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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACRS)

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NuSCALE SUBCOMMITTEE

OPEN SESSION

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TUESDAY

MARCH 3, 2020

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2D10, 11545 Rockville Pike, at 3:05 p.m., Walter L.
Kirchner, Chair, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chair

RONALD G. BALLINGER, Member

DENNIS BLEY, Member

CHARLES H. BROWN, JR., Member

VESNA B. DIMITRIJEVIC, Member

1 JOSE MARCH-LEUBA, Member
2 DAVID PETTI, Member
3 JOY L. REMPE, Member
4 PETER RICCARDELLA, Member
5 MATTHEW W. SUNSERI, Member

6

7 ACRS CONSULTANTS:

8 MICHAEL L. CORRADINI

9 STEPHEN SCHULTZ

10

11 DESIGNATED FEDERAL OFFICIAL:

12 MIKE SNODDERLY

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P R O C E E D I N G S

3:04 p.m.

CHAIR KIRCHNER: Okay, we're back in session. For members of the public, we are turning now to the staff for their presentation on NuScale design certification application, the PRA. And with that, I'll turn to you first, Tony.

MR. NAKANISHI: Well, good afternoon, my name is Tony Nakanishi, and I'm with the Division of Risk Assessment. I'm here with Maria Pohida, also with the Division of Risk Assessment.

So today we'd like to provide a briefing that focuses on PRA and its, we tried to structure our briefing to be responsive to some of the feedback that we received from the ACRS members relative to the PRA focus areas. So if we could go to the next -- oh, I guess I'll have to. Yeah, I'm driving also.

So what we thought might be useful is to start out with a bit of a discussion relative to the design PRA and its context in terms of the Part 52 regulatory framework in terms of its uses, limitations, and the staff review associated with the DC PRA. And then get into some of the topics that were identified by the members. And so that includes the ECCS model, the sensitivity and uncertainty

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1 analyses, and the reactor building crane operations.

2 So under the Part 52 process, consistent
3 with Commission policy and direction, the primary
4 focus of the PRA is to identify risk insights to
5 inform the design, identify insights that could
6 support things like the reliability assurance program
7 that we were talking about, RTNSS, risk-significant
8 human actions, things like that.

9 Obviously part of the PRA is to show that
10 the new design is an improvement in terms of severe
11 accident performance relative to the operating
12 reactors. So from a quantitative standpoint, there's
13 one use with respect to compliance or consistency with
14 the Commission goals relative to CDF and LRF.

15 And I guess the emphasis that I, the
16 emphasis here is that while we rely upon numbers that,
17 you know, risk insights are really what we're trying
18 to go after here at the DC stage. And our staff
19 review of the PRA acceptability is really to support
20 the PRA uses at the DC stage.

21 I also want to just highlight the
22 progression of the PRA under Part 52. At the DC
23 application stage and also at the COL application
24 stage, there's a lot of unknowns that have to be
25 addressed through assumptions. And over time, you

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1 know, there are regulatory provisions to ensure that
2 the PRA improves and the level of detail, the scope of
3 the PRA. And just overall capability of the PRA.

4 And that's, sometimes we refer to the fuel
5 load PRA at, right before operations, and that's, you
6 know, that'll be developed or updated by the COL
7 holder. And then, but even at that stage, you know,
8 the plant hasn't been operated. So you're still
9 lacking in plant-specific operating experience.

10 You'll have procedures by that time, but
11 certainly there's still a lot of unknowns that have to
12 be addressed via assumptions. And any risk-informed
13 decisions will require the evaluation of those
14 assumptions for impact on any decisions.

15 And just to, in terms of the guidance at
16 the DC stage, we have a PRA acceptability regulatory
17 guide that we apply primarily in the operating
18 reactors space. Obviously, plant is in the design
19 phase and there's no, there's many things that are
20 unavailable.

21 And so Reg Guide 1.200 can't be applied
22 directly, and so we do have a interim staff guide
23 instead that sort of provides guidance to staff in
24 terms of how we review the PRA for DC and COL
25 applications.

