not -- I can't criticize or ask
22 questions about that much -- I'm curious about how did
23 you -- for the analysis or -- for the simulation of
24 the Chapter 15 accidents you were using RELAP and
25 NRELAP?

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1 MR. BOWMAN: Correct.

2 MEMBER CORRADINI: Okay.

3 MR. BOWMAN: The simulator model, as you
4 -- so this was after you guys visited, so it would
5 have been a more developed version of the same
6 simulator that you guys saw.

7 MEMBER CORRADINI: Okay. Fine. Thank
8 you.

9 MR. BOWMAN: Okay. So these tasks, we
10 took the sampling of tasks, we grouped them into three
11 very challenging scenarios and each crew, these two
12 crews performed all three scenarios. So these
13 scenarios -- I would have some examples for you what
14 we put into them, but there was -- if any of you are
15 familiar with the initial license training exam, it
16 would look two or three of them stacked together at
17 times and how much was going on in these scenarios.
18 We intended them to be very challenging high-workload
19 scenarios to prove that the design could be operated
20 with the operators we had.

21 MEMBER CORRADINI: And so I'm sorry to ask
22 this question. So let me make sure I understand. So
23 you had the dozen units, modules, whatever you call
24 them, and something would happen here and something --
25 okay. That's what I wanted to check.

1 MR. BOWMAN: Right. We would have
2 multiple events on multiple units in a single
3 scenario.

4 MEMBER CORRADINI: Okay.

5 MR. BOWMAN: Scenarios generally lasted
6 about less than two hours and they would run across --
7 for example, they might run across a Chapter 15 event
8 and a design-basis event and then maybe a multi-unit
9 event as well.

10 MEMBER CORRADINI: Thank you.

11 MR. BOWMAN: So our testing methodology
12 was based on what we anticipated doing for integrated
13 system validation testing, so that meant that we took
14 -- we had observers in the room. We collected their
15 feedback. We collected feedback from the operators
16 themselves. We collected task times, which means if
17 there was a timed task within that evolution, we would
18 take a stopwatch and watch the guy from start to
19 finish and see how long it took him. And our SPV
20 again successfully demonstrated that NuScale design
21 could be safely operated by the proposed staff.

22 So after SPV we did some more work on
23 human system interface design. Just a little bit of
24 background about it. We have a multi-faceted team, so
25 we -- I talked a lot about the operators we used. We

1 also have human factors engineers that do work for us,
2 too. So we're -- their input is important, but we are
3 led by the operations group in terms of doing this
4 human factors engineering work. It sounds a little
5 strange, but that's the way we did it.

6 MEMBER CORRADINI: Doesn't sound strange
7 to me.

8 MR. BOWMAN: I mean, my background, I
9 don't have any human factors engineering background
10 and I'm in charge of our human factors engineers. But
11 they've been a great resource and they've been a great
12 fantastic input to us.

13 So we went through and --

14 MEMBER SKILLMAN: Let me ask this: The
15 two groups of five you chose, two groups of five --

16 MR. BOWMAN: Yes.

17 MEMBER SKILLMAN: -- what gives you
18 confidence that those individuals are representative
19 of a future licensee's individuals?

20 MR. TOVAR: So that wasn't really the
21 intent of the staffing plan validation. That was more
22 the intent of the integrated system validation, which
23 is a more comprehensive test. For this we wanted to
24 show that a crew of competent licensed operators; and
25 that's what they simulated, would be capable of

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1 operating the plant in a very challenging high-
2 workload situation.

3 MEMBER SKILLMAN: This is kind of a proof
4 of principle as opposed to --

5 MR. TOVAR: Exactly.

6 MEMBER SKILLMAN: -- checking out a future
7 licensee? Understand.

8 MR. TOVAR: Okay.

9 MR. BOWMAN: Okay. Yes, thanks.

10 MR. BOWMAN: Okay. So here's an example
11 screen we have up. And this is actually what we
12 termed the process library, so when you ask about your
13 electronic procedures, this is the screen that does
14 our electronic procedures for us.

15 On the left-hand side you can see a column
16 with a menu list of various procedures that you're
17 allowed to go access. On the very right-hand column
18 you have a progress bar and that progress bar shows
19 you all the active procedures anywhere in all 12 units
20 at any time. So anybody in the control room can
21 access that information on the right-hand bar and tell
22 every activity that's going on in the control room at
23 the time. And he can also go click on it, select it
24 and it will pull up into his process library and he
25 can see live where that person is at.

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1 CO-CHAIR BLEY: Any time they hit a point
2 where they trip the unit and put it in its safe mode,
3 does this disappear or are they still in the middle of
4 those procedures?

5 MR. BOWMAN: So I show you this as a
6 single example. It would probably be good to have a
7 layout. You've seen the layout. But we have three
8 work stations --

9 CO-CHAIR BLEY: It's been a long time.

10 MR. BOWMAN: -- we have three work
11 stations. There's four screens in front of the
12 operator. Each operator is at their work station.
13 There's also a large horseshoe that has all 12 units
14 mimicked up in front of it. So when a unit does for
15 example a reactor trip there's many indications that
16 come in to tell the operator this has happened.

17 One is there's a large overview screen
18 that provides an indication that the reactor is
19 tripped and whether or not that trip has been
20 successful or not. There's a series of four screens
21 below it in the horseshoe that also come out of sleep
22 mode and wake up and show the status of for example
23 our critical safety functions and -- but there's lots
24 of ways for him to know that has happened. This stays
25 up and available at all times. Or I shouldn't say at

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1 all times, but it doesn't change status because of
2 that --

3 CO-CHAIR BLEY: Okay.

4 MR. BOWMAN: -- change in the status of
5 the unit.

6 MEMBER BROWN: If a screen pops up, how
7 long before it disappears?

8 MR. BOWMAN: As long as there is an
9 actuated safety function those screens stay up, right?

10 PARTICIPANT: Right.

11 MEMBER BROWN: But if something else
12 happens and you need it -- so it disappears and
13 something else comes in in its place?

14 CO-CHAIR BLEY: Or they stack up?

15 MR. FLAMAND: So the critical safety
16 function display isn't meant to be moved. It's pretty
17 much got an area so that way the operator always know
18 to go look there. At the work station you're able to
19 maneuver your screens however the user wants them.
20 And so --

21 MEMBER BROWN: But they don't change
22 without you changing them?

23 MR. FLAMAND: Not at your work station.

24 MR. BOWMAN: Correct.

25 MEMBER BROWN: Let me give you a

1 frustration. How many times have I been doing
2 something, had to go pull something else up and I have
3 to make it so small I can't read it or you cover up
4 what you're doing, you can't remember what you read on
5 the other page and you're snapping back and forth, and
6 by that time, when you're my age, you've forgotten
7 what you're looking for in the first place.

8 MEMBER CORRADINI: They're not that --

9 MEMBER BROWN: Huh?

10 MEMBER CORRADINI: They're not going
11 through --

12 (Laughter.)

13 MR. FLAMAND: That's my answer.

14 MR. BOWMAN: We've addressed many of those
15 things. For example, the font sizes are limited based
16 on the screen, a human factors engineering principle.
17 You can't actually -- they have to be a certain size
18 to be readable at all times. We don't shrink down
19 into windows for any screens or fall full screen
20 systems, but you can go through and select what
21 screens you want up. And operators, as we went
22 through the integrated system validation, found they
23 wanted certain sequences of screens up, and that's
24 what they like, depending on what work they were
25 doing.

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1 MEMBER CORRADINI: Are some of these back
2 up on paper, pull up paper? I think they asked the
3 same question about --

4 MR. BOWMAN: Some of the procedures you
5 have paper backup when appropriate.

6 MEMBER MARCH-LEUBA: Some or all?

7 MR. BOWMAN: Some. Not all.

8 CO-CHAIR BLEY: They're --

9 MR. BOWMAN: You got to --

10 CO-CHAIR BLEY: The DCA says some.

11 MR. BOWMAN: Yes, so the -- go ahead.

12 MR. FLAMAND: I was just going to say one
13 of the things that we showed -- because we did have
14 operators use backup procedure sets. And they were
15 still electronic. They were just on tablets. So then
16 we could have whole sets of procedures on an
17 electronic tablet. And the nice thing about that is
18 then the same feel and look at the operator would see
19 in an interface is what they see on the tablet, same
20 place keeping, same -- so that way it wasn't a
21 jarring. They moved from one --

22 (Simultaneous speaking.)

23 MEMBER CORRADINI: -- a three-ring binder
24 is a tablet, an external --

25 (Simultaneous speaking.)

1 MR. FLAMAND: Correct. Yes. And now you
2 can have 10 of those and have your entire procedure
3 set.

4 MEMBER MARCH-LEUBA: The failure that
5 happens here is reproduced on the tablet? That's what
6 you're saying?

7 MR. FLAMAND: Say that again, please?

8 MEMBER MARCH-LEUBA: The same failure of
9 your software that is happening on this screen is
10 reproduced on the tablet?

11 MR. FLAMAND: Well, the tablet is not
12 connected to the HSI. They're separate.

13 MEMBER MARCH-LEUBA: But it's a logic
14 failure where the programmers messed up?

15 MR. BOWMAN: Well, we do have --

16 CO-CHAIR BLEY: I mean, if they have the
17 procedure -- and if it's a procedure, it can be in
18 black and white or it can --

19 (Simultaneous speaking.)

20 MEMBER MARCH-LEUBA: No, it's a failure to
21 implement it. I mean, it's a quality control --

22 MR. BOWMAN: But for example -- I'll give
23 you an example: We do have a paper procedure
24 available. The paper procedure is the loss of I&C,
25 because if you lose that, you don't have access to

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1 this. So where appropriate we do have paper backup
2 procedures.

3 MEMBER MARCH-LEUBA: Why not have them
4 all on paper? It's just been too -- a little
5 obstinate.

6 MEMBER BROWN: What did you call these?
7 The tablets, whatever the latest winkle is for these
8 little doohickeys?

9 MR. FLAMAND: Yes.

10 MEMBER BROWN: You can tell I don't have
11 one. They're not really paper?

12 MEMBER MARCH-LEUBA: Similar to your
13 phone.

14 MEMBER BROWN: 2002 cell phone. It works.
15 They're not paper? There's no paper is what you're
16 telling me. They're written in tablets?

17 MR. BOWMAN: No, no. There is some paper
18 where appropriate.

19 MEMBER BROWN: Oh, okay. All right.

20 MR. BOWMAN: For example, the loss of
21 I&C --

22 MEMBER BROWN: I got lost in that
23 iteration back and forth here with the --

24 MR. BOWMAN: For example, the loss of I&C
25 procedure is on paper because when you lose I&C, you

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1 don't have access to these procedures in the HSI
2 anymore. So it's then appropriate to have --

3 MEMBER BROWN: Yes, but you've got the
4 tablet.

5 MR. BOWMAN: We could use the tablet, but
6 in this case it might be easier just to turn around
7 and grab the paper procedure.

8 MEMBER BROWN: It's much easier to look at
9 pages than turning back and forth.

10 CO-CHAIR BLEY: Depends your generation,
11 right?

12 MR. FLAMAND: Depends on your generation.

13 CO-CHAIR BLEY: But when you go to the
14 tablet wherein the big board, the normal system it
15 says as the following three functions achieved and it
16 will tell you yes, they are. You don't have that on
17 the tablet, correct? You have to go find it yourself?

18 MR. FLAMAND: You're not communicating
19 with the HSI, so you --

20 CO-CHAIR BLEY: At all?

21 MR. FLAMAND: So for instance; and Doug
22 talked about this earlier, one of the reasons of the
23 STA to go look for things separate was, one, to try to
24 address the issue of a problem on the HSI, a software
25 problem. That's another backup. Another could be if

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1 all the -- if the system's gone, I have a way to still
2 address the critical safety functions manually. And
3 then of course there is a paper version of the
4 critical safety -- of the emergency operating
5 procedures. So that would be one of the few set of
6 paper procedures available.

7 CO-CHAIR BLEY: in your test programs have
8 you run at least some kind of simulation on every
9 emergency operating procedure?

10 MR. BOWMAN: We have gone through -- we
11 did not get through every branch in the simulator. We
12 have on tabletops on everything in the emergency ops.
13 Every branch --

14 CO-CHAIR BLEY: Have you exercised them
15 all? The reason I ask is, out in the operating fleet,
16 we've done a pretty good job of that. Somewhere
17 people have exercised all of them. And then, we came
18 up with the shutdown emergency procedures and thought
19 we were really smart. And I was doing some work with
20 one of the plants that had done that, and we started
21 running events, and procedures had all kinds of dead-
22 ends in them that the guy who wrote them never thought
23 of. If you don't exercise them, you don't know
24 they're going to work, even for the things you've
25 thought of, let alone the things that we talked about.

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1 MR. BOWMAN: So, my background was you had
2 to go through every branch of the procedure to
3 validate it. So, that effort, the open item in
4 Chapter 13 about validation of the GTGs --

5 CO-CHAIR BLEY: So, you will do that?

6 MR. BOWMAN: Yes.

7 MEMBER CORRADINI: What open item is that?

8 MR. BOWMAN: The Chapter 13 one about the
9 validation of --

10 MEMBER CORRADINI: The 13.5.1?

11 MR. BOWMAN: -- the Generic Technical
12 Guidelines. I think it's 13.5.1, yes.

13 MEMBER CORRADINI: Okay, fine.

14 MR. BOWMAN: Yes.

15 MEMBER CORRADINI: All right. Thank you.
16 Thanks.

17 MR. BOWMAN: That's what we need to do.

18 CO-CHAIR BLEY: Okay. And that part of
19 testing you have not done?

20 MR. BOWMAN: We've actually completed it.
21 We just haven't written the report on it yet.

22 CO-CHAIR BLEY: Oh, okay. So, that's --

23 MR. BOWMAN: So, in Integrated System
24 Validation, we were able to complete a large majority
25 of that work of getting through the emergency

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1 operating procedures. So, we took credit for that.

2 CO-CHAIR BLEY: And then, you had a few
3 more?

4 MR. BOWMAN: We had a few more that we had
5 to clean up.

6 CO-CHAIR BLEY: Okay.

7 MR. BOWMAN: Okay. So, human factors
8 verification and validation. This is where we get
9 into that Integrated System Validation. We all talk
10 about Integrated System Validation as V&V, but there's
11 several other elements to V&V and human factors
12 engineering design.

13 Design verification would be one of those.
14 So, those activities were conducted between August of
15 2017 and July of 2018. And then, we did actual
16 Integrated System Validation testing performed with
17 the crews from July 23rd, 2018 through September 6th,
18 2018.

19 So, we had three crews of operators. They
20 were selected to participate in the training program
21 to qualify them as ISV Certified Training Operators.
22 So, unlike the training we did for staffing plan
23 validation, which was limited, this looked more like
24 a full-blown certification program, five and a half
25 months of training. Both classroom and simulator

1 training was done for the operators. These people
2 were brought in mostly from outside of our company and
3 were independent from our HSI design group.

4 MR. FLAMAND: I'd just like to make one
5 point since we're talking about this topic. One of
6 the specific things we were looking for, when we
7 brought this group of people in, is who would be the
8 operators, what would be the dynamics of operators at
9 a future NuScale plant. So, there was a large cross-
10 section of experience, you know, younger experience.
11 And that was on purpose, so that we could get a wide
12 range of who we thought -- you know, they might get a
13 license operator upgrade or you might get someone
14 through the Navy. And we had all of those kind of
15 backgrounds involved.

16 MR. BOWMAN: Yes, we had people directly
17 from engineering school, directly out of the Navy.
18 Some had been non-licensed operators at other
19 facilities. Some had been licensed operators at other
20 facilities. So, we had a mix of just everybody we
21 thought would be in a program.

22 MEMBER SKILLMAN: Was there a proportion
23 of those that washed out?

24 MR. BOWMAN: We did not wash anybody out.
25 We did lose people along the way. They were contract

1 staff, and in some cases some chose to take other jobs
2 along the way.

3 MEMBER SKILLMAN: Okay.

4 MR. TOVAR: I'll correct that. We did --

5 MR. BOWMAN: Oh, I'm sorry, yes.

6 MR. TOVAR: We did terminate two
7 individuals, and then, we had additional individuals
8 that left on their own choice.

9 MEMBER SKILLMAN: Thank you.

10 MR. TOVAR: Yes.

11 MR. BOWMAN: So, the overall conclusion of
12 Integrated System Validation testing, although this is
13 staff a draft topic, is that NuScale's control and
14 design staffing plan supports safe operation of a
15 NuScale plant.

16 So, the V&V RSR is an open item from the
17 Chapter 18 SER. It's more than one open item. It's
18 many open items in Chapter 18.

19 The V&V RSR, Results Summary Report, will
20 be submitted by the end of March 2019. We completed
21 two trials for 12 scenarios. So, we had three
22 different crews, and we cycled those crews through
23 these two different trials. So, we rotated them
24 through, and all the crews saw some portion of the
25 testing.

1 During those 24 total scenarios, we
2 collected 8,000 total data points. We created and
3 wrote 32 human engineering discrepancies. We have
4 three categories. We had no Priority 1s, nine
5 Priority 2s, and 23 Priority 3s.