1 So just to provide a summary in terms of
2 the DC PRA for NuScale, we want to mention that the
3 PRA acceptability is to be commensurate with its
4 intended use. And the primary findings that we're
5 making at this stage is relative to ensuring the
6 Commission objectives relative to PRA use in design
7 are satisfied.

8 I want to clarify that findings are not
9 made on specific numerical results. We found that PRA
10 acceptability is sufficient to support PRA uses in the
11 design certification. And, you know, as a previous
12 slide tried to highlight, there's established
13 regulatory frameworks that will ensure that PRA will
14 reflect an as-built and as-operated condition for
15 operational phases.

16 And we also want to highlight that we
17 applied a focus review approach for the Chapter 19
18 review, and we, you know, we focused on the
19 information needed to reach the safety findings that
20 we, that I mentioned.

21 So getting more specific into some of the
22 topics that were raised, so for the ECCS model,
23 there's certainly recognition that there's a lot of
24 uncertainty in our view that, you know, there's
25 obviously no operating experience. And you took a

1 look at the model, I guess, at the closed session.
2 But we believe that for the purposes that we indicated
3 earlier, that the model is sufficient.

4 And that, you know, there are assumptions
5 that are used to model the ECCS with respect to the
6 level of detail, completeness, and, you know, data.
7 But we evaluated those assumptions for impact on the
8 findings made at this stage and found them acceptable.

9 DR. SCHULTZ: Tony, when you say you
10 evaluated those, could you describe basically how you
11 did that, what's your approach.

12 MR. NAKANISHI: Sure, so yeah, it's a
13 really a good segue to the next slide, which is, you
14 know, sensitivity and uncertainty analyses. So the
15 applicant provided some sensitivity studies addressing
16 things like common cause failure, of human failure,
17 operator action.

18 And we sort of applied the common cause
19 failure sensitivity study as sort of a surrogate for,
20 you know, evaluating the impact of less reliable ECCS
21 system. And you know, the applicant showed that they
22 still, the design is still, you know, consistent with
23 the Commission goals and things like that.

24 MEMBER DIMITRIJEVIC: That's one of my
25 main issues.

1 MR. NAKANISHI: Okay.

2 MEMBER DIMITRIJEVIC: This sensitivity
3 uncertainty only supported conclusion that they meet
4 safety goal. No any other. Am I right?

5 MR. NAKANISHI: So there's, so in terms of
6 the CCF, the common cause failure sensitivity
7 analysis, so the applicant --

8 MEMBER DIMITRIJEVIC: Let me add that all
9 of these, they just show you that you're always
10 meeting safety goals. But you never evaluate the
11 implication on the input would be the up to human
12 factors to anything. You just say, oh, we make safety
13 goal so we are fine.

14 MR. NAKANISHI: So the DRAP process we --
15 so I guess I'll first of all mention I wasn't the
16 reviewer that looked at the DRAP process. But I
17 believe we, it was a kind of a integrated look at the
18 design. So certainly the risk significance, yeah,
19 methodology is one aspect.

20 MEMBER DIMITRIJEVIC: I didn't want to put
21 you on the spot because you did not do it, and nobody
22 does it. So it's all right. If you did it, it would
23 be revolutionary thing. But you specifically say in
24 SER, that's a not true statement, you specifically say
25 the sensitivity uncertainty were used to evaluate

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1 insight. They're only used to evaluate safety goal,
2 not the insight.

3 So that statement is not true, and if you
4 did not do it, nobody did it during the, you know, EPR
5 review. Nobody's, this is advanced step to say, oh,
6 okay, if you change this how does this imply insight.

7 So therefore I will note clearly, you can
8 say the uncertainty and sensitivities are done to
9 support the design meets safety goal, that's perfectly
10 true and it's perfectly fine. But don't say they use
11 that to support all other regulatory findings.
12 Because they're not really used, they're just done,
13 they illustrate that we meet safety goal for all these
14 cases, but nobody looks at the implications, you know.