6 I'll let Ryan talk quickly about
7 priorities.

8 MR. FLAMAND: Yes, what does that mean to
9 us? A Priority 1 would be a safety-significant-type
10 action. So, if we found something that potentially an
11 important action couldn't be performed, that would
12 probably fall under that priority. Priority 2 is more
13 operation of the plant or operability of equipment.
14 Priority 3 is basically, hey, it doesn't fall into
15 safety, it doesn't really fall into operation of the
16 plant.

17 So, you can see we had a lot of Priority
18 3s. Those are things that were typically we saw
19 performance that could be better, but it wouldn't have
20 affected the plant safety or operations.

21 CO-CHAIR BLEY: So, the HEDs, the human
22 engineering discrepancies, they are things, when you
23 did the testing, you said, "That isn't what we
24 expected," or something like that?

25 MR. FLAMAND: Right.

1 CO-CHAIR BLEY: Is that where they came
2 from? I didn't see that well laid out, where they
3 came from.

4 MR. BOWMAN: And you probably really won't
5 see them until the Results Summary Report come out.

6 Yes, most of our stuff was, most of the
7 items were gathered as -- would have started out
8 potentially as feedback from the operators or from the
9 observers.

10 CO-CHAIR BLEY: Okay. So, maybe not the
11 testing itself, but the operator said, "This is
12 something that was" --

13 MR. BOWMAN: It could have been a testing
14 problem as well.

15 CO-CHAIR BLEY: Okay.

16 MR. BOWMAN: But, yes, most of what we
17 wrote up as human engineering discrepancies are: this
18 procedure step doesn't work the way I like it to work.

19 CO-CHAIR BLEY: Okay. So, they were kind
20 of reports from the people trying to use them?

21 MR. BOWMAN: Or this human-system
22 interface, I don't like the way this is laid out. I'd
23 rather have it laid out this way.

24 CO-CHAIR BLEY: Okay. And those, if they
25 were Priority 1s, your goal was to fix them

1 MR. BOWMAN: We had to fix before we
2 finished the RSR.

3 CO-CHAIR BLEY: Okay. And fixing was a
4 design change usually or --

5 MR. BOWMAN: Results Summary Report.

6 It could be a design change. It could be
7 a procedure change. It could be a human-system
8 interface change.

9 CO-CHAIR BLEY: Okay. If the procedure
10 wasn't working right, yes. Okay.

11 MR. BOWMAN: You could have even
12 potentially addressed it as a training item.

13 CO-CHAIR BLEY: So, when we see -- is it
14 the report on the ISV --

15 MR. BOWMAN: Yes.

16 CO-CHAIR BLEY: -- where we'll see these
17 delineated --

18 MR. BOWMAN: That's correct.

19 CO-CHAIR BLEY: -- and what you did about
20 them?

21 MR. BOWMAN: Yes.

22 CO-CHAIR BLEY: Okay. And that will all
23 be reviewed by the staff by the time we get back
24 together on this. Okay. Thank you.

25 MEMBER SKILLMAN: Were the HEDs primarily

1 on the primary side or on the secondary side?

2 MR. FLAMAND: I don't know if I really
3 categorize them primary or secondary.

4 MEMBER SKILLMAN: If they were over on the
5 reactor side or over on the steam plant auxiliary side
6 shooting a bogus signal into the primary?

7 MR. FLAMAND: No, they weren't really -- I
8 wouldn't categorize them quite that way. It was more,
9 a good example might be someone is using a startup
10 procedure. And this is just an example. But they had
11 maybe a wording issue or there was some clarification
12 that the crew got through the scenario, but it just
13 wasn't --

14 MEMBER SKILLMAN: Crisp?

15 MR. FLAMAND: -- efficient and crisp and
16 clean. So, it's definitely something we wanted to
17 fix. So, at the end of the day, the crew was able to
18 get through startup, and then, we showed that, but
19 there might be a piece to that that there was
20 discussion on, or whatever.

21 And so, I do want to say, too, during this
22 testing there is acceptance criteria. So, there's
23 clean acceptance criteria as part of the test, and
24 then, there's what we called performance measures.
25 So, certain things that they would do. Workload is a

1 performance measure. That could have been a way an
2 HED is generated.

3 The participants get asked certain
4 questions. They might say, "Hey, my workload is
5 really high, and that might have triggered us." So,
6 maybe we saw nothing, you know, like it didn't really
7 happen. I would say we pretty much saw everything.
8 But, potentially, they could have reported a high
9 workload, which, then, generated us to figure out,
10 okay, why did that happen; where did that come up?
11 Maybe it was because this procedure wasn't written
12 well, and that's how we're going to fix it.

13 MEMBER SKILLMAN: I asked the question
14 because it's hard to be operating at, say, 85 percent
15 of power unless your secondary plant is absorbing 85
16 percent power by the reactor. So, sometimes you say
17 the plant is not functioning, and the question is,
18 which part of the plant is not functioning? Is it on
19 the reactor side or condensate feedwater, or, you
20 know, the turbine? What's going on over there? So,
21 it takes the two.

22 MR. TOVAR: Yes, I think most of the human
23 engineering deficiencies that we saw --

24 MEMBER SKILLMAN: Over on the primary side
25 probably?

1 MR. TOVAR: Well, like were related to the
2 human-system interface. Like, for example, the
3 notification system for the alarms, cautions, and
4 notifications. So, that would cross boundaries. If
5 a caution came in and we didn't have an audio sound
6 that was supposed to be there, or it was inconsistent,
7 that may be like a human engineering deficiency, but
8 it would cross boundaries, depending on where the
9 caution came from. But it was part of the human-
10 system interface and not really a plant-generated
11 issue.

12 MEMBER SKILLMAN: Okay. Thank you.

13 MR. TOVAR: I did want to just throw out
14 a couple items here. Cleanup. We said NRELAP was
15 used in the simulator. It is actually RELAP. So, I
16 just wanted to do that correction. We used RELAP5-3D,
17 Studsvik S3R, Jay TOP, Merit, and Jay ELECTRIC as our
18 modeling software.

19 One other thing we talked about was having
20 data lost to the operators and getting confusing. In
21 the Integrated System Validation, we didn't run into
22 that as an issue with the operators losing data. If
23 you had an overhead view of what the operator station
24 looked like, they have four separate computer screens
25 that they can put data on. And so, they became very

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1 proficient at putting data up and accessing the data
2 that they needed.

3 That was it.

4 MR. BOWMAN: A point on this slide, the
5 important human actions integrated with some
6 validation were completed with 70 percent margin of
7 the time allowed; i.e., it took us 25 percent of the
8 required time to complete the action on average.

9 MEMBER CORRADINI: So, these are the seven
10 actions, five --

11 MR. BOWMAN: Only the two important human
12 actions.

13 MEMBER CORRADINI: Oh, oh, oh, excuse me.
14 The two that would solve the three -- okay.

15 MR. BOWMAN: That's correct.

16 Okay. Design implementation --

17 MEMBER SKILLMAN: Wait, wait, wait.

18 MR. BOWMAN: Go ahead.

19 MEMBER SKILLMAN: When you communicate
20 that, that the operators completed those actions
21 within 25 percent of 100 percent of the time that was
22 necessary or required, is that telling you something
23 about your design other than there's a lot of margin
24 in the time that is allowed for the operator actions?
25 Is that communicating something that needs to be

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1 listened to?

2 MR. BOWMAN: That's all we're trying to
3 communicate, is the fact that we have lots of time to
4 complete those important human actions as well.

5 MEMBER SKILLMAN: Okay. Thank you.

6 CO-CHAIR BLEY: Can you be specific about
7 margin to what? Your expectation or margin to damage
8 or?

9 MR. BOWMAN: So, our PRA group did
10 analysis for us that shows how long from the time the
11 operator sees the queue to take that action until he
12 needs to be done to be successful.

13 MEMBER CORRADINI: But I think what he's
14 asking is, what state variable goes awry that creates
15 the end time? In other words, if the time is two
16 minutes, is it to get to, essentially, the fuel design
17 criteria?

18 MR. BOWMAN: The best thing to do would be
19 to walk you through an example. So, in a bypass LOCA,
20 containment bypass LOCA, you have 90 minutes to get
21 CVCS in service. That starts at a time whenever the
22 operator --

23 MEMBER CORRADINI: We can do it later.

24 MR. BOWMAN: We can do it later. Sorry.

25 CO-CHAIR BLEY: Okay. So, we'll try to

1 remember that for the closed session.

2 MR. BOWMAN: We'll answer your question
3 later. I hope this will answer your question.

4 MEMBER SKILLMAN: You said "minutes," not
5 "seconds," right?

6 CO-CHAIR BLEY: We'll wait for the closed
7 session.

8 MR. BOWMAN: I said -- no, I might have
9 said "seconds". I don't know.

10 (Laughter.)

11 MEMBER CORRADINI: He didn't say anything.

12 MEMBER SKILLMAN: He didn't say that.

13 (Laughter.)

14 MR. BOWMAN: All right. We're pretty
15 close anyway. So, let's finish this up.

16 Design implementation. So, this is an
17 activity that happens in the future, right? Design
18 implementation takes the design. Once we're done, we
19 have a DCA-committed design, an approved design, and
20 this will track the changes that are done to the
21 design between what we did and what the COL eventually
22 implements. And there is ITAAC that will confirm
23 that.

24 So, COL items, there are three COL items
25 in Chapter 18, one for the human performance

1 monitoring program, which is essentially a program
2 that looks at how the operators are functioning within
3 the HSI and reports on their performance, then takes
4 corrective actions.

5 Also, one we already discussed about the
6 non-licensed operator staffing.

7 And then, the training program and
8 procedure development for the COL are addressed in
9 Chapter 13, which we have previously covered.

10 Open items. So, there are a total of 23
11 open items in the SER. And as you asked earlier, 19
12 of those we believe will be closed by the submission
13 of the V&V Results Summary Report. One will be closed
14 when we complete a revision to the Human-System
15 Interface Style Guide after the RSR is completed, the
16 Results Summary Report is completed. One will be
17 closed by the completion of the Chapter 7, 15, and 19
18 SERs. So, we're tied into those three chapters.

19 And then, the closure of the remaining two
20 items are actively being pursued between the NRC and
21 NuScale staff. One of them is related to the main
22 control room and human-system interface ITAAC and its
23 method of closure, and the second one is related to
24 the remote shutdown station ITAAC.

25 And that's all I've got to discuss. Any

1 other questions?

2 CO-CHAIR BLEY: Nothing from the
3 Committee?

4 MEMBER BROWN: Yes.

5 CO-CHAIR BLEY: Well, talk.

6 MEMBER BROWN: No, I thought you had
7 something.

8 CO-CHAIR BLEY: I was going to send us on
9 a break. Are you interfering with our break?

10 (Laughter.)

11 MEMBER BROWN: Do you want me to ask my
12 question before the break?

13 CO-CHAIR BLEY: If you want to ask it.

14 MEMBER BROWN: Oh, okay. I just wanted to
15 backtrack to the alarm avalanche routine where you
16 talk about your alarms, cautions, and notices. And I
17 went back through Chapter 7, and it talks about
18 they're generated by the MCS and, then, presented to
19 the operators in the main control room and remote
20 shutdown station.

21 But there's nothing in either of the
22 chapters which talks about how they're aggregated,
23 what alarms. You talked about you all did an analysis
24 of the alarms, but you didn't want -- unimportant
25 alarms, but they're all important -- but critical

1 alarms to be masked by what I would call the trip-
2 less-important or less-critical alarms. But there's
3 nothing listing it. Who is going to develop that list
4 and where is it? Are they specified now? Are they
5 delineated or required by the DCA? It didn't sound
6 like -- I could find no listing in any chapter of
7 alarm aggregation. I only looked at three, the ones
8 that had instrumentation in them.

9 MR. BOWMAN: We did do that alarm
10 aggregation for the Integrated System Validation. So,
11 we have those set of alarms that we built for
12 Integrated System Validation, based off of those
13 design documents. You know, what was put as an alarm,
14 what was put as a caution, what was put as a notice
15 within that model, meaning the control --

16 MEMBER BROWN: But how are they displayed
17 for aggregation purposes? I mean, are the critical
18 alarms displayed so the guy can see them, and the ones
19 that are yellow are on some other panel somewhere
20 where he doesn't have to look at them?

21 MR. BOWMAN: Every screen, if you look at
22 this, the top of the screen --

23 MEMBER BROWN: My God, that's terrible.

24 (Laughter.)

25 You just lost it right there.

1 MR. BOWMAN: So, up at the top there's a
2 red stop sign at the top left.

3 MEMBER BROWN: I can see the little red
4 thing up in the upper right-hand corner.

5 MR. BOWMAN: Yes, but hold on.

6 MEMBER BROWN: I got it.

7 MR. BOWMAN: So, this one is on every
8 screen. This top bar is on every screen. So, no
9 matter what screen you have up, you always have an
10 indication of how many alarms are happening. And
11 again, the alarm --

12 MEMBER BROWN: That tells you how many?

13 MR. BOWMAN: That tells you how many also,
14 yes.

15 CO-CHAIR BLEY: Well, that's very
16 intelligible. I'm not cutting any slack here.

17 MR. TOVAR: It would be much, much more
18 clear when you get into the actual control room to see
19 this. It's displayed in multiple locations, but it's
20 very clear to the operations individuals how many
21 alarms they have, how many have cleared.

22 CO-CHAIR BLEY: If you want to talk about
23 this more, let's wait until later.

24 MEMBER BROWN: This is for the closed
25 session?

1 CO-CHAIR BLEY: Yes, there's some things
2 I want to tell you, too, in the closed session.

3 MEMBER MARCH-LEUBA: Give me 20 seconds.
4 I talk very fast.

5 CO-CHAIR BLEY: We know that.

6 (Laughter.)

7 MEMBER MARCH-LEUBA: Is it fair to say
8 that your validation of your human operations is based
9 on this alarm aggregation? And if you change the
10 aggregation, you will have to rerun it?

11 MR. BOWMAN: We would have to evaluate it.
12 I don't know that we would have to rerun it. It would
13 depend on whether or not it impacted the results of
14 ISV.

15 MEMBER MARCH-LEUBA: Okay. So, you plan
16 to use it to validate?

17 MR. BOWMAN: Yes.

18 MEMBER MARCH-LEUBA: Just as well as you
19 did with the hours?

20 (Laughter.)

21 CO-CHAIR BLEY: Okay. At this point --

22 MEMBER BROWN: Just one observation, so
23 they can think about it while we break.

24 CO-CHAIR BLEY: You bet.

25 MEMBER BROWN: It's just, for those of you

1 who are nuclear operators, we spent a lot of time
2 trying to make sure that there was nothing showing up
3 red that didn't have to be paid attention to
4 immediately. And the warnings were pretty much
5 sublimated. They were kind of -- I won't say "out of
6 mind," but they were out of -- we paid a lot of
7 attention to that. And that's why I asked the
8 question. I just look for some way, a visual way for
9 the operators not to be distracted; that's all.

10 CO-CHAIR BLEY: We can come back and --

11 MEMBER BROWN: That's my thought process.
12 That's all I wanted to get across during the break.

13 CO-CHAIR BLEY: That was a hammer. We're
14 on break until 3:20.

15 (Whereupon, the foregoing matter went off
16 the record at 3:03 p.m. and went back on the record at
17 3:21 p.m.)

18 CO-CHAIR BLEY: This SER feels to me like
19 it's all process, meeting criteria from this NUREG,
20 that NUREG. And it becomes very repetitious. It's
21 really hard to read. And the technical meat is hidden
22 under those things and never gets really brought out.

23 For example, there's no words that really
24 explain to a reader, or a regulator I would think, how
25 do the minimum staff actually control 12 reactors, and

1 why does it work? How does it work? Does it really
2 work?

3 So, we're meeting lots of criteria, but I
4 didn't see anything that really talked to the
5 technical issues. But I look forward to your
6 presentations, and we'll probably have some questions
7 as you go forward.

8 Prosanta, I'll turn it over to you.

9 MEMBER SKILLMAN: Dennis?

10 CO-CHAIR BLEY: Yes?

11 MEMBER SKILLMAN: Just an issue of admin
12 here. My version of the SE has "Official Use Only -
13 Proprietary Information" at the top of each page. So,
14 I'm wondering what environment we are in in this
15 meeting as we, if you will, dig into this issue. Is
16 this a proprietary session?

17 MR. SNODDERLY: This is Mike Snodderly
18 from the staff.

19 So, Dick, that's partly my fault. When
20 the staff first provides us the SE in a timely manner,
21 they also send it to NuScale for them to do their
22 proprietary designation. So, prior to that
23 designation, we call it "proprietary". So, that's why
24 it's labeled the way it is.

25 What I would suggest is that you proceed

1 with your question, and then, we'll ask NuScale or the
2 staff to step in if they feel like you're going into
3 an area, and we'll do it during the closed session.
4 Does that sound fair?

5 CO-CHAIR BLEY: Yes, as long as it's okay
6 with NuScale.

7 MR. SNODDERLY: Right. That's what I'm
8 saying. I think they'll stop us from saying anything
9 that --

10 CO-CHAIR BLEY: So, interrupt us if
11 anything --

12 MR. SNODDERLY: Say, "Let's cover this in
13 a closed session."

14 CO-CHAIR BLEY: I don't know where you
15 stand on this.

16 MR. SNODDERLY: That's the version you
17 have. That's the version that you guys --

18 CO-CHAIR BLEY: And it's proprietary
19 because at this point it hadn't been reviewed to
20 ensure --

21 MR. SNODDERLY: We're asking you to treat
22 it as such until the staff --

23 CO-CHAIR BLEY: -- that it's not
24 proprietary?

25 MR. CHOWDHURY: Wait. Please let me

1 chime-in here.

2 Again, let me introduce myself once again.
3 I'm Prosanta Chowdhury. I'm the Project Manager for
4 Chapter 18, the NuScale design certification
5 application review.

6 And the staff will present the Chapter 18
7 Safety Evaluation at this meeting. And this is the
8 phase 2 SER with Open Items.

9 To go back to your initial comment about
10 the voluminous SE, this SE will be streamlined. The
11 staff needed to document. We recognize the issue that
12 you brought up. The staff documented everything that
13 they needed to, so that they can go into the phase
14 with no open items to clean it up. So, in phase 5
15 you'll see --

16 CO-CHAIR BLEY: I look forward to phase 5.

17 MR. CHOWDHURY: Yes. So, I want to
18 clarify that.

19 Then, regarding the proprietary version,
20 we initially provide any SE to the applicant as
21 proprietary pending their verification of proprietary
22 information and any factual errors. Once we receive
23 confirmation that there is no proprietary, we list it
24 publicly, or if there is proprietary, redact it and
25 release it for the public.

1 For Chapter 18 SE, a redacted version has
2 been released to the public. So, that portion does
3 not have proprietary marking on any page at all. And
4 both the ML numbers have been provided to ACRS staff.

5 So, maybe it's the timing issue that you
6 didn't get to have that in your system, but we do have
7 a redacted version for the purpose of this meeting.
8 In the proprietary version, we do have proprietary
9 information bracketed with bold paired brackets. So,
10 please be aware of those.

11 CO-CHAIR BLEY: And if we should wander
12 into that or ask you questions, please say, "That's
13 proprietary. We can't go into it." But we'll have a
14 closed session at the end --

15 MR. CHOWDHURY: We will.

16 CO-CHAIR BLEY: -- to cover both Chapter
17 13 and 18, if there are additional questions for the
18 staff.

19 MR. CHOWDHURY: Sure.

20 CO-CHAIR BLEY: Thanks, Prosanta. Please
21 go ahead.

22 MR. CHOWDHURY: Sure.

23 The technical staff we have today is
24 Lauren Nist, next to me. And then, next to her is Dr.
25 Brian Green, and then, Maurin Scheetz, and Dr. Amy

1 D'Agostino. And the lead Project Manager for this
2 project is Greg Cranston. I wanted to recognize him.

3 With that, I'll turn it over to Lauren.
4 She will be the key presenter, and then, the others
5 will assist her in fulfilling. And they will provide
6 you their credentials as well as the sections of the
7 application that they have individually reviewed and
8 coordinated.

9 Lauren?

10 MS. NIST: Good afternoon. As Prosanta
11 said, I'm Lauren Nist, and I have been at the NRC
12 -- can everyone hear me, by the way, or should I turn
13 this microphone?

14 CO-CHAIR BLEY: Turn it towards you,
15 please.

16 MS. NIST: Thank you.

17 CO-CHAIR BLEY: We have to have a good
18 record.

19 MS. NIST: Thank you.

20 So, I've been working here now at the NRC
21 for about four and a half years as a Human Factors
22 Engineering Technical Reviewer and, also, as an
23 Operator Licensing Examiner. Prior to joining the NRC
24 staff, I worked also with Maurin at San Onofre Nuclear
25 Generating Station in license operator requalification

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1 training. And prior to that, I was also in the
2 nuclear Navy, also on a target, the USS Nimitz, for
3 about two and a half years and non-nuclear Navy prior
4 to that on a destroyer.

5 So, that's my background, and introduce
6 Brian Green.

7 MR. GREEN: Hi. I'm Brian Green. I've
8 been with the NRC almost nine years now, almost all of
9 it doing human factors work, both in NRO and in NRR.
10 Prior to that, I was at the University of Buffalo
11 where I studied trust in automation and human factors
12 associated with aviation maintenance tasks.

13 MS. D'AGOSTINO: Hi. I'm Dr. Amy
14 D'Agostino. I've been with the NRC since 2009. So,
15 I'm coming up on 10 years. I work in the Office of
16 Research, but I did a year-long rotation to NRO to
17 help with this review. I'm a Human Factors Analyst.
18 My background is I have my PhD in organizational and
19 human factors psychology from the University of
20 Connecticut.

21 MS. NIST: So, today we will discuss the
22 purpose and scope of our review, the review activities
23 that we've conducted thus far, the activities that we
24 plan to complete in the near-term, areas of interest
25 specific to our review, the status of the open items

1 discussed in our Safety Evaluation Report, and our
2 plans for closing them.

3 Additionally, some of our colleagues who
4 are reviewing Chapter 7, Instrumentation and Controls,
5 of the application shared with us that there were some
6 human factors-related questions that were raised
7 during the Subcommittee meeting back in August. And
8 so, we tried to address those questions in this
9 presentation as well.

10 Also, before we move on, I'd like --

11 MEMBER BROWN: Will you highlight those?

12 MS. NIST: I can do that.

13 MEMBER BROWN: When you get there.

14 MS. NIST: Sure.

15 Before we move on, I'd actually like to
16 address two of the questions that came up in the
17 previous session. So, the first question I'd like to
18 address has to do with the concept of ops, Concept of
19 Operations Technical Report, and clarification of what
20 it means for a document to be incorporated by
21 reference and where you will find that information.

22 So, the concept of operations document
23 that talks about the roles and responsibilities of the
24 operators, methods of control, that document is
25 incorporated by reference into DCD Tier 2. That means

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1 it is essentially, even though it's in literally a
2 separate paper, it is treated as the DCD Tier 2 --

3 CO-CHAIR BLEY: Where does it say that?
4 Sometimes I see it spelled out. I didn't see it
5 spelled out for this one.

6 MS. NIST: You know what is incorporated
7 by reference by looking at Chapter 1. There's a
8 section of Tier 2, Table 1.6-2, which shows you the
9 technical reports that are part of the DCA.

10 CO-CHAIR BLEY: Thank you.

11 MS. NIST: And then, the Topical Reports
12 are in Table 1.6-1.

13 That is different than going to Chapter 18
14 of the DCD and looking at the individual sections and
15 seeing references listed. Those are just references.
16 That does not mean --

17 CO-CHAIR BLEY: Yes, but somewhere in
18 Chapter 18 one of the other reports actually is
19 labeled "incorporated by reference".

20 MS. NIST: Well --

21 CO-CHAIR BLEY: There you go.

22 MS. NIST: You have to go to Chapter 1 to
23 see what is actually incorporated and treated as part
24 of the DCD.

25 The second question --

1 CO-CHAIR BLEY: And concepts of
2 operations, RP-2015, or whatever it is, is
3 incorporated by reference?

4 MS. NIST: Yes, sir.

5 CO-CHAIR BLEY: Okay. That makes me more
6 comfortable.

7 MR. GREEN: I believe the acronym that's
8 used to describe this document is simply CONOPS, and
9 it's in the functional requirements analysis. There's
10 a reference to the document in there.

11 CO-CHAIR BLEY: As CONOPS?

12 MR. GREEN: But it may not have been clear.

13 CO-CHAIR BLEY: Chapter 13, right, is --
14 never mind. To me, this is the real concept of
15 operations. It's how you're going to operate the
16 machine --

17 MR. GREEN: There's an overlap between the
18 two.

19 CO-CHAIR BLEY: Yes.

20 MR. GREEN: It makes sense to consider it
21 in both.

22 CO-CHAIR BLEY: And lack of overlap, too,
23 yes.

24 Okay. Go ahead.

25 MS. NIST: And then, the second question

1 was from the Chapter 13 session that I'm going to let
2 Maurin address, having to do with inspection of
3 operating procedures at a site.

4 MS. SCHEETZ: So, you asked about when or
5 how does the NRC staff review the plant-specific
6 technical review guidelines and the emergency
7 operating procedures.

8 So, the plant-specific technical review
9 guidelines are submitted with a COL applicant and
10 they're part of a procedure generation package. Those
11 would be reviewed at the COL application level by the
12 NRC staff using NUREG-0800, the Staff Review Plan.

13 CO-CHAIR BLEY: So, if another plant comes
14 along, they would reference that COL, yes?

15 MS. SCHEETZ: If another COL comes along,
16 they could submit their own plant-specific ones or --

17 CO-CHAIR BLEY: Or they could reference
18 this --

19 MS. SCHEETZ: But I think the thought that
20 they use NuScale's Generic Technical Guidelines to
21 create their own plant-specific. How plant-specific
22 that is depends on the COL.

23 And then, the emergency operating
24 procedures are looked at in the NRC's Construction
25 Inspection Program. So, that's during inspection as

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1 we get closer to fuel loading, so that EOPs, emergency
2 operating procedures, are expected to be very mature
3 at that point. And the inspectors will go in using
4 Inspection Procedure 42454, which is Part 52,
5 Emergency Operating Procedures, which has very clear
6 guidance for inspectors to look at the emergency
7 operating procedures.

8 CO-CHAIR BLEY: Yes, and most of our
9 existing plants, there's a wide range -- well, not a
10 wide range -- there's a lot of differences in
11 specifics, different set points, that sort of thing,
12 as you go through the EOPs from one unit to another of
13 the same general type. But, in most of those cases,
14 they didn't stick to the design cert. They've done
15 other things.

16 MS. SCHEETZ: I think when you talk about
17 the operating reactors, emergency operating procedures
18 came about at a later time, not --

19 CO-CHAIR BLEY: I wasn't talking about the
20 operating plants.

21 MS. SCHEETZ: Okay.

22 CO-CHAIR BLEY: I was talking about ones
23 that have come forward to get --

24 MS. SCHEETZ: To get design certifications?

25 CO-CHAIR BLEY: Yes.

1 MS. SCHEETZ: I can't answer that. I'm
2 not --

3 CO-CHAIR BLEY: I told you what.

4 MS. SCHEETZ: Okay.

5 CO-CHAIR BLEY: Go ahead.

6 MS. SCHEETZ: I thought you were asking.
7 I'm sorry.

8 CO-CHAIR BLEY: So, in this case, people
9 come in and use the actual design, replicate it. And
10 then, one would expect that the procedures won't
11 change very much because the reason they changed in
12 the other cases was because there were design
13 differences actually within the same general design
14 cert.

15 Go ahead.

16 MS. SCHEETZ: That's all I have.

17 CO-CHAIR BLEY: So, when the applicant was
18 up, they talked that they kind of expect all these
19 plants to follow very closely. We see that. It could
20 be that only the -- let me turn my question around.

21 They have a document that lays out, it
22 has, essentially, a version of the procedures. If a
23 COL comes along and adopts those essentially as is,
24 would you have to review it again or would you just
25 point to the design cert and say that it's a match?

1 Do you review them to the depth that you could say
2 you've actually reviewed the proposed EOPs?

3 MS. SCHEETZ: I don't see any way out of
4 not completing the inspection procedure for inspectors
5 to look at the emergency operating procedures. So, my
6 belief is that they would be reviewed by those
7 inspectors at the as-constructed plant.

8 And in that procedure there's a lot of
9 detail about how many of these procedures were
10 actually table-topped or simulated in the simulator
11 with the COL staff. So, not NuScale doing it as part
12 of a different validation, but the COL at that point
13 doing it.

14 CO-CHAIR BLEY: So, in the design cert,
15 what we're doing now, you haven't reviewed that
16 document that contains what might be the procedures
17 for the first COL?

18 MS. SCHEETZ: No. We've looked at what's
19 supposed to be used as generic technical information
20 for a COL to base their emergency operating procedures
21 on.

22 CO-CHAIR BLEY: I'm not saying this the
23 way I'm trying to. You've reviewed that as generic?

24 MS. SCHEETZ: Generic.

25 CO-CHAIR BLEY: If I come in with an

1 application next year for a COL and say I'm going to
2 use that exactly as written, would there be an
3 additional review?

4 MS. SCHEETZ: Yes, there would be a review
5 during the construction program.

6 CO-CHAIR BLEY: Even if they're using the
7 same thing? Is that because you didn't review them at
8 the level one would review it at the COL stage?

9 MS. SCHEETZ: Yes, I think that they're
10 not going to be called -- I doubt that a COL -- I'm
11 speculating. I doubt that a COL would be operating
12 with generic technical guidelines. They'd be
13 operating with emergency operating procedures, which
14 are required in technical specifications. So, they're
15 going to be looked at through the Technical
16 Specifications Program, and then, the Construction
17 Inspection Program.

18 MS. NIST: So, if I might add, what has
19 been reviewed for within the scope of the design
20 certification is the design certification element
21 provided a document that can be used as the guidelines
22 for the development of their site-specifics
23 procedures.

24 When a COL applicant applies, then we have
25 review criteria that we'll be reviewing, in part to

1 address the COL item provided in Section 13.5. And
2 so, part of our review criteria would be to look and
3 see if certain things have been provided and if they
4 have sufficient process to develop site-specific
5 emergency operating procedures.

6 Now what we're looking at here is
7 -- correct me if I'm wrong -- adequacy of these
8 guidelines as the basis for the development of the
9 site-specific procedures. So, there would be
10 additional review at the COL stage when the
11 application comes in.

12 CO-CHAIR BLEY: Okay.

13 MS. NIST: And then, there's the
14 inspection piece which happens prior to operation
15 after the license is issued.

16 CO-CHAIR BLEY: I apologize that I haven't
17 read the current document because I didn't know it was
18 there until today. I'll be reading it. But the way
19 it was described is that, although it's guidelines,
20 it's really essentially the procedures they expect a
21 plant would use, and if you adopted it verbatim, I'm
22 wondering why there would be another review. Is that
23 because we didn't review them as if they were
24 operating procedures today? Or is it something else?
25 Does that question make sense to you? If it doesn't

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1 make sense, just say so.

2 MS. NIST: I think what's confusing is --
3 so, you're basically asking, why is there a COL item
4 if they're provided procedures, essentially?

5 CO-CHAIR BLEY: Well, I asked them that
6 earlier. I mean, you heard their answer, I suppose.
7 I don't know if you were here.

8 MS. NIST: I did hear the answer, and I
9 can tell you, you know, that we've reviewed what's on
10 the docket and what's been provided as generic
11 technical guidelines to meet the scope of the DC
12 review.

13 CO-CHAIR BLEY: Go ahead. Whoever is
14 next, go ahead.

15 MS. NIST: That would be me.

16 (Laughter.)

17 Next slide, please.

18 So, the purpose of our human factors
19 engineering review was to determine whether the human
20 factors engineering design of the NuScale standard
21 plant control room supports operators in the safe
22 operation of the plant. Additionally, the Applicant
23 requested that minimum licensed operator staffing
24 requirements specific to the NuScale power plant
25 design be adopted as requirements applicable to

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1 licensees, referencing the NuScale power plant design
2 certification in lieu of those stated in
3 10 CFR 50.54(m).

4 To provide a technical justification for
5 its proposed operator staffing requirements, the
6 Applicant conducted a staffing plan validation test,
7 which they discussed previously, using personnel
8 trained on NuScale operations to perform a set of
9 challenging high workload scenarios in the 12-unit
10 main control room simulator.

11 So, I'd also like to take this opportunity
12 just to remind us that many of the specific details of
13 the staffing plan validation tests were proprietary.
14 And so, if we have a specific discussion about that,
15 we will need to do that in the closed session.

16 To conduct our review and develop the
17 Safety Evaluation, we reviewed the following parts of
18 the application: we reviewed the application Tier 2,
19 Chapter 18, as well as parts of Chapter 7, 15, and 19
20 that were related to human factors engineering topics.

21 Chapter 18 of the DCD also summarizes the
22 numerous human factors engineering technical reports
23 that were included with the application. These
24 reports contain a description of the methods the
25 Applicant used to conduct the various human factors

1 analyses and summaries of those results; a description
2 of the human-system interfaces, or HSIs, available to
3 the operators; the concepts of operations, which
4 describes the roles and responsibilities of the
5 control room operators and how they will interact with
6 one another and use the HSIs to operate the plant; a
7 description of the methods that the Applicant used to
8 conduct and evaluate the staffing plan validation as
9 well as the results. They also provided a description
10 of the methods that they used to conduct the
11 Integrated System Validation test.

12 As previously mentioned, the Applicant
13 completed its Integrated System Validation testing in
14 September of 2018, and they have informed us that they
15 will provide us the results of that testing by the end
16 of this March.

17 Additionally, we reviewed the information
18 in Tier 1, Section 3.15, for human factors
19 engineering, which includes design description as well
20 as an ITAAC for human factors engineering.

21 Chapter 14 of the Safety Evaluation Report
22 documents our review of the human factors engineering
23 ITAAC. And there is some overlap with Chapter 18.

24 Our review activities also included
25 several audits. And on the next slide, I'll discuss

1 in more detail what we did and what we observed and
2 when we did it.

3 As discussed in the Chapter 18 Safety
4 Evaluation Report, we used the guidance in NUREG-0711,
5 HFE Program Review Model, and NUREG-0700, Human System
6 Interface Design Review Guidelines, to evaluate the
7 Applicant's HFE design and make our findings; in our
8 Safety Evaluation documents, the current status of our
9 review and the conclusions that we've made so far, as
10 well as the open items.