15 Like for example, the ECCS valves are not
16 as reliable, obviously you really want to have a
17 charging, and you know, containment and things because
18 that's your only other level of defense. So that's
19 what I was trying to say with the sensitivity
20 uncertainty.

21 MR. NAKANISHI: Right, I think there could
22 have been a more explicit --

23 MEMBER DIMITRIJEVIC: This is what you say
24 in SER. You say that we can't appropriately consider
25 uncertainty sensitivity a traditional relation

1 regulation defense in depth, blah, blah, blah, blah,
2 to, in addition to risk insight to determine it is
3 significant for DRAP, as discussed in Section 1744.
4 That's not a true statement. If you can prove me,
5 show me how uncertainty sensitivities are used there,
6 I will be impressed.

7 MR. NAKANISHI: Yeah, I would say the
8 focus was more on the, you know, the qualitative
9 aspects, like the defense in depth and --

10 MEMBER DIMITRIJEVIC: But there is no
11 defense in depth they also face, because you're only
12 defending on ECCS valves, your next defense is that is
13 charging, I mean, you know. So it's not, definitely
14 not defense in depth.

15 MR. NAKANISHI: Well, right, so defense in
16 depth meaning sort of the design, considering the
17 design itself. I think there was some discussion
18 earlier about, you know, the level of redundancy with
19 respect to CVCS.

20 And you know, also the fact that it's a,
21 you know, it's in a protected, you know, aircraft
22 impact-proof reactor building. We think, you know,
23 putting it on the DRAP may or may not necessarily add
24 so much. It's already, you know, it's a normally
25 operating system.

1 So I think things like that, we looked at
2 it, you know, more of a, in holistic manner. We sort
3 of went back and forth with the applicant regarding
4 expert panel process. I think expert panel process is
5 very important.

6 MEMBER DIMITRIJEVIC: That's true.

7 MR. NAKANISHI: I think the numbers, like
8 I said, you know, you could sort of play around with
9 the assumptions and, you know, get where you want.

10 MEMBER DIMITRIJEVIC: But, and I don't
11 think you need to do anything more, don't get me
12 wrong. I'm just saying it should be stated truthfully
13 here and say when the PRA is completed in this spaces,
14 you know, then that this insight should be evaluated
15 because sensitivity, the sensitivity only addresses
16 your safety goal.

17 MR. NAKANISHI: Right, so we'll look at
18 that and consider rewording.

19 MEMBER DIMITRIJEVIC: That was my main
20 concern, whenever I brought uncertainty sensitivity.
21 Not just safety goal.

22 MR. NAKANISHI: Right, understood.

23 DR. SCHULTZ: Tony, just to amplify that,
24 on the slide 3 in your last bullet, for the DC PRA
25 uses, you have a number of things in the last bullet

1 that could be done. And the question is were they
2 done for the passive design here.

3 MR. NAKANISHI: So they have been. So
4 RTNSS evaluation has been done. From a probabilistic
5 standpoint it's what we call the focus scope -- focus
6 PRA where you assume that the non-safety systems are
7 unavailable and you evaluate the CDF and LRF. The
8 applicant evaluated that process and determined and we
9 accepted that there's no written SSCs.

10 ITAAC is, you know, per our guidance it's
11 supposed to be a risk-informed process. And so we
12 tried to incorporate risk insights, I believe the
13 crane, ITAAC on crane.

14 MS. POHIDA: The review of the crane
15 resulted in additional ITAACs.

16 DR. SCHULTZ: In particular, yes.

17 MS. POHIDA: Thank you.

18 DR. SCHULTZ: And we'll talk about that
19 later.

20 MR. NAKANISHI: And we talked about RAP,
21 and tech spec I think it's a little, you know, there's
22 this, I think it's primarily deterministic in terms of
23 how we, you know, 5036 is written, so.