11 Next slide, please.

12 So, one of the members asked that I point
13 out a question from the Subcommittee. I think we
14 attempted to address those here on that slide. But
15 one of the questions was whether the staffing plan had
16 been settled in the DCD or if it was a policy issue
17 before the Commission. And the answer is that this
18 particular issue is being addressed as part of this
19 design certification review activity. That is in
20 accordance with, this strategy is in accordance with
21 the plan that was set forth in SECY-11-0098, where we
22 informed the Commission that we would evaluate
23 staffing proposals on a case-by-case basis using some
24 of the guidance that had been developed specifically
25 for that purpose.

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1 CO-CHAIR BLEY: Did they issue an SER on
2 that SECY?

3 MS. NIST: An SRM?

4 CO-CHAIR BLEY: Yes. Sorry.

5 MS. NIST: No, sir. It was an information
6 paper.

7 CO-CHAIR BLEY: Okay.

8 MS. NIST: Also, someone had asked whether
9 the design of the human-system interfaces were fixed.
10 And the answer is basically yes, at the end of the
11 design certification review, the HED design for the
12 standard plant will be fixed by NuScale completing the
13 activities related to verification and validation.

14 CO-CHAIR BLEY: So, when we see the V&V,
15 verification and validation, report, we will see those
16 details of what the panel looks like, how it's used,
17 all the information?

18 MS. NIST: Well --

19 CO-CHAIR BLEY: I mean, I think this is
20 important because -- well, you guys had a visit out
21 there, right?

22 MS. NIST: Yes, at least one.

23 CO-CHAIR BLEY: Did you watch the
24 simulator?

25 MS. NIST: Yes, we did.

1 CO-CHAIR BLEY: Did they run a whole
2 series of things on it?

3 I'm still stuck with the two things that
4 made that convincing to me, and those are not directly
5 addressed here. One is the way the panel was laid out
6 so that one person could really have an understanding
7 of what was going wrong in particular units, if that
8 started to happen, particular modules, and then, pass
9 it off to others.

10 The other piece was the ability to easily
11 put it into a safe state, so they didn't have to spend
12 time monitoring it.

13 There aren't any words about that in the
14 SER that I saw. To me, that's more convincing than
15 saying, "We met all the criteria in NUREG so-and-so
16 and the B&O report." And there's nothing there that
17 tells me that you really paid attention to that.

18 MS. NIST: So, I think what we can do,
19 because I think that we have that information there,
20 but, unfortunately, like you said earlier, I don't
21 think it's elevated in the document such that it's
22 blinking light, you know, getting your attention,
23 hoping to make a finding. So, we hear your feedback,
24 and we thank you for.

25 I'll talk about this more at the end, but

1 we will be -- we need to recognize this is an interim
2 product. And so, our review strategy, as I said a
3 moment ago, we reviewed this guidance. And so, this
4 guidance has a lot of guidance related to the overall
5 HFE process. And so, we can talk about why we felt
6 that it was necessary to review the process activities
7 that ultimately led to the development of the HSI
8 design.

9 But, having said that, we do realize that
10 we need to, as we get the results, we need to tie that
11 together into a way that ultimately supports our
12 findings. And so, hearing your feedback is valuable
13 to us to make sure that we rely on the information,
14 and not only that we find it compelling from a process
15 standpoint, but our observations, which are
16 documented, maybe not necessarily in the SER, but in
17 some of the audit reports -- and we can go back and
18 look at that.

19 CO-CHAIR BLEY: Okay. I think that would
20 be useful.

21 Maybe at some point we'll talk about
22 schedule with the Applicant again. But there's a lot
23 of open items here, but they don't depend on many
24 sources. So, when you get a couple of these sources
25 back, you'll be able to deal with them.

1 From what we've heard, they've done most
2 of the tests they plan to do. Can you give me a hint
3 of when you expect to hear from them and how long it's
4 going to take you to go through? I think this section
5 will be much more understandable once that work is
6 done. But I am curious, how does the time line up
7 with the time available?

8 MR. CHOWDHURY: Chapter 18 has identified
9 23 open items. I think 19 of them are related to the
10 V&V RSR that the Applicant informed us would be
11 submitted by March 31st.

12 CO-CHAIR BLEY: Okay.

13 MR. CHOWDHURY: So, here's what happens:
14 it is that two things will happen. One is that we
15 received Revision 2 of the design certification
16 application in October. By that time, the staff had
17 completed writing or drafting the SER. So, this SER
18 is consistent with Revision 1 of the application.

19 Changes that have been made as a result of
20 NuScale's own initiatives as well as in response to
21 certain RAIs, Requests for Additional Information,
22 those will be incorporated in the next version of the
23 SE.

24 CO-CHAIR BLEY: Well, Rev. 2 is already
25 posted on the NRC website.

1 MR. CHOWDHURY: That is correct, Rev. 2 of
2 the application, the SE going into phase 5 --

3 CO-CHAIR BLEY: Ah, okay.

4 MR. CHOWDHURY: So, we think between this
5 phase 3 that we are going through now and phase 4 this
6 SE will be updated, revised, streamlined, as I
7 mentioned before. And then, a clean product will be
8 available by the end of the phase 4. I don't have the
9 date right now, but the schedule. You know, we have
10 a schedule of phase 4. I believe that's the end of
11 this year, but I have to make sure that's correct.
12 But, by phase 4, the SE will have no open items and be
13 clean.

14 CO-CHAIR BLEY: Okay.

15 MR. CHOWDHURY: So, right now, we know
16 that March 31st, the deadline that the Applicant wants
17 to submit the Results Summary Report, it is important
18 for us to meet the subsequent milestones of our SE.

19 CO-CHAIR BLEY: Okay.

20 MR. CHOWDHURY: So, we have not developed
21 internal milestones because we want to make sure that
22 we get that. And also, one RAI response is still
23 pending, the response to RAI 9415. We are expecting
24 it next week, also, or the end of this month. So,
25 based on all of --

1 CO-CHAIR BLEY: So, it looks to be
2 tracking?

3 MR. CHOWDHURY: Yes.

4 CO-CHAIR BLEY: I guess just one more
5 comment on the SER. Since you based it on meeting the
6 criteria in at least two NUREGs and the BNL-NUREG/CR,
7 it's very repetitive. Because lots of those criteria
8 are repetitive, it would be easier for almost anyone
9 to read and understand if you could somehow merge
10 those kind of things that are the same into one place
11 and not repeat them many times.

12 MS. NIST: Right. So, we realize that,
13 and that is going to be something that we will be
14 paying attention to moving forward.

15 CO-CHAIR BLEY: What you said earlier,
16 yes.

17 MS. NIST: I think part of this is an
18 artifact of an intention to be very thorough in this
19 review and be transparent about what we reviewed, why
20 we looked at it. But, certainly, moving forward to
21 the final product, we'll definitely take that into
22 consideration and work for readability of the
23 document.

24 CO-CHAIR BLEY: Thank you.

25 Go ahead.

1 MS. NIST: Okay. I think that actually we
2 can --

3 MR. CHOWDHURY: Let me make one comment.
4 On this slide, you will see the last bullet. It says,
5 "Phase 4 activities in progress." So, what it means
6 is that the staff has already started reconciling
7 information that came in response to RAIs.

8 CO-CHAIR BLEY: Okay. And Chapter 10 is
9 on V&V and is really loaded with them, yes.

10 MR. CHOWDHURY: Okay.

11 MS. NIST: Now I'd like to discuss the
12 activities that we've completed in the course of our
13 review of --

14 CO-CHAIR BLEY: I'm sorry?

15 MEMBER MARCH-LEUBA: Use the microphone.

16 MS. NIST: Okay. How's that? Okay.
17 Thank you.

18 So, I'd like to discuss the activities
19 that we've completed and what we're planning to do
20 moving forward. As part of pre-application activities
21 that started around the 2015 timeframe, we reviewed
22 the Applicant's Human Factors engineering
23 Implementation Plan which described their proposed
24 means of conducting human factors analyses, developing
25 the human-system interface design, and validating the

1 effectiveness of that design.

2 As part of that, we also reviewed their
3 method for conducting the staffing plan validation,
4 and we observed one of two weeks of the staffing plan
5 validation testing. NuScale is the first applicant to
6 conduct a staffing plan validation, and we're
7 reviewing the staffing plan validation results for the
8 first time.

9 As we discussed previously, we used two
10 guidance documents to evaluate the Applicant's
11 staffing plan validation methods and results. So, the
12 first was NUREG-1791, Guidance for Assessing Exemption
13 Requests, and the nuclear power plant license operator
14 staffing requirements in 10 CFR 50.549(m). And the
15 second is Attachment B of Chapter 18 of the standard
16 review plan, "Methodology to Assess the Workload of
17 Challenging Operational Conditions in Support of
18 Minimum Staffing Level Reviews".

19 NUREG-1791 describes a process for
20 systematically reviewing and evaluating alternative
21 staffing plans. This process involves reviewing data
22 and analyses from validation exercises that are
23 performed to demonstrate the effectiveness and safety
24 of a proposed staffing plan.

25 And Attachment B, Chapter 18, of the

1 standard review plan is based on the technical report
2 that was prepared by Brookhaven National Laboratory.
3 Its main focus is to provide a methodology for
4 developing a sample of scenarios to be used
5 specifically for this kind of a test to simulate
6 challenging high workload scenarios. Key performance
7 measures for the staffing plan validation include
8 acceptable task performance, operator workload, and
9 situation awareness.

10 As discussed in Chapter 18 of the Safety
11 Evaluation Report, we concluded that the Applicant's
12 method for performing the validation was consistent
13 with this guidance. And, also, the results of the
14 staffing plan validation shows that, for each of the
15 scenarios, the operators completed all of the tasks
16 within any specified time limits while maintaining
17 workload and situation awareness within acceptable
18 levels.

19 Additionally, as I mentioned, we went to
20 observe one of the two weeks of testing. And we
21 observed that the operators were able to complete all
22 of the tasks in the scenarios. They maintained
23 adequate situation awareness, and it appeared that
24 their workload was very manageable.

25 The operators were able to use the

1 indications provided by the HSI to diagnose the
2 scenario events in a timely manner and take
3 appropriate actions. So, for example, one event
4 resulted in an increase in megawatts and reactor power
5 for one unit. The HSI or the displays and controls
6 for the affected unit showed an increase in megawatts
7 and reactor power. The operators identified the
8 change in these parameters for the affected unit
9 within seconds of the HSI providing the changes. And
10 during this event, the operators also used other
11 indications in the control room to confirm their
12 diagnosis.

13 So, ultimately, we have concluded that the
14 staffing plan validation results do validate the
15 proposed staffing plan.

16 Following docketing of the application and
17 the start of our review, we reviewed the Applicant's
18 human factors engineering analyses, as summarized in
19 the application. We also conducted two audits to
20 review the results of those analyses.

21 Specifically, we reviewed a sample of the
22 Applicant's operating experience review, their task
23 analyses, and their function allocation results. We
24 found that the Applicant completed those analyses that
25 were necessary to identify the inputs to the human-

1 system interface design, and we found that those
2 analyses were acceptable.

3 So, we also conducted an audit to review
4 the Integrated System Validation Test Plan. And then,
5 we went out to observe two of the seven weeks of the
6 Integrated System Validation testing. We observed
7 that the preliminary scenario results showed that the
8 pass/fail criteria for the scenarios had been met and
9 issues were being identified and documented for
10 further analysis and evaluation by the Applicant.
11 Issues were identified and documented, but the staff
12 did not observe that there were any apparent
13 significant human performance degradations as a result
14 of the identified issued.

15 While we were observing the ISV testing,
16 we also assessed a sample of the control room HSIs to
17 confirm that the design complies with certain
18 regulatory requirements for human-system interfaces
19 and, also, that it conformed to their own design-
20 specific human factors engineering design guidelines.
21 For example, we compared a sample of the computer-
22 based procedures to the relevant guidance in
23 NUREG-0700 and found that they conformed to the
24 guidance with a few minor exceptions, and that there
25 was adequate justification for not conforming to all

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1 of the guidelines.

2 We also observed the operators using the
3 safety display and indication system to complete
4 critical safety function checks following simulated
5 unit trips. And we saw that the crew could complete
6 those checks for all units in the time required by the
7 Applicant's procedure.

8 Finally, when we receive it, we will
9 review the Applicant's ISV and other validation
10 results and update the Safety Evaluation Report. And
11 in phase 4, we'll also be resolving the open items,
12 which we'll discuss in more detail later.

13 Next slide, please.

14 In preparation for review of small modular
15 reactor designs, the staff developed two guidance
16 documents that identified potential human performance
17 issues that were specific to small modular reactors.
18 These were NUREG/CR-7126, Human Performance Issues
19 Related to the Design and Operation of Small Modular
20 Reactors, and NUREG/CR-7202, NRC Reviewer Aid for
21 Evaluating the Human Performance Aspects Related to
22 the Design and Operation of Small Modular Reactors.

23 Some of the potential human performance
24 issues identified in these NUREGs were relevant to the
25 NuScale design. And so, we considered them during our

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1 review, and I'd like to share a few examples.

2 First, the design allows for operation of
3 all units from a single-operator workstation. So, we
4 were interested particularly to see what kinds of
5 design features would help to prevent operators from
6 taking actions intended for one unit on a different
7 unit, or otherwise referred to as wrong unit errors.

8 We observed that the Applicant has used
9 consistent and clear schemes for unit labeling on
10 their displays that are used for monitoring and
11 control. Also, the concept of operations defines the
12 roles and responsibilities of the control room
13 operators. The operators have different
14 responsibilities for the different units, which can
15 also help to prevent operating errors.

16 Additionally, although the human-systems
17 interfaces at the operator workstations can be used to
18 operate safety-related components, the operator must
19 first deliberately operate the enable non-safety
20 control switch and no automatic or manual safety
21 actuation signals can be present. Operation of the
22 enable non-safety control switch to allow operation of
23 safety-related components from these operator
24 workstations is only necessary under a limited set of
25 conditions. Also, it is an action that is intended to

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1 be controlled by procedures, and because it occurs in
2 the control room within sight of the control room
3 supervisor's workstation, it can also be overseen by
4 the control room supervisor.

5 Additionally, if an event occurs on a
6 given unit that requires actuation of a protective
7 signal from the module protection system, the module
8 protection system will position the safety equipment
9 as necessary, regardless of the position of the enable
10 non-safety control switch or the component.

11 Thus, we concluded that the HSI design
12 features, the concept of operations, and the module
13 protection system design features do help to minimize
14 opportunities for, and consequences of, significant
15 wrong unit errors.

16 We were also interested to see how the
17 crew could manage the operation of up to 12 units from
18 one single control room. For example, if multiple
19 alarms are received at once for one unit, the HSI
20 should help the operators identify the high-priority
21 alarms and determine what actions, if necessary, are
22 needed.

23 The NuScale Plant Notification System is
24 designed with multiple features that allow operators
25 to identify relatively higher-priority alarms and

1 determine how to respond. During the ISV audit that
2 we conducted, we observed alarm prioritization, and we
3 did not observe any cascading alarm conditions that
4 impacted operator performance during those scenarios.

5 Additionally, as was discussed
6 previously --

7 CO-CHAIR BLEY: Was that because of the
8 nature of the drills you were watching or was it
9 because of some aspect of the design of these modules?

10 MS. NIST: So both. The design, as Doug
11 mentioned earlier, they've set up a tiered system to
12 help prioritize and display the important alarms and
13 priority to the operators. So, we observed, also, the
14 operators using that system, interacting with that
15 system. Of course, given the scenario, you would
16 expect to have more alarms, depending on how
17 significant the consequences are of that scenario
18 other than others.

19 But we did, just from a sampling
20 perspective, when we were trying to figure out when we
21 wanted to go observe, we were interested specifically
22 in observing scenarios where there would be relatively
23 more action happening, so that we could observe what
24 to us would be the more significant scenarios to see
25 how operators were interacting with the system.

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1 CO-CHAIR BLEY: I don't know if this kind
2 of information is appropriate for the SER. Is it
3 documented in a trip report or something? I don't see
4 anything referred to. You know, the things you're
5 telling me here are pretty important with the judgment
6 that you're making in the SER.

7 MS. NIST: Yes, we refer to the audit
8 report for the ISV audit.

9 CO-CHAIR BLEY: In the SER?

10 MS. NIST: Yes, we have.

11 CO-CHAIR BLEY: Which part?

12 MS. NIST: It would be --

13 CO-CHAIR BLEY: The staffing part?

14 MS. NIST: No. It would be in 18.10.

15 CO-CHAIR BLEY: 10, V&V. Okay.

16 MS. NIST: Yes. And the staffing plan
17 validation audit also has an audit report that is also
18 referenced in 18.5 of the SER.

19 Finally, the last point on this slide,
20 speaking to novel HSI design features, we've observed
21 that the Applicant has included novel HSIs in the
22 control room. For example, one of these control room
23 display designs, which is proprietary, is intended to
24 help operators detect changes in unit status. And we
25 were interested to see how operators use this display

1 during both the staffing plan validation and the
2 Integrated System Validation testing, and whether it
3 was effective. And we observed instances where this
4 particular display was an effective tool to alert the
5 operators promptly to changes in unit status.

6 Next slide, please.

7 We've talked to some extent today about
8 this, but, again, there are several open items. The
9 majority of those we expect to be able to close when
10 we get the results of the validation testing.

11 There's one open item related to adequacy
12 of the scope of the human factors engineering ITAAC,
13 and we are working with NuScale to resolve that issue.
14 There's also an open related to remote shutdown, as
15 it's described in Chapter 7, and we'll be tracking the
16 resolution of that issue to make sure that our SER is
17 consistent with the way that that issue is resolved.

18 Also, the reviews for Chapter 7, 15, and
19 19 are happening at the same time as this review.
20 Chapter 7 is much further along. But we will be
21 monitoring the progress of those reviews to make sure
22 that our conclusions are consistent with the
23 conclusions in those Safety Evaluation Reports as they
24 progress as well, since the information in those
25 sections feeds directly into Chapter 18 in some cases.

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1 And then, also, this is more of an
2 administrative item. It's just to ensure that the HFE
3 reports yet to be received are incorporated by
4 reference into Tier 2.

5 Next slide, please.

6 So, in conclusion, to speak to what we've
7 been able to determine thus far about the Applicant's
8 HFE design and the proposed staffing plan, there was
9 also the staffing plan validation testing does support
10 the Applicant's proposed staffing plan. And we'll
11 confirm if there were any staffing issues identified
12 during ISV, that they've made any changes to that
13 plan, if they were necessary.

14 Also, based on our observations of ISV
15 tests, we expect that the ISV results will provide
16 evidence that the HFE design adequately supports
17 personnel in the safe operation of the plant. But,
18 again, we do need to resolve the open items and
19 complete our review of the validation and verification
20 results prior to making our finding, which we will be
21 doing in phase 4.

22 CO-CHAIR BLEY: I have a minor request.
23 I guess we won't have another break. But, at some
24 point in time, if you can flag to where those audit
25 reports are referenced, it would be helpful.

1 MS. NIST: Sure.

2 CO-CHAIR BLEY: The references aren't at
3 the end of every chapter. So, they must be scattered
4 through. That would be helpful.

5 MS. D'AGOSTINO: The ISV audit is, if you
6 look at page 18-142, the ML number is 1829A, or
7 298A189.

8 CO-CHAIR BLEY: There were more, though,
9 right?

10 MS. D'AGOSTINO: Yes. That was the ISV
11 audit, and there is the June 2018 audit as well.

12 CO-CHAIR BLEY: Oh, yes. Okay. And
13 they're in ADAMS, so we can find them.

14 MS. D'AGOSTINO: Yes.

15 CO-CHAIR BLEY: Okay. Thank you.

16 MS. D'AGOSTINO: ML 18208A370.

17 MR. GREEN: Was that the staffing plan
18 validation? I think he was looking for that one as
19 well.

20 MS. D'AGOSTINO: No, they were just the
21 two ISVs.

22 MR. GREEN: Okay.

23 CO-CHAIR BLEY: Thanks, Lauren.

24 MS. NIST: Sure.

25 CO-CHAIR BLEY: You don't need to give us

1 any more.

2 MS. D'AGOSTINO: Okay.

3 CO-CHAIR BLEY: We can find them now.

4 MS. NIST: Thank you. That concludes our
5 prepared remarks.

6 CO-CHAIR BLEY: On everything?

7 (Laughter.)

8 MS. NIST: I wanted to make sure we had
9 plenty of time to address any questions.

10 CO-CHAIR BLEY: I guess I think I agree
11 with you, a lot of the confusion comes from trying to
12 get everything in here. Some of the judgments are
13 probably laid out in your audit reports. It would be
14 helpful to have some of that up in the SER, so you
15 understand the engineering basis for some of the
16 conclusions. I mean, it felt very checklist-oriented
17 to me. "We met criterion 3. We met criterion 4." I
18 find if the engineering judgments are in there,
19 they're so buried among the other stuff, I couldn't
20 find them or missed them.

21 MS. NIST: I understand.

22 CO-CHAIR BLEY: Anything from other
23 members in the open session?

24 (No audible response.)

25 Raise your hand if you have questions for

1 the closed session.

2 Okay. Were there other things that we
3 flagged for the closed session that you remember?

4 Okay. Oh, no, it's the open session. So,
5 yes, get the phone line open.

6 And while we're waiting for the phone
7 line, is there anybody in the room who would like to
8 make a comment? If so, please come to the podium over
9 here and state your name and who you represent, and
10 give us your comment.

11 Don't be shy.

12 Okay. Is the phone line open?

13 If anybody on the public line is there,
14 just say a word or two, so I can see if it's open, if
15 there is anybody. We don't know yet.

16 PARTICIPANT: NuScale Corvallis is here,
17 just so you know the line is open.

18 CO-CHAIR BLEY: Okay. So, NuScale's line
19 is open.

20 MR. SNODDERLY: Yes. Yes, the NuScale
21 line is always open.

22 CO-CHAIR BLEY: If there's anybody on the
23 public line who would like to make comment, please
24 give us your name and your comment.

25 (No audible response.)

1 Going, going. I guess not. Thank you.

2 MR. SNODDERLY: So, please close that open
3 line. But keep the NuScale line open, but close the
4 public line.

5 CO-CHAIR BLEY: I'll wait until we finish
6 the closed session --

7 MR. SNODDERLY: And so, if the NuScale
8 person is on the open line, hold there to make sure it
9 is closed. If not, you'll tell us.

10 And then, as we go into closed session, I
11 need to ask anyone from the public or from the staff
12 that does not have a need to know to leave.

13 Prosanta and Steve, if you can help?

14 Okay. So, I think we're good.

15 All right. Once we verify the open line
16 is closed, I think, yes, we can go into closed
17 session.

18 CO-CHAIR BLEY: Okay. So, is the NuScale
19 person who was on the public line still there? If so,
20 say something very loud, so we can hear you.

21 (No audible response.)

22 I guess it's closed.

23 (Whereupon, at 4:09 p.m., the foregoing
24 matter recessed from open session and went into closed
25 session.)

NuScale Nonproprietary

ACRS Presentation

Conduct of Operations

Chapter 13 Overview

January 23, 2019

Doug Bowman
Supervisor Plant Operations



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Revision: 0

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Introductions

- Doug Bowman- Supervisor Plant Operations
- Ryan Flamand- Senior Reactor Operator 5

Operations Staff

- 18 previously licensed SROs
- Licenses held at:
 - Byron
 - Columbia
 - DC Cook
 - Limerick
 - Nine Mile Point
 - Palisades
 - HB Robinson
 - Seabrook
- 569 years of nuclear experience
- 16 Navy nuclear veterans

Conduct of Operations – Chapter 13

Primarily a collection of action items for a Combined Operating License holder to describe the structure of the organizations and programs supporting plant operations, as well as the qualification of the individuals in the organizations.

Security and FFD programs covered separately.

Organizational structure

Section 13.1 includes COL actions to describe:

- corporate or home office management and technical support organization
- onsite operations organization
- qualification requirements for each management, operating, technical, and maintenance position described in the operating organization

Training programs

Section 13.2 includes COL actions for a description and schedule for:

- initial license training program for reactor operators and senior reactor operators
- licensed operator requalification program
- initial training, periodic retraining, and qualification(s):
 - non-licensed operators
 - shift supervisors
 - shift technical advisors
 - I&C technicians
 - electrical maintenance personnel
 - mechanical maintenance personnel
 - radiological protection technicians
 - chemistry technicians
 - engineering support personnel

Emergency Plan

Section 13.3 describes the emergency facilities included in the standard plant design. This includes:

- TSC – including the following associated systems
 - Ventilation systems
 - Communications systems
 - TSC workstations
- Emergency response data systems

This section also includes 3 COL actions that require development of:

- 1) operations support center
- 2) emergency offsite facility
- 3) the overall emergency plan

Operational programs

Section 13.4 includes COL actions to provide site-specific information, including implementation schedule:

- Pre-service and In-service testing and inspection
- Environmental Qualification
- Fire protection
- Containment leak rate
- Process and Effluent monitoring and sampling
- Radiation protection
- Training
- Process control
- Emergency planning
- Security
- Quality Assurance
- Motor operated valve
- Maintenance Rule
- Initial test

Plant Procedures

Section 13.5 includes COL actions to provide a description of and a plan for the development, implementation and control of the following procedure areas:

- administrative procedures
- operations and maintenance procedures
- plant radiation protection procedures
- emergency preparedness procedures
- calibration and test procedures
- chemical-radiochemical control procedures
- radioactive waste management procedures
- maintenance and modification procedures
- material control procedures
- plant security procedures

Plant Procedures – Generic Technical Guidance

Section 13.5 also includes COL actions to ensure that plant specific emergency operating procedures are developed

The staff requested that we provide a set of generic technical guidelines as part of the DCA

Goals for development:

- Symptom based procedure
- Status easily assessed by the operator
- Fully integrated into the HSI
- A single procedure set addresses all post accident actions (covers the legacy emergency operating procedure, severe accident management, LOLA/ELAP/extensive damage mitigation)

Plant Procedures – Generic Technical Guidance

How did NuScale start development of the GTGs?

Source document	Credited Actions
FSAR Chapter 7 I&C failure defense in depth analysis	0
FSAR Chapter 15 plant design basis response to DBE's	0
FSAR Chapter 18 HFE task analysis and associated reference	0
FSAR Chapter 19 operator actions assumed in beyond-design-basis PRA	7
FSAR Chapter 20 operator actions assumed in beyond-design-basis evaluations	2
FSAR Chapter 21 multi-unit design considerations	0
System requirements and limitations as defined in system description documents	0

Acronyms

CFDS- containment flooding and drain system

COL- combined license

CVCS- chemical and volume control system

DCA- Design Certification Application

DBE- design basis event

ECCS- emergency core cooling system

ELAP- extended loss of AC power

FFD- fitness-for-duty

FSAR- Final Safety Analysis Report

GTG- Generic Technical Guidelines

HFE- human factors engineering

HSI- human system-interface

I&C- instrumentation and control

IHA- important human action

LOLA- loss of large areas

PRA-probabilistic risk assessment

TSC- technical support center

SRO- Senior Reactor Operator

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Safety Evaluation with Open Items: Ch 13, Conduct of Operations

NuScale Design Certification Application Review

ACRS Subcommittee Meeting
January 23, 2019

Agenda

- NRC staff review team
- Purpose and scope
- Review activities and timeline
- Focus areas
- Open items
- Conclusion

NRC Staff Review Team

- **Technical Staff Presenters**

- ♦ Maurin Scheetz, NRR – DCA Sections 13.1, 13.2, 13.5
- ♦ Amanda Marshall, NSIR – DCA Section 13.3
- ♦ Prosanta Chowdhury, NRO – DCA Section 13.4

- **Project Managers**

- ♦ Greg Cranston – Lead Project Manager
- ♦ Prosanta Chowdhury – Chapter 13 Project Manager

Overview of Chapter 13

Section	Description
13.1	Organizational Structure – contains COL items which require the COL applicant to develop the management and tech support organizational structure including design, construction, operating, and maintenance responsibilities. This includes the qualification requirements such as education, training, and experience for each position.
13.2	Training – contains COL items which require the COL applicant to develop the description and schedule of the training program for licensed reactor operators and non-licensed plant staff.
13.3	Emergency Planning – contains a description of design-related emergency planning features, such as the Technical Support Center, as well as COL Items pertaining to emergency planning.
13.4	Operational Programs – contains a COL item which requires a COL applicant to provide site-specific information, including implementation schedule, for operational programs.
13.5	Plant Procedures – contains COL items which require the COL applicant to describe the admin & operating procedures for all operational modes, and a schedule for preparing the procedures.

Technical Topics

Section 13.1 – Organizational Structure

Scope of Review

- The purpose of this section is to provide assurance that the applicant has established acceptable COL Information Items pertaining to the corporate-level management, technical support and onsite operating organizations necessary for the safe design, construction, testing and operation of the nuclear plant, including training and qualification requirements. That is, the COL applicant will have the necessary managerial and technical resources to support the plant staff in construction, operation, maintenance, and in the event of an emergency.

Focus Areas

- Three COL information items are provided, COL 13.1-1 through 13.1-3. Staff found that the COL information items appropriately identified and sufficiently addressed the required information.

Open Items

- None

Conclusion

- The staff has reviewed DCA Part 2, Tier 2, Section 13.1, “Organization Structure,” and determined that the applicant’s approach for COL items describing the corporate-level management and technical support organization, and the onsite operating organization, is acceptable to meet all applicable requirements.

Technical Topics

Section 13.2 – Training

Scope of Review

- The purpose of this section is to provide assurance that the applicant has established acceptable COL Information Items pertaining to a description of, and schedule for, (1) the licensed operator training program for reactor operators and senior reactor operators, including the licensed operator requalification program, and (2) the training program for the nonlicensed plant staff.

Focus Areas

- Two COL information items COL 13.2-1 and COL 13.2-2 are provided pertaining to a description and schedule of training programs for licensed and non-licensed staff.

Open Items

- None

Conclusion

- The staff has reviewed DCA Part 2, Tier 2, Section 13.2, “Training,” and determined that applicant’s approach for COL items for training programs is acceptable.

Technical Topics

Section 13.3 – Emergency Planning

Scope of Review

- The purpose of this section is to address those design features, facilities, functions, and equipment that are technically relevant to the design, that are not site specific, and that affect some aspect of emergency planning (EP) or the capability of a licensee to cope with plant emergencies. The applicant may choose the extent to which the application includes EP features to be reviewed as part of the design certification.

Focus Areas

- Technical Support Center (TSC)
- Emergency Response Data System
- TSC Engineering Workstations
- Decontamination Facilities
- Process Sampling System (Post-Accident Sampling function)
- Operations Support Center (COL Item 13.3-1)
- Emergency Operations Facility (COL Item 13.3-2)
- Emergency Plan (COL Item 13.3-3)
- EP ITAAC (COL Item 14.3-1)

Technical Topics

Section 13.3 – Emergency Planning

Open Items

- **Open Item 13.3-1 – Process Sampling System**

- DCA Part 2, Tier 2, Section, 9.3.2, states that “[t]he function of the process sampling system (PSS) is to provide the means to obtain representative liquid and gaseous samples from various primary and secondary process streams and components for monitoring and analyzing the chemical and radiochemical conditions. The PSS capability is used during normal plant operations and following accident conditions without the need for a dedicated post-accident sampling system.”
- The capability to obtain a post-accident sample is an interface item between SRP Section 9.3.2, “Process Sampling Systems,” and SRP Section 13.3.
- Resolution is ongoing: If the process sampling system is determined to be acceptable as a means for obtaining a post-accident sample in accordance with 10 CFR 50.34(f)(2)(vii) and (viii), then this open item will be resolved.

Conclusion

- With the exception of Open Item 13.3-1, the staff concludes, on the basis of its review of the EP design-related features included in the DCA, that the applicant has met the applicable regulatory requirements.

Technical Topics

Section 13.4 – Operational Programs

Scope of Review

- COL applicants are required by 10 CFR 52.79 to describe operational programs, but similar requirements do not exist for DCAs. Staff evaluated this section using Draft Revision 4 of SRP 13.4, which was published in September 2018, to ensure COL Information Item(s) include necessary requirements for COL applicants consistent with the SRP.

Focus Areas

- The applicant provided COL Item 13.4-1 stating that a COL applicant that references the NuScale Power Plant design certification will provide site-specific information, including implementation schedule, for operational programs.

Open Items

- None

Conclusion

- The staff has reviewed DCA Part 2 Tier 2, Section 13.4, “Operational Programs,” and determined that the COL Information Item is acceptable because the applicant appropriately directs the COL applicant to develop operational programs, consistent with the list in SRP Section 13.4, draft Rev. 4.

Technical Topics

Section 13.5 – Plant Procedures

Scope of Review

- The purpose of this section is to for the NRC staff to review the acceptability of COL information items for descriptions of plant procedures and the establishment of a program for development and implementation of plant procedures. The staff also reviewed the technical adequacy of the NuScale Generic Technical Guidelines (GTGs) for use as a basis for development of COL applicant Plant Specific Technical Guidelines (P-STGs).

Focus Areas

- Seven COL information items are provided, COL 13.5-1 through 13.5-5, 13.5-7, and 13.5-8 for plant procedures.
- The GTG review focused on (1) the three CSFs defined for the NuScale power plant, (2) the methodology used to identify operator actions, and (3) the CSF flowchart logic and operator actions necessary to assess and maintain the CSFs, including the bases.

Open Items

- The staff is unable to conclude that the NuScale GTGs are acceptable for use as a basis for the development of COL applicant P-STGs. This is contingent upon the achievement of satisfactory results from ISV testing and validation activities and the subsequent incorporation of any necessary changes to the GTGs and the associated PAM variables. This is being tracked as **Open Item 13.5-1**.

Conclusion

- The staff has reviewed DCA Part 2, Tier 2, Section 13.5, “Plant Procedures,” and determined that the COL Information Items the applicant provided are appropriate and acceptable. The staff will make a conclusion on the GTGs at a later time.