24 DR. SCHULTZ: There's some of that done
25 but not --

1 MR. NAKANISHI: Right.

2 DR. SCHULTZ: Not a lot now.

3 MR. NAKANISHI: Right. And --

4 DR. SCHULTZ: Same with the COL action.

5 MR. NAKANISHI: COL action items,
6 certainly.

7 DR. SCHULTZ: Well, the action items are
8 there, so right.

9 MR. NAKANISHI: And then the interface
10 requirements is really more relative to the specific
11 site, site-specific features, how the design
12 interfaces with like the ultimate heat sink and things
13 like -- for NuScale it's a little different because
14 their ultimate heat sink is, you know, within the
15 design.

16 DR. SCHULTZ: Good, I appreciate the extra
17 information. Thank you.

18 MEMBER DIMITRIJEVIC: I have additional
19 questions. I found that in SER, but I thought I saw
20 in slide, but I cannot. You said that you think that
21 the applicant adequately addressed multi-module risk.
22 That's within SER, I thought it was in some slide,
23 but. How is multi-module risk defined, how does staff
24 define multi-module risk?

25 MR. NAKANISHI: So the staff guidance for

1 multi-module risk is not quantitative. Like, the SRP
2 19 doesn't require the applicant to do a quantitative
3 multi-module risk analysis. Really, the, what we were
4 looking for and what we reviewed was did the applicant
5 do a systematic analysis of multi-module scenarios and
6 did they identify, you know, potential risk-
7 significant issues associated with that.

8 And I believe the crane --

9 MS. POHIDA: We can discuss this with the
10 crane, but there is no requirement for an applicant to
11 quantify multi-module risk. The requirement is to
12 look for potential system interactions. And that's
13 what the applicant has done, and those are described
14 in Chapter 19.

15 MEMBER DIMITRIJEVIC: Okay, because see
16 they calculate multi-module risk in Chapter 19 as a
17 risk to fail two modules, more than one module, right?
18 Is that how you define multi-module risk?

19 MR. NAKANISHI: So the applicant decided
20 to quantify the multi-module risk. Our finding is
21 really of a, based on a qualitative assessment.
22 Correct me if I'm wrong.

23 MEMBER DIMITRIJEVIC: Because there is a
24 different aspect of this. Multi-module risk would be
25 more than one module failing, or it could be increased

1 risk because you have multiple modules on the same
2 side.

3 MR. NAKANISHI: It's the former, former.

4 MEMBER DIMITRIJEVIC: For --

5 MR. NAKANISHI: Simultaneous core damage
6 events.

7 MEMBER DIMITRIJEVIC: So why wouldn't you
8 look in increase the reason, or the presence of multi-
9 module where we can start moving one module, heating
10 that, as you know, have explosion of hydrogen above
11 all of them. You know, whenever one event happens,
12 affect all modules. Why was not staff interested that
13 type of multi-module?

14 MR. NAKANISHI: So no, that is the, that's
15 the multi-module --

16 MEMBER DIMITRIJEVIC: Because you said the
17 former, which was more than one module failing, but.

18 MR. NAKANISHI: Yeah, maybe I
19 misunderstood you, so --

20 MEMBER DIMITRIJEVIC: That's what they
21 quantify in the Chapter 19, just the common cause
22 within different systems and things like that.

23 MR. NAKANISHI: Right.

24 MEMBER DIMITRIJEVIC: But there is not
25 any, like nobody even look in the, nobody even discuss

1 the, for example, operator will have to do multiple --
2 but multiple modules in the same time because they're
3 exposed to the same external event and things like
4 that. And even there is a section, don't we have a
5 multi-module?

6 Joy, I think you were in charge when they
7 only identify common systems but not never common risk
8 contributions, right?

9 MEMBER REMPE: You're talking about in
10 Chapter 19?

11 MEMBER DIMITRIJEVIC: No, I'm talking
12 about --

13 MEMBER REMPE: In 20, Chapter 20.

14 MEMBER DIMITRIJEVIC: So that's why I sort
15 of think that maybe there is some missed opportunity
16 here to talk about the some risk impact from presence
17 of multi-modules on the same site.