Acronyms

COL: Combined License

CSF: Critical Safety Function

DCA: Design Certification Application

EP: Emergency Planning

GTG: Generic Technical Guidelines

ISV: Integrated System Validation

ITAAC: inspections, tests, analyses, and acceptance criteria

OER: operating experience review

NRO: US NRC Office of New Reactors

NRR: US NRC Office of Nuclear Reactor Regulation

NSIR: US Office of Nuclear Security and Incident Response

PAM: Post Accident Monitoring

PSS: Process Sampling System

RES: US NRC Office of Research

TSC: Technical Support Center

NuScale Nonproprietary

ACRS Presentation

Human Factor Engineering

Chapter 18 Overview

January 23, 2019

Doug Bowman
Supervisor Plant Operations



PM-0119-64207
Revision: 0

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Human Factors Engineering – NuScale goals

1. Integrate HFE into the development, design, and evaluation of the plant
 - Eliminate operator actions in the design basis
2. Provide an HFE design that facilitates the safe, efficient and reliable operation, maintenance, testing, inspection, and surveillance of the plant
 - Ensure an operator is able to quickly assess the status of all 12 units
3. Provide a state-of-the-art human factors design that satisfies regulatory requirements
 - Expand the use of automation for routine normal tasks to limit operator workload

Operating Experience Review

- NuScale performed an extensive review of operating experience in the following industries and facilities:
 - Currently operating nuclear power plants
 - Nuclear facilities that do not produce power
 - Nonnuclear power plants
 - A U.S. military platform
 - The health care, electrical distribution, airline industry
- The purpose of the review was to identify HFE-related safety issues and incorporate identified positive features in the NuScale plant design.

Operating Experience Summary

Current Industry concerns and benefits:

- Alarm avalanche in the control room and the need to prioritize and control them.
 - Tiered alarm system – Alarm, Caution and Notice
- Operating multiple units from a single control room
 - SMEs with commercial plant experience from various disciplines at NuScale provided input to the initial staffing levels and bases.
 - Benchmarking at Bruce Power displayed the operation of four reactors in the same control room.
 - From this benchmarking trip, the concept of the control room supervisor as a resource manager and providing additional operators as a resource to the at the controls operator evolved.
 - Benchmarking at T. H. Wharton Gas Turbine generating station (a total of 17 gas and steam turbine units operating in both simple and combined cycle) operated by a single operator from a single control room.
 - From this benchmarking trip, the concept of a single operator in control of multiple units evolved.
 - Providing the operators with back up control stations and a thorough understanding of various I&C system failures and effects was important.

Task Analysis

- Performed by SMEs – former commercial licensed operators.
- Provided the foundation for all procedures developed for SPV testing required to operate the plant.
- TA was the cornerstone for cognitive and performance based operator training that is required for S&Q.
- TA was essential to the HSI development and the V&V process.
- Used a software database that the nuclear industry currently uses to manage operator training programs.

Treatment of Important Human Actions Results

Important Human Actions:

- The NuScale plant identified two risk-important human actions:
 - 1) Add water to the Reactor Coolant system with the Chemical and Volume Control system
 - 2) Add water to Containment with the Containment flood and drain system
- No deterministic-important human actions were identified by transient and accident analysis or by diversity and defense-in-depth coping analysis.

Treatment of Important Human Actions Results

- The IHAs are utilized in three major beyond design basis accident conditions:
 - Containment Bypass event
 - ECCS failure of either all Reactor Vent valves or all Reactor recirc valves to open
 - Complete failure of the decay heat removal system and both reactor safety valves
- Both important human actions were sampled during staffing plan validation
- All human actions performed from the MCR assumed in the PRA were sampled during ISV

Staffing and Qualifications Summary

- S&Q activities were based on the following NuScale design attributes:
 - no operator actions are required for design basis events.
 - the HSI design provides ‘at-a-glance’ assessment of plant conditions and facilitates early detection of degrading conditions.
 - one operator can have primary focus of maintaining a monitoring role during normal, abnormal, and emergency conditions.
- SPV verified that a NuScale power plant can be operated safely and reliably from a single control room by a contingent of:
 - three licensed reactor operators
 - three licensed senior reactor operators
- Non-Licensed operators
 - COL will address the staffing and qualifications of non-licensed operators.

Staffing Plan Validation

- Performed August 2016
- Consisted of two crews of five NuScale Operations staff
 - Trained to perform the tasks necessary to accomplish the validation
 - Did not know the content or sequence of the scenarios

Staffing Plan Validation

Scenario Tasks were sampled from the task analysis based on the following attributes:

- High risk
- High stress
- High consequence of inaccurate performance
- High cognitive or physical work load
- Requires communication outside of operations
- Abnormal, transient or severe conditions
- High time pressure
- Also sampled tasks with a high frequency (once a day or more)

Staffing Plan Validation

- These tasks were grouped into three very challenging scenarios and each crew performed all three scenarios
- Testing methodology was based on NuScale's anticipated ISV testing methodology
- Observer and operator feedback was collected
- Task times were collected for those tasks that had time limits
- SPV successfully demonstrated that the NuScale design could be safely operated by the proposed staff.

Human-System Interface Design Summary

- NuScale's integrated HSI design was developed by a multi-faceted HSI design team that brought unique skills and knowledge to the effort.
- FRA/FA, TIHA and TA results, tabletop activities helped the team develop the layout and construct the MCR simulator.

Human-System Interface Design Summary

The screenshot displays a software interface for managing procedures. At the top, navigation elements include a left arrow, a right arrow, and a box containing '01 : Special > Process Library'. On the right side of the top bar, there are three status icons: a green 'X' in a circle, a yellow warning triangle, and a document icon, each with a '0' next to it. Below the top bar, a tabbed interface shows 'Procedures' as the active tab, with 'Automations' and 'Unit01 : Authorize a Tagout' also visible. The main content area is divided into a left sidebar and a central workspace. The sidebar lists various procedure categories: 'ADMIN - Administrative Procedures' (with sub-items 'Work Control' and 'General'), 'EOP - Emergency Operating Procedures', 'IAP - Integrated Abnormal Procedures', 'IOP - Integrated Operating Procedures', 'AB - Auxiliary Boiler System', 'BAS - Boron Addition System', 'BPS - Backup Power Supply System', 'CAR - Condenser Air Removal System', 'CE - Containment Evacuation System', 'CFD - Containment Flooding and Drain System', and 'CHW - Chilled Water'. The 'Work Control' sub-item is selected, showing a list of procedures: 'Authorize a Tagout' (9 steps), 'Authorize a Work Order' (6 steps), and 'Receive a Consumable Delivery' (8 steps). The central workspace displays the details for the 'Authorize a Tagout' procedure. It begins with a note: 'NOTE: This procedure is used for both hanging OR restoring a tagging order'. Below this, there are three main steps, each with a green checkmark icon: 1. 'REVIEW the reason AND tagout comments to DETERMINE plant impact.' 2. 'REVIEW the TAG sequence components AND positions.' 3. 'PERFORM a pre-job brief with individuals performing the tagging. ENSURE the NLO is clear on scope of work AND can communicate the applicable tagging notes AND any mitigation actions identified.' Below these steps, there are three unchecked checkboxes: 'NOTIFY crew members of tagging impact.', 'PERFORM the tagging order as follows:', and 'ENSURE the tagging order is Approved'. At the bottom of the workspace, there are three buttons: 'Skip Remaining', 'Check Remaining', and 'Cancel Procedure'. On the right side of the interface, there is a vertical panel showing the progress of the 'Unit01 - Authorize a Tagout' procedure. It indicates a progress of '22.2 %' and a status of 'Active'. The bottom of the interface features a system tray with icons for network, display, and other system functions, along with the text 'Disconnected'. The date and time '8:00:56 AM 2/8/2018' are displayed in the bottom right corner.

01 : Special > Process Library

Procedures Automations Unit01 : Authorize a Tagout

NOTE: This procedure is used for both hanging OR restoring a tagging order

REVIEW the reason AND tagout comments to DETERMINE plant impact.

REVIEW the TAG sequence components AND positions.

PERFORM a pre-job brief with individuals performing the tagging.
ENSURE the NLO is clear on scope of work AND can communicate the applicable tagging notes AND any mitigation actions identified.

NOTIFY crew members of tagging impact.

PERFORM the tagging order as follows:

ENSURE the tagging order is Approved

Skip Remaining Check Remaining Cancel Procedure

Unit01 - Authorize a Tagout
Progress: 22.2 % Status: Active

8:00:56 AM
2/8/2018

Human Factors Verification and Validation Summary

- Design verification activities were conducted between August 23, 2017 through July 23, 2018
- The NuScale ISV testing was performed from July 23, 2018 through September 6, 2018.
- Three crews of operators were selected to participate in a training program to qualify them as ISV-certified operators.
- This training primarily focused on technical design knowledge, but also stressed the importance of providing feedback during the ISV testing period.
- The overall conclusion of the testing is that the NuScale control room design and staffing plan support safe operation of the NuScale plant.

Human Factors Verification and Validation Summary

- V&V RSR is an open item for the Chapter 18 SER.
- V&V RSR will be submitted by the end of March 2019
- Completed 2 trials for all 12 scenarios
~8000 total data points captured
- 32 HEDs
 - no Priority 1
 - 9 Priority 2
 - 23 Priority 3
- IHA actions completed with 72% margin of the time allowed

Design Implementation Summary

- Completion of design implementation activities is tracked and confirmed by an ITAAC.
- This ensures that the as-built design conforms to the verified and validated design resulting from the HFE design process.
- After completion of start-up testing and provisional turn over, a licensee institutes a HPM program to evaluate impacts on human performance going forward.

COL items

- A COL applicant that references the NuScale Power Plant design certification will provide a description of the HPM program in accordance with applicable NUREG-0711 or equivalent criteria.
- A COL applicant that references the NuScale Power Plant design certification will address the S&Q of non-licensed operators.
- The training program and procedure development for the COL are addressed in Chapter 13.

Open items

- Total of 23 open items in the SER
- 19 will be closed by the V&V RSR
- 1 will be closed by completion of revision to HSI Style Guide
- 1 will be closed by completion of the Chapter 7, 15 and 19 SERs

Closure of the remaining 2 items are being actively being pursued between the NRC and NuScale staff

- RAI 9415 - MCR and HSI ITAAC and its method of closure
- RAI 9612 Remote Shutdown Station ITAAC

Acronyms

- COL- combined license
- ECCS- emergency core cooling system
- FA- functional analysis
- FRA- functional requirements analysis
- HED- human engineering discrepancies
- HFE- human factors engineering
- HPM- human performance monitoring
- HSI- human system-interface
- I&C- instrument and controls
- IHA- important human action
- ISV- integrated system validation
- ITAAC- Inspections, Test, Analyses, and Acceptance Criteria
- MCR- main control room
- PRA- probabilistic risk assessment
- RSR- results summary report
- SER- safety evaluation report
- SME- subject matter expert
- SPV- staffing plan validation
- S&Q- staffing and qualification
- TA- task analysis
- TIHA- treatment of important human actions
- V&V- verification and validation

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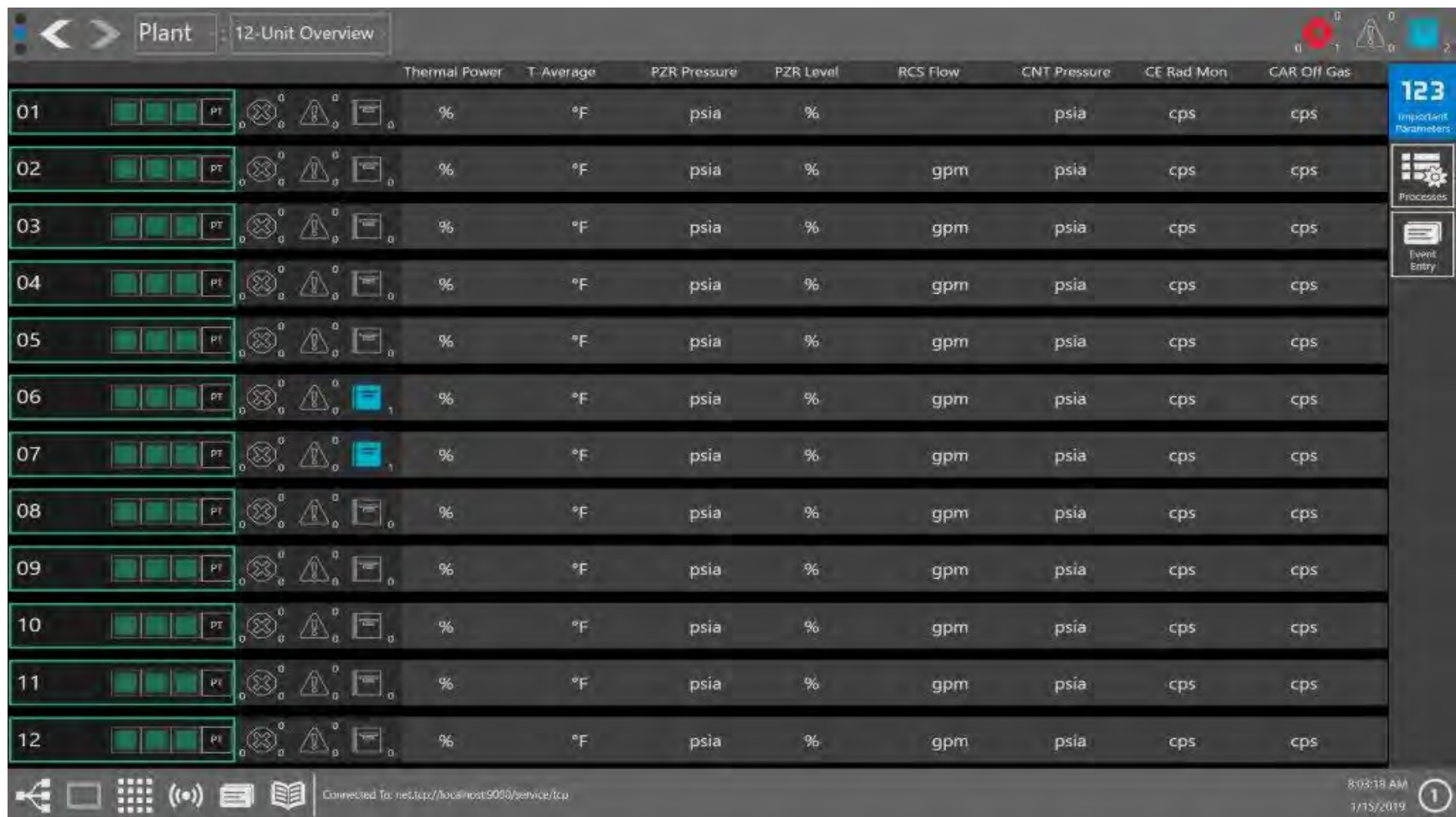
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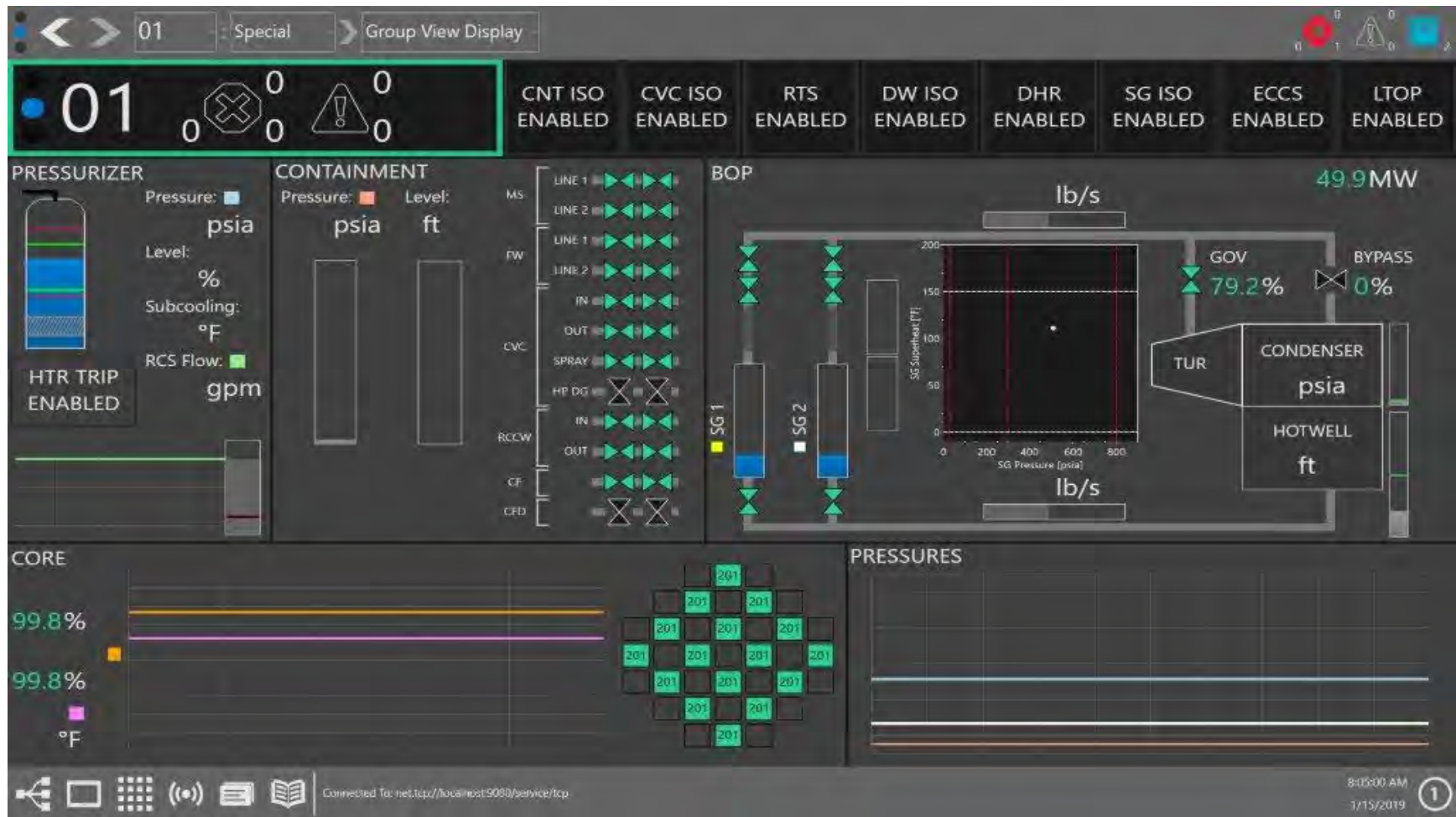
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Extra Slides