18 MS. POHIDA: May I provide a
19 clarification? Regarding, and if I misspeak I'll
20 defer to NuScale on this one, but in multi-module risk
21 for full power conditions, multi-module risk was
22 quantified by the use of module adjustment factors.

23 MEMBER DIMITRIJEVIC: Right.

24 MS. POHIDA: To look at the potential
25 commonalities of operator actions and shared systems.

1 So that was done for full power. Multi-module risk in
2 terms of a drop a module impacting another module,
3 that is evaluated in DC Section 19.1.7, and that was
4 done qualitatively.

5 In terms of multi-module risk regarding
6 external events, as I recall, that was also done, you
7 know, qualitatively, Chapter 19.

8 MEMBER DIMITRIJEVIC: This is where I have
9 to say I disagree. What is done in Chapter 19 is
10 calculate frequency or core damage frequency of
11 failing two modules.

12 MS. POHIDA: Yes.

13 MEMBER DIMITRIJEVIC: This wasn't done is
14 calculating crease of core damage frequency for single
15 module due to presence of other modules. And that's
16 what I would define as one aspect to multi-module.

17 MS. POHIDA: That's one aspect of several.

18 MEMBER DIMITRIJEVIC: Because let's say I
19 agree that we are only we're looking in one module and
20 that's what we are worried. But that module has
21 increase in risk because of setup of these multiple
22 modules. Because the operators could be, you know,
23 distracted with a million or doing different things
24 because eventually we move each of those modules
25 around each other. They have some common spatial

1 things.

2 So I think that this was a failed
3 opportunity to identify this type of increase in
4 multi-module risk. That's in my opinion.

5 MEMBER REMPE: But just to clarify, it is
6 in Chapter 19, but remember, I had to recuse myself.
7 So I think we need to look at Steve.

8 MEMBER DIMITRIJEVIC: What was the, when
9 you were addressing all these common system, that was
10 some chapter you --

11 MS. POHIDA: Chapter 20.

12 MEMBER REMPE: But that was mitigation of
13 beyond design-basis events. But there is, as Marie,
14 said a multi-module risk in Chapter 19.

15 MEMBER DIMITRIJEVIC: But that's a
16 different, that's what I know am I discussing. But
17 what was the chapter where they say this is new bad
18 concern or how about they connect the modules?

19 PARTICIPANT: System interactions.

20 MEMBER DIMITRIJEVIC: System interaction.

21 MEMBER REMPE: That was where we were
22 talking about buildup, and that was back in Chapter 9.
23 But that wasn't like a risk assessment, it was just
24 how they would build up. I just was confused a bit on
25 where you're going.

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1 MEMBER DIMITRIJEVIC: I'm not talking
2 about risk assessment because it wasn't in that
3 chapter but I thought it should be.

4 MEMBER REMPE: Okay.

5 MEMBER DIMITRIJEVIC: That was what,
6 whatever chapter that was. All right, did you
7 understand my point?

8 MR. NAKANISHI: I think so, yes.

9 MEMBER DIMITRIJEVIC: All right.

10 MS. POHIDA: Thank you.

11 MR. NAKANISHI: So I think I'm going to
12 turn it over to Marie at this point to talk about the
13 crane operations.

14 MS. POHIDA: Yeah, as I presented in the
15 phase 3 ACRS discussion, the calculated drop
16 probability is dominated by operator errors. You
17 know, overspeed, over-raise, over-travel. And
18 failures of instrumentation that's, interlocks or
19 switches to provide a safety stop. And that was based
20 on the reactor building crane PRA, which we understand
21 that reactor building crane design is evolving.

22 During that period since our last
23 briefing, key assumptions was added for the low power
24 and shutdown PRA in DC table 19.1-71 to state that
25 movement of the reactor building crane is modeled as

1 being operator controlled. And you know,
2 administrative controls will ensure that reactor
3 building safety features, those limit switches and
4 interlocks to prevent undesired movement, are
5 functional during module movement.

6 We do have a COL action item, 19.1-8,
7 where the validity of these reactor building crane
8 assumptions and the crane data will be confirmed by
9 the COL applicant.

10 MEMBER BLEY: Before you leave that--

11 MS. POHIDA: Sure.

12 MEMBER BLEY: NuScale and you said, and
13 you folks agreed, as I recall, I don't remember if
14 it's in the SER or somewhere else, that their crane
15 vendor would do an analysis of human-related failures
16 of the crane. And I would assume then the COL
17 applicant would present that and you folks would
18 review it. Is that your understanding?

19 MS. POHIDA: My understanding, if there
20 are changes that impact the crane data or the crane
21 assumptions in the DCA, that we would keep format --

22 MEMBER BLEY: They don't even have a crane
23 now.

24 MS. POHIDA: I beg your pardon?

25 MEMBER BLEY: They don't have a crane yet.

1 They're laying out a specification, and you agreed
2 that was a reasonable way to do it in Chapter 18. And
3 then their vendor will, is being tasked with doing the
4 human reliability analysis to support the crane. And
5 I would assume that makes its way back to the PRA
6 eventually in the COL stage. And you look like this
7 is news.

8 MS. POHIDA: No, my -- I apologize. My
9 understanding is is that we would be looking at that
10 at COL stage.

11 MEMBER BLEY: Okay, that's fine.

12 MS. POHIDA: Thank you.

13 CHAIR KIRCHNER: Just an observation,
14 Dennis and Vesna, and I think, and Joy, this rises to
15 the level it's on of note.

16 PARTICIPANT: Yeah, it's already flagged.

17 CHAIR KIRCHNER: Yeah, we flagged it
18 before, and I think this is one of the items that
19 should find its way into our final letter on this.
20 Thank you.

21 MEMBER DIMITRIJEVIC: But I just want to
22 note that everybody that has that in mind, this core
23 damage frequency through the cane is not part of core
24 damage frequency consider safety goal. Because it
25 cannot result in release.

1 So therefore it's irrelevant, it just
2 hangs there like -- they decided that this, when new
3 report core damage frequency and large release
4 frequency, this core damage frequency is not included.
5 And it's not used in importance measure, it's a
6 separate chapter. Because it doesn't lead to
7 releases. Because if they drop the module then, you
8 know, they made the argument that there's not going to
9 be releases from the pool.

10 MS. POHIDA: May I make a clarification on
11 that?

12 MEMBER DIMITRIJEVIC: Sure.

13 MS. POHIDA: Okay. In the module drop
14 analysis in the SER, we do do a comparison of
15 NuScale's module drop probability and the resultant
16 CDF against the Commission goals. And what we also
17 used was a drop probability from the EPRI report on
18 spent fuel casks, which was on the order of 5E minus
19 6. And what we recognize is that the use of either
20 drop probability yields a core damage frequency that
21 meets the Commission goals, okay.

22 And as we say in the SER, if we drop a
23 single module, it does not result in a large release.
24 So we do do a comparison of the drop probability and
25 resultant CDF against the Commission CDF goal. Does

1 that help?

2 MEMBER DIMITRIJEVIC: Yeah, I know you do
3 that, but it's not part of the, you know, any risk
4 insights because it just fends for itself with large
5 number of existing things, so. I'm not sure,
6 actually, how to treat that, it's the first time I saw
7 something like this happening, so.

8 MS. POHIDA: Well, the risk significance
9 of the reactor building crane, and it's actually on
10 this slide, the risk significance of the crane is
11 inclusion of DRAP. That was used to initiate a deeper
12 look into ITAACs and see, you know, what additional
13 ITAACs could be performed to give a little bit more,
14 for lack of a better term, infrastructure to the drop
15 probability that was assumed in the PRA. And that was
16 done.