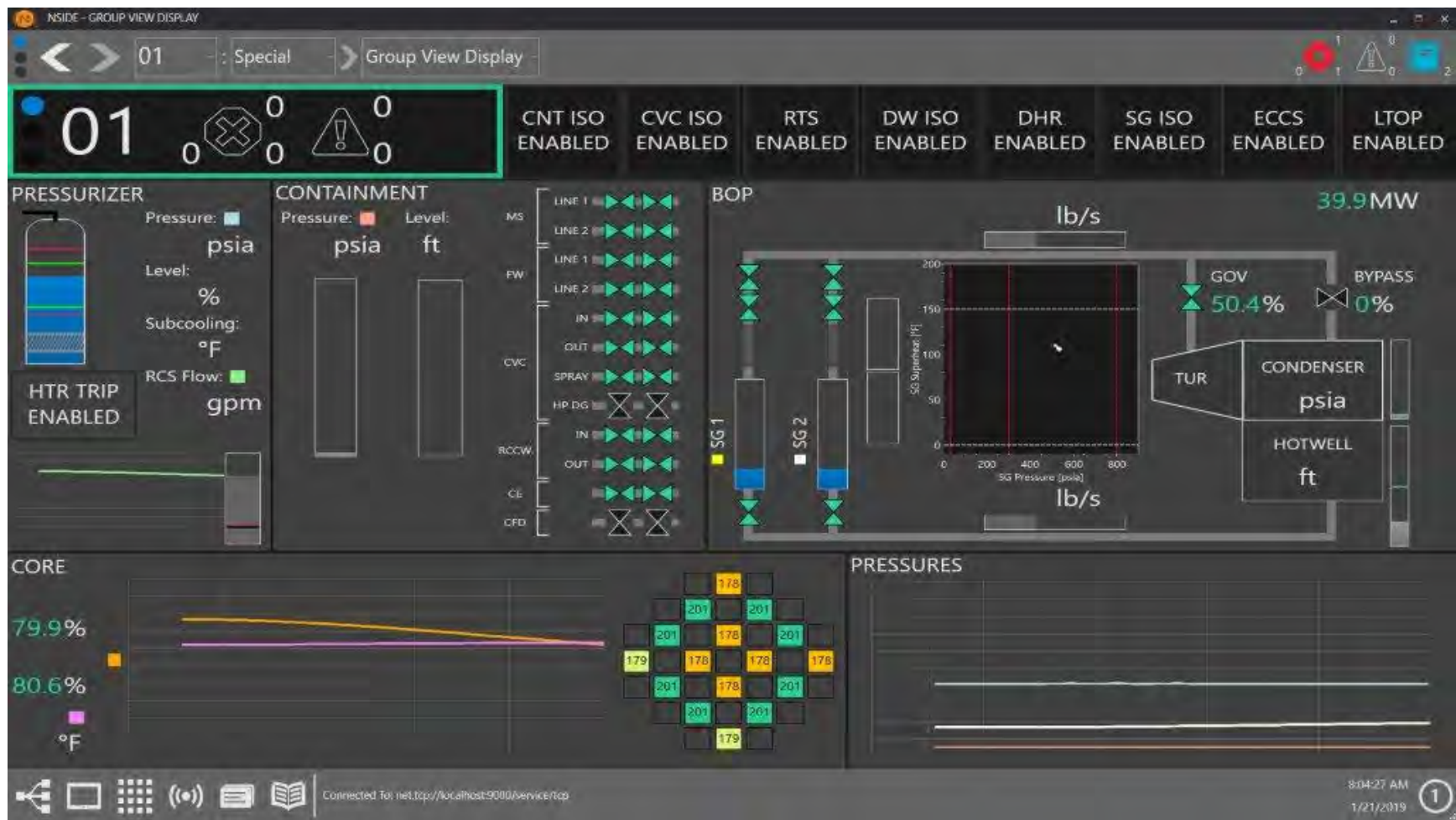
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Extra Slides



Extra Slides



Extra Slides

NSIDE - PLANT NOTIFICATION SYSTEM

Plant - Plant Notifications

PLANT ACK ALL RESET ALL SILENCE CLEAR TRANS Units Displayed: Types Displayed: CLEARED, ACKNOWLEDGED, ACTIVE UNSET ALL FILTERS SHOW SUPPRESSED ACTIVE ONLY ALARMS CAUTIONS

UNIT	Type	Unit	State	Short Title	Full Description	Suppressed	Date	Time	Plant System
UNIT 01	Alarm	01	Active	AO not within limits	Axial Offset not within limits with reactor power greater than 25%	False	1/21/2019	08:10:46	In-Core Instrumentation System
UNIT 02	Alarm	01	Active	Control Rod 01 Misalignment	Respond to Control Rod 01 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 03	Alarm	01	Active	Control Rod 02 Misalignment	Respond to Control Rod 02 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 04	Alarm	01	Active	Control Rod 03 Misalignment	Respond to Control Rod 03 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 05	Alarm	01	Active	Control Rod 04 Misalignment	Respond to Control Rod 04 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 06	Alarm	01	Active	Control Rod 05 Misalignment	Respond to Control Rod 05 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 07	Alarm	01	Active	Control Rod 06 Misalignment	Respond to Control Rod 06 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 08	Alarm	01	Active	Control Rod 07 Misalignment	Respond to Control Rod 07 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 09	Alarm	01	Active	Control Rod 08 Misalignment	Respond to Control Rod 08 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 10	Alarm	01	Active	Control Rod 09 Misalignment	Respond to Control Rod 09 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 11	Alarm	01	Active	Control Rod 10 Misalignment	Respond to Control Rod 10 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
UNIT 12	Alarm	01	Active	Control Rod 11 Misalignment	Respond to Control Rod 11 Misalignment	False	1/21/2019	08:10:45	Control Rod Drive System
COMMON	Caution	01	Active	FW Header Flow Low	Feedwater System Header Total Flow Low	False	1/21/2019	08:10:27	Condensate and Feedwater System
COMMON	Caution	01	Active	HP Feedwater Heater	High pressure Feedwater Heater level low	False	1/21/2019	08:09:03	Heater Vents and Drains

01 - Control Rod 01 Misalignment
Control Rod Drive System

SUPPRESS

Description
Respond to Control Rod 01 Misalignment

Device
01_Control_Rod_01
01_Control_Rod_01_DMD

Setpoint
RP rod position does not match demanded Rod Position by 6 steps.

Live
60.00
0.00 >=6 or
0.00 <=6
90.00 >=6

Automatic Actions
Rod movement stops

Operator Actions
CANCEL any Unit 01 power maneuvering or turbine bypass maneuvering automations.
GOTO Control Rod Malfunction abnormal procedure for misaligned rods