17 Does that help? Okay. All right, getting
18 back to bullet number one, in DC table Chapter 9.1.5-
19 1, that does document the max speeds and lists heights
20 for the reactor building crane. The reactor building
21 crane is to be constructed single failure proof
22 consistent with operating plants. I forgot the NUREG
23 number and the supplemented by guidance in NOG-1.

24 The applicant, the COL applicant will
25 describe the process for handling and the receipt of

1 heavy loads, including the nuclear power module per a
2 COL action item, 19.1-5. Since phase 3, the reactor
3 building is included within the scope of the human
4 factors process during COL, according to the human
5 factors designing implementation plan.

6 And as I stated earlier, the risk
7 significance of the reactor building crane did result
8 in additional ITAACs. And that's for, you know, rated
9 low tests of the module lifting fixture and the module
10 lifting adapter. And inspection of the, you know, as-
11 built welds for the module lifting adapter and the
12 module -- module-lifting fixture, excuse me, and the
13 module-lifting adapter.

14 And as I stated previously, a postulated
15 single module drop does not result in a large release.

16 So this concludes my presentation. I'll
17 be happy to address any questions.

18 CHAIR KIRCHNER: Did you go beyond that,
19 Marie and the staff, did you look at the build-out of
20 the plant and any, are there any limitations on
21 operating other modules while you're building out?
22 You know, the nominal concept of operations has the,
23 I believe it's unfueled, the nuclear power module
24 comes in on a special trolley, it's positioned, if
25 it's fueled, it's moving.

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1 Are there any limitations on operations of
2 any other modules that are pre-existing or installed
3 while those operations are ongoing?

4 MS. POHIDA: That, those conditions were
5 not evaluated in 19. I'm questioning whether they
6 were addressed in Chapter 9, but I'm not the proper
7 reviewer for that.

8 CHAIR KIRCHNER: I don't think so, nor is
9 20, to my knowledge.

10 MS. POHIDA: Yeah, that was not addressed.

11 CHAIR KIRCHNER: This is one of the rather
12 unique features of this plant. And does that set of
13 operations introduce risk significance to how the
14 plant is built out?

15 MS. POHIDA: What was discussed in Chapter
16 19 was the postulated drop of a module being removed
17 -- being moved for refueling on top of another, on an
18 operating module. Whether it strikes the top and
19 could result in breaks of CVCS piping, or if it's
20 struck, you know, it hits the module at the bottom, at
21 the pedestal, that is described in Chapter 19.

22 MEMBER REMPE: So what Vesna's mentioning
23 is slowly coming back to me, that there are, and I'm
24 having trouble remembering what chapter --

25 MEMBER DIMITRIJEVIC: Chapter 21, it was

1 actually.

2 MEMBER REMPE: Yeah, okay, there is a
3 chapter that has some requirements about when they
4 even start building, how many modules have to be
5 supported by how many systems. I've not seen any
6 assessment of when they're bringing in another module,
7 but they do have some requirements. I just, you were
8 puzzling me when you brought it up because I hadn't
9 thought about it for a while.

10 MEMBER DIMITRIJEVIC: Twenty-one is called
11 multi-module consideration. But it is very bare, this
12 only identifies systems which are common for all the
13 modules and nothing else. There is not any other
14 multi-module consideration there. It is a pity, it
15 could be fantastic and very informative section.

16 CHAIR KIRCHNER: Yeah. For example,
17 although each module will have its own CVCS system,
18 there's common supply of boron addition as one example
19 of potential multi-module --

20 MEMBER REMPE: And so they do consider
21 that one, as I recall, and it helped me remember. But
22 isn't it like one boron addition a system for six or
23 something like that. And so I would assume the risk
24 assessment would have done like a one out of six or
25 something or other.

1 It would have considered that. Because
2 again, even though you had two for 12, you would have
3 been thinking about those kind of relationships as a
4 way to kind of think about this right now and what
5 you're required to do. Does that make sense, what I'm
6 trying to say?