ACKNOWLEDGE RESET
GO TO SYSTEM OPEN PROCEDURE

Connected to: net.tcp://localhost:9080/service/tcp

8:10:46 AM
1/21/2019

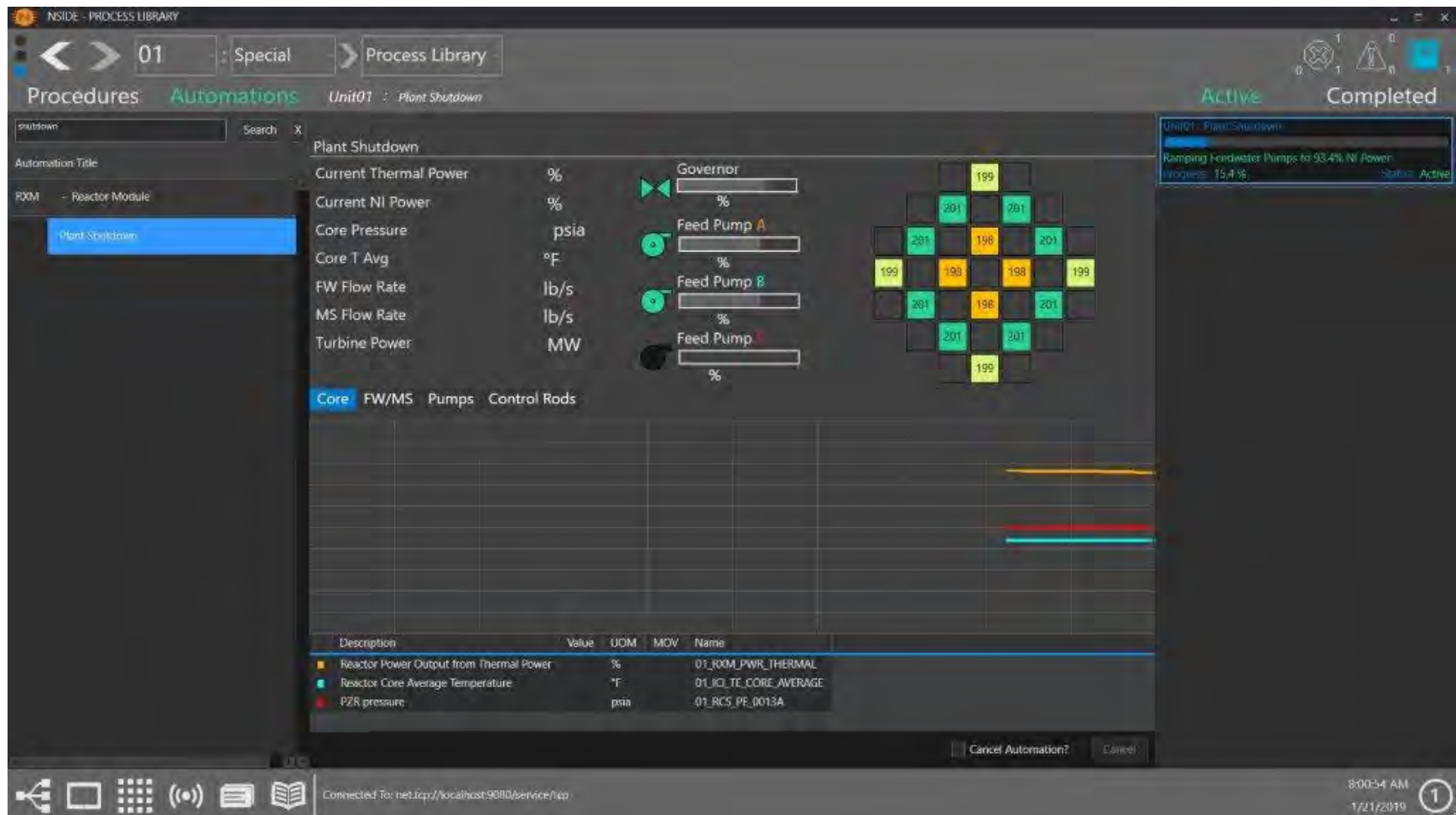
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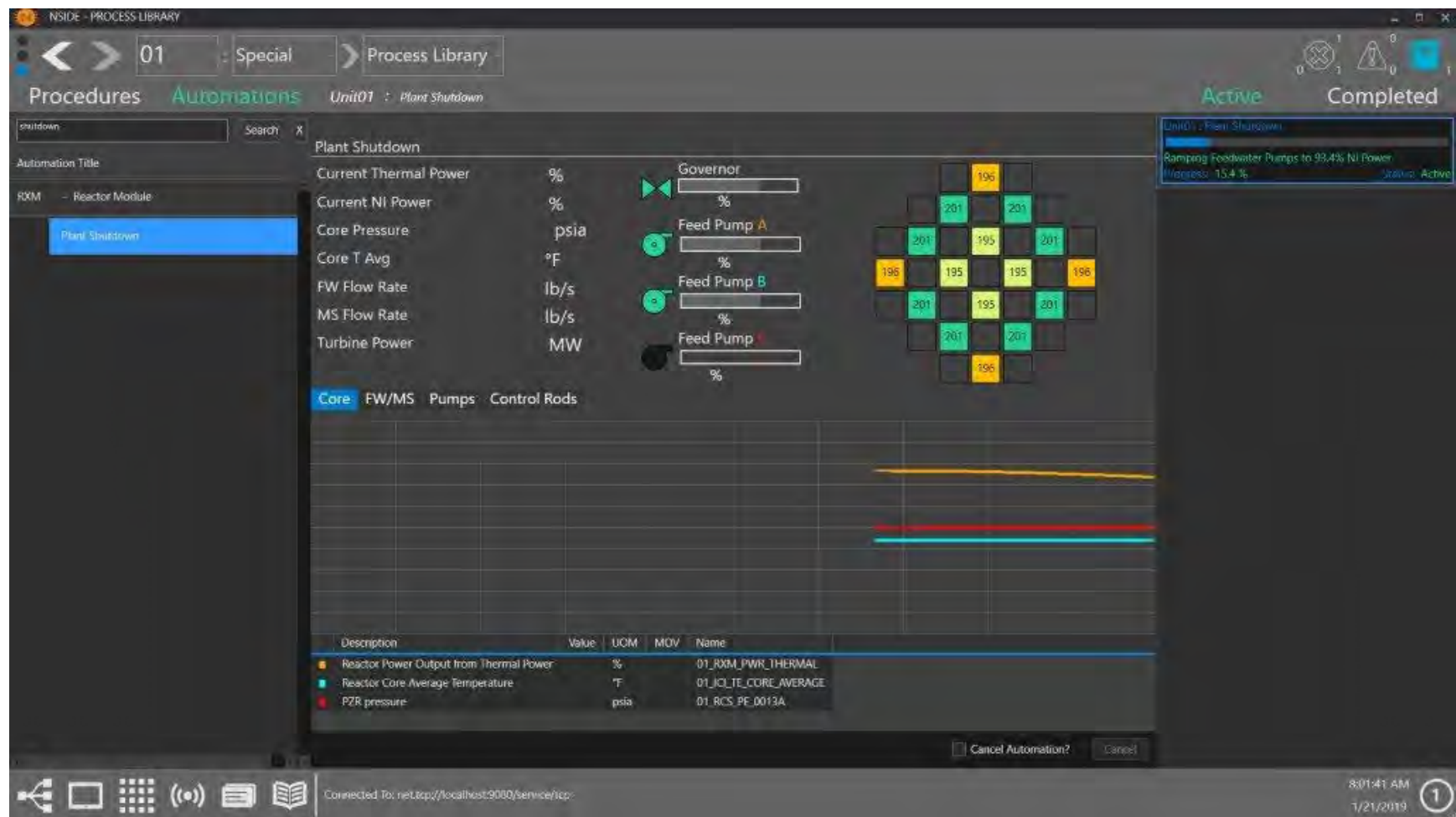
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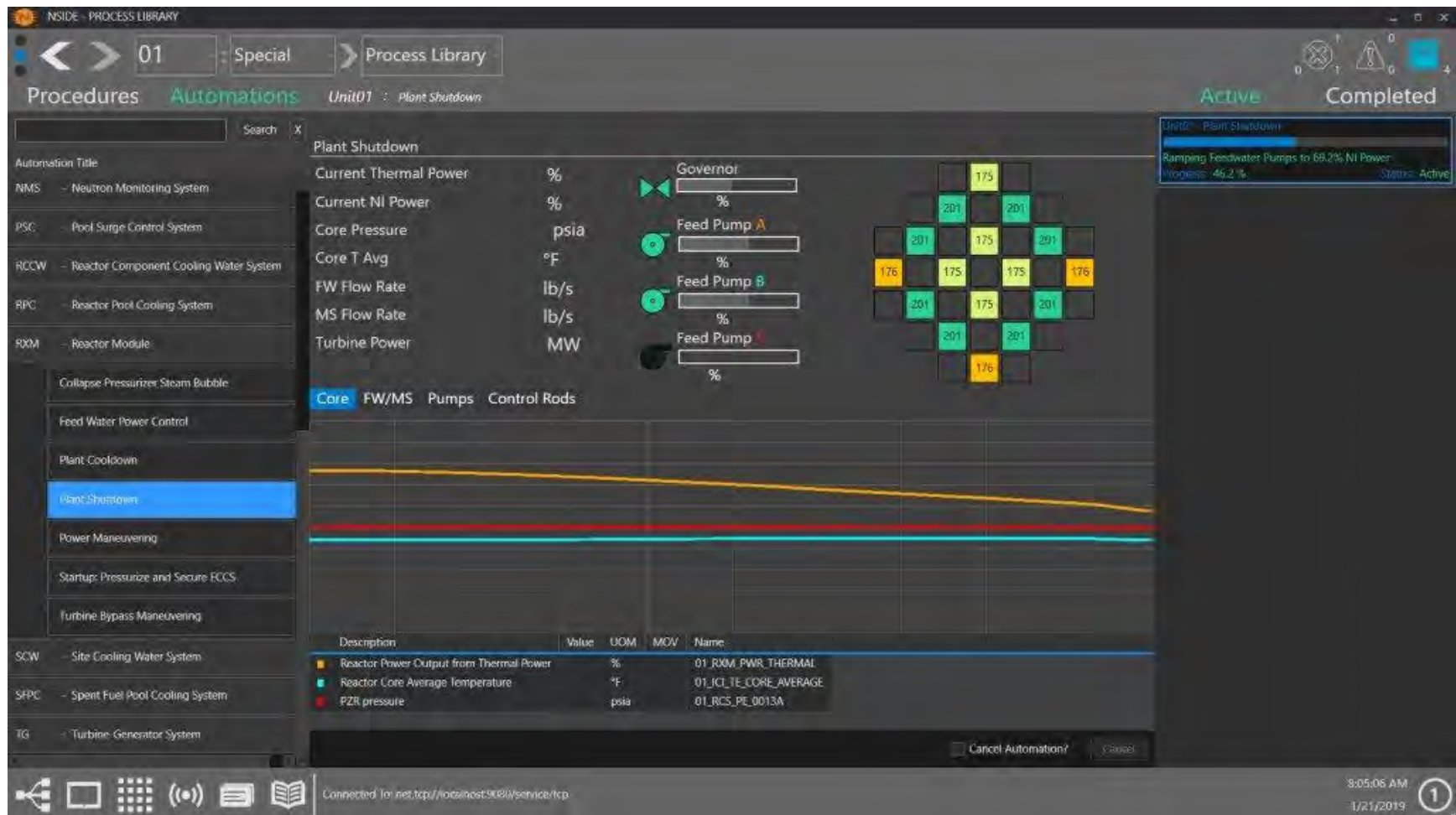
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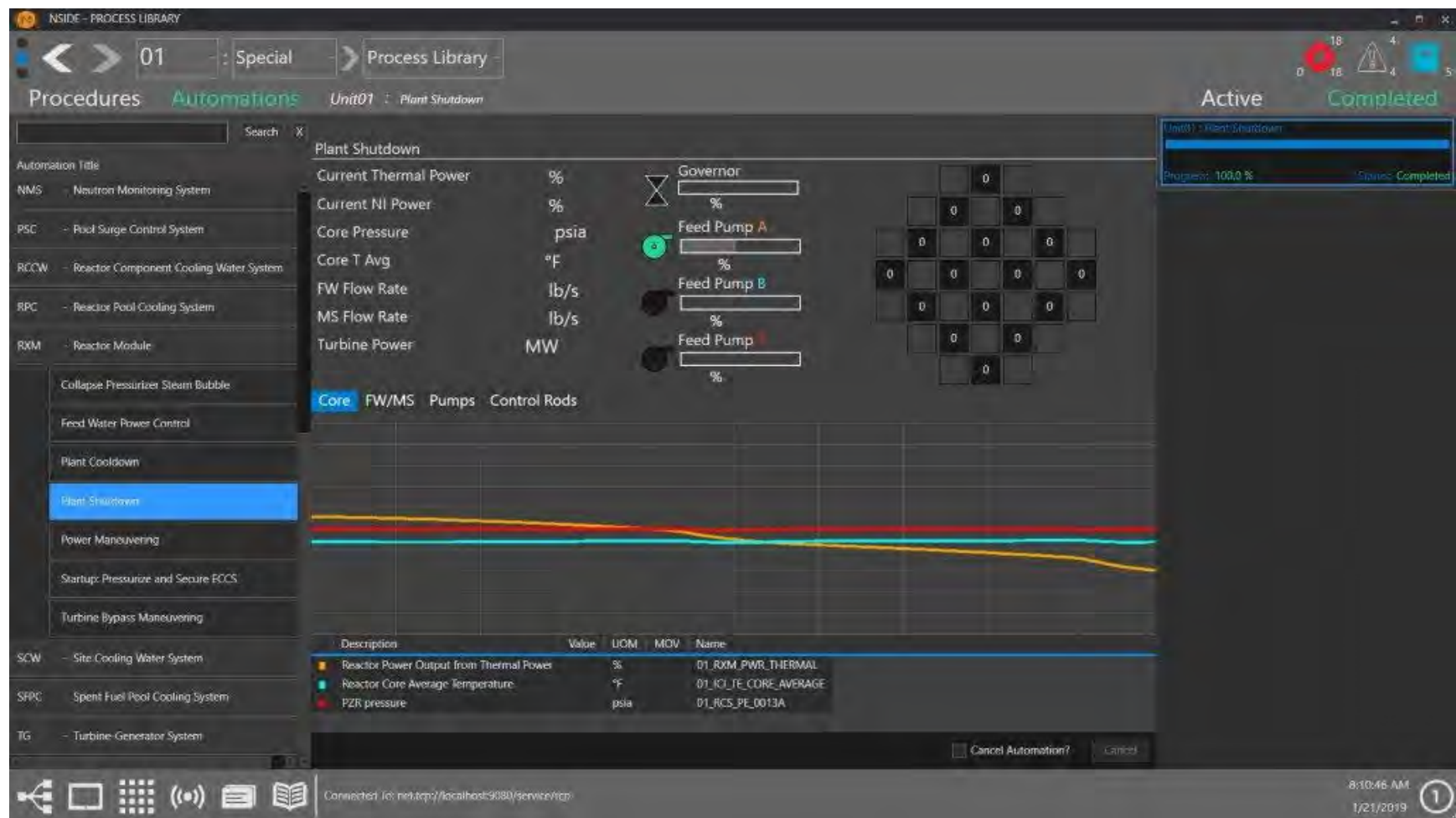
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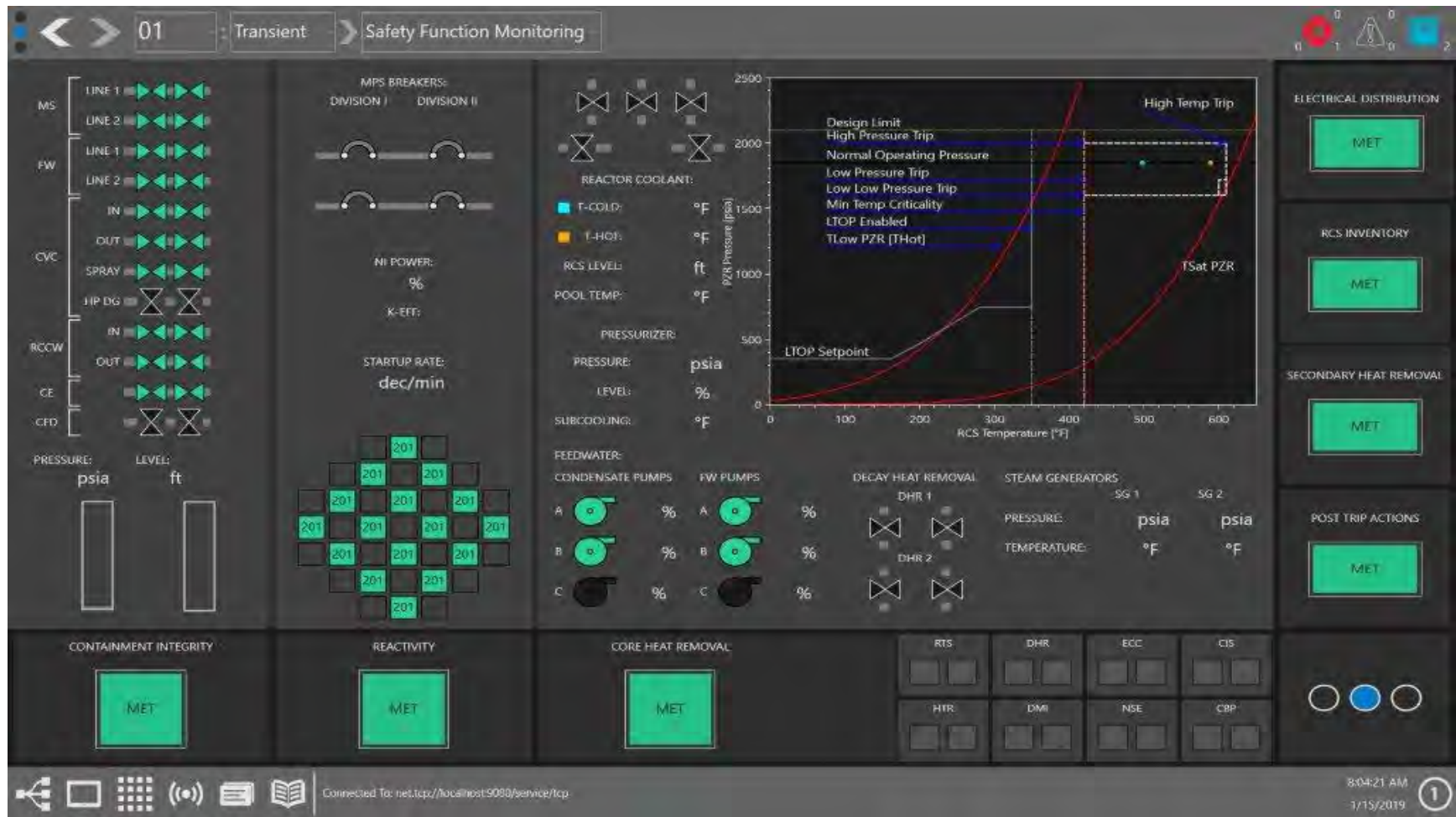
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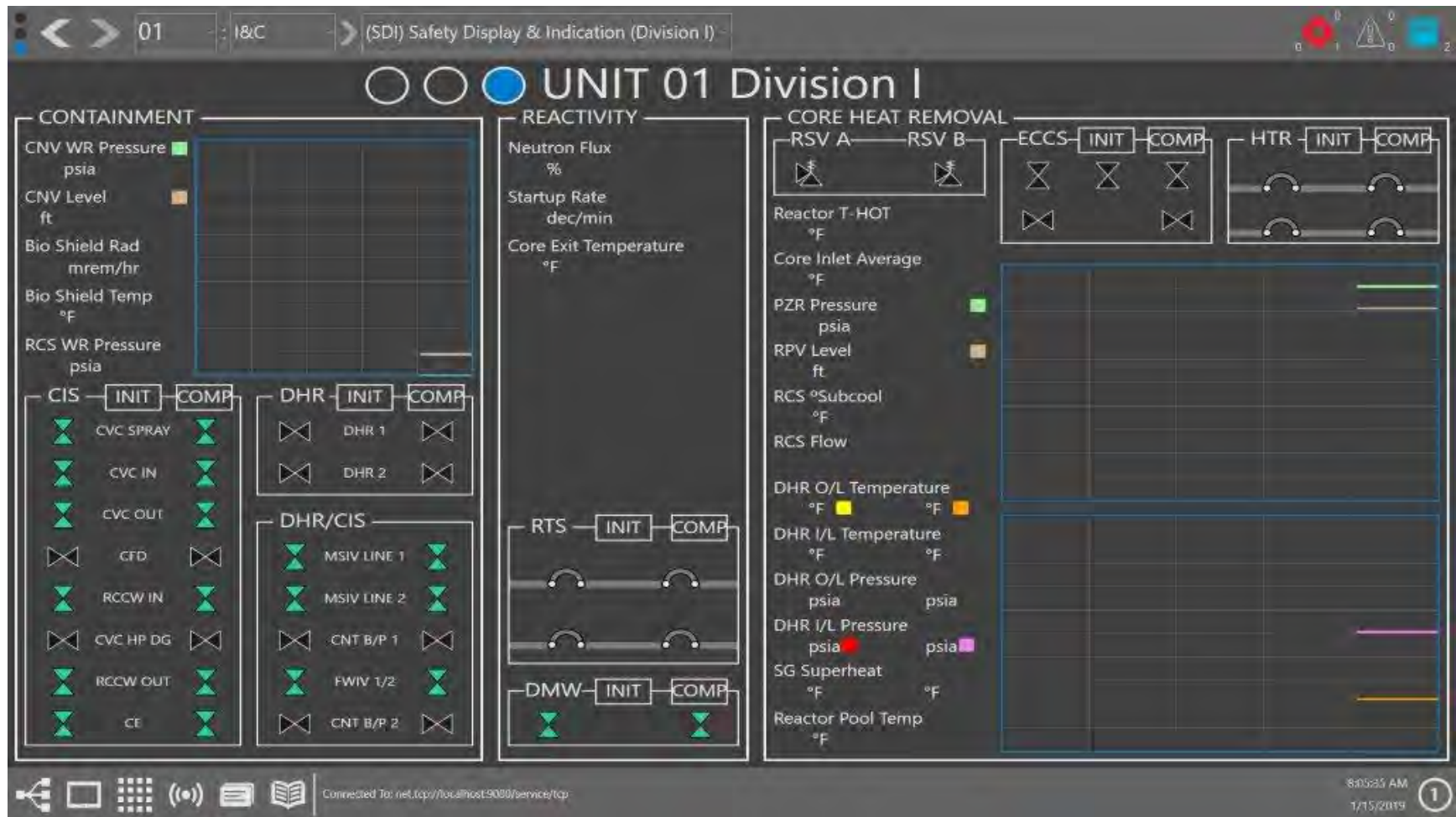
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Safety Evaluation with Open Items: Ch 18, Human Factors Engineering

NuScale Design Certification Application Review

ACRS Subcommittee Meeting
January 23, 2019

NRC Staff Review Team

- **Technical Staff**

- ♦ Dr. Amy D'Agostino, RES
- ♦ Dr. Brian Green, NRR
- ♦ Lauren Nist, NRR
- ♦ Maurin Scheetz, NRR

- **Project Managers**

- ♦ Greg Cranston – Lead Project Manager
- ♦ Prosanta Chowdhury – Chapter 18 Project Manager

Agenda

- Purpose and scope
- Review activities and timeline
- Areas of interest
- Open items
- Conclusion

Purpose and Scope

- Purpose
 - Verify that the HFE design of the NuScale Standard Plant control room supports operators in the safe operation of the plant
 - Verify there is sufficient technical justification for a new, design-specific staffing regulation
- Scope
 - DCA Part 2, Tier 2, Ch 18 as well as parts of Ch 7, 15, and 19
 - HFE technical reports
 - Methods used to conduct HFE analyses and the results
 - Description of the HSI design and the concept of operations
 - SPV methods and results
 - ISV methods (**note:** ISV results will be submitted no later than March 2019)
 - DCA Part 2, Tier 1, Section 3.15
 - Audits of HFE analyses, SPV testing, and ISV testing

Review Activities and Timeline

- Pre-application activities (complete)
 - Reviewed HFE IPs
 - Conducted audit of SPV methods and SPV test
- Phase 1 and 2 activities (complete)
 - Reviewed and conducted audit of results of HFE analyses
 - Reviewed and conducted audit of ISV methods, ISV testing, and HSIs
- Phase 4 activities (in progress)
 - Review the applicant's V&V results and resolve open items

Areas of Interest

- Potential human performance issues specific to SMRs are identified in NUREG/CR-7126 and NUREG/CR-7202
- The staff considered the effects of the following on human performance and safe plant operation:
 - Multi-unit operation from a single operator workstation and from a single control room
 - Relatively higher amount of automation
 - Novel HSI design features

Open Items

- The Phase 2 SER contains 23 open items for the following topics:
 - Review of the applicant's V&V results (19 open items)
 - Scope of the HFE ITAAC and documentation of the HFE activities to be performed by the licensee (1 open item)
 - Evaluate whether changes to Ch 7 related to remote shutdown affect Ch 18 and verify accuracy of the SER (1 open item)
 - Confirm conclusions in SER Chapters 7, 15 and 19 about the treatment of important human actions are consistent with those in Ch 18 (1 open item)
 - Ensure that HFE reports are incorporated by reference into Tier 2 (1 open item)

Conclusion

- The results of the SPV testing support the applicant's proposed staffing plan. The staff will confirm the ISV results also support the staffing plan or that any changes have been made if needed.
- Based on the staff's observations of the ISV test, the staff expects that the ISV results will provide evidence that the HFE design adequately supports plant personnel in safely operating the plant.
- The open items identified in the safety evaluation need to be resolved for the staff to find that the HFE design complies with all NRC requirements related to HFE and thus that the HFE design supports personnel in the safe operation of the plant.

Acronyms

FA: function allocation

FRA: functional requirements analysis

HFE: human factors engineering

HSI: human-system interface

IP: implementation plan

ISV: integrated system validation

ITAAC: inspections, tests, analyses, and acceptance criteria

OER: operating experience review

NRR: US NRC Office of Nuclear Reactor Regulation

RES: US NRC Office of Research

RSR: results summary report

SER: safety evaluation report

SPV: staffing plan validation

TA: task analysis

V&V: verification and validation