7 MS. POHIDA: Yes, I understand. I would
8 have to go back and look at the full power, you know,
9 multi-module risk assessment that was done and see how
10 those module adjustment factors, in other words the
11 impacts, the conditional impacts in the other modules
12 was done. But I would have to go back and look at
13 that. I can take that back, though.

14 CHAIR KIRCHNER: The reason I bring it up
15 is because I, from looking at like Chapter 21, it
16 looks like it's really deferred to the COL to develop
17 a conduct of operations plan for build-out. And hence
18 a risk assessment, and a in-depth look at where
19 they're reliant -- they are, as I mentioned just one
20 example, the CVCS, there's one system for each module.

21 That sounds good, but they do share a
22 common heating system, a common foreign injection
23 system, and so on. So one starts to think, well, we
24 got something operating and we're bringing something
25 else in. What's the implications of that?

1 MS. POHIDA: We can take that back as an
2 item to look at.

3 MEMBER REMPE: Yeah, I think we actually
4 documented that concern in our letter. It's been
5 awhile.

6 CHAIR KIRCHNER: I think so, because
7 Chapter 21 is rather thin.

8 MS. POHIDA: It is very.

9 MEMBER DIMITRIJEVIC: And a factor is very
10 simple, the system is common, they will just fail it
11 for both modules. So the factors will not help if
12 with this concern is.

13 MS. POHIDA: With this type of, this new,
14 this consideration of the build-up of the modules as
15 they're being brought online.

16 MEMBER DIMITRIJEVIC: Or be the common
17 challenges were also not addressed in this, you know,
18 two different modules. And the same operator's action
19 affecting human. Probably not big deal, but it's
20 very, it should be somewhere, you know. Now it's too
21 late, but things.

22 DR. CORRADINI: Just to remind people,
23 this was the June meeting letter, and it's a common
24 letter between 19 and 21 where we did not have any
25 specific recommendations for multi-module design

1 considerations. Most of it was --

2 MEMBER DIMITRIJEVIC: There was a common
3 letter. Why would they be common --

4 DR. CORRADINI: It was the same letter,
5 June.

6 MEMBER DIMITRIJEVIC: Oh, you mean in the
7 same letter, but there is --

8 DR. CORRADINI: It's in the same letter.

9 MEMBER DIMITRIJEVIC: There was not --

10 DR. CORRADINI: But there was no
11 recommendation specifically for multi-module design
12 considerations, but there was a discussion in the
13 discussion, most of what you've talked about is in the
14 letter from June.

15 CHAIR KIRCHNER: I just brought it up
16 because following on with Vesna's comments on -- you
17 know, I think for the existing fleet, when they talk
18 about multi-module, their concerns were much more
19 limited. Here we have multi-modules within the same
20 reactor building, different states of operation and so
21 on.

22 Whereas most multi-module plants, even if
23 they share control rooms adjacent or something, don't
24 have the commonality of support systems that the
25 NuScale design will have. Including the ultimate heat

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1 sink, etc.

2 MEMBER REMPE: I want to --

3 MEMBER BLEY: They don't, but this
4 committee has a history of recommending that people
5 consider site risk in its entirety.

6 MEMBER REMPE: On kind of a different
7 topic, I'm thinking aloud here, and I think we have
8 time for hypothetical, but we've commented throughout
9 several meetings about the COL applicant will develop
10 the procedures. And this table that documents
11 assumptions would be a good place for the staff to
12 evaluate those COL applicant procedures at some point
13 in the future.

14 And perhaps, you know, it's a good
15 repository of a lot of such assumptions to help.
16 Because I think this, because of the newness of and
17 the uniqueness of the design, that the procedures that
18 are used are going to be more important than maybe if
19 we just had an evolutionary LWR coming through.

20 And is that kind of the best place for
21 looking at this? And like right now in the earlier
22 discussions on other topics this week, we're going to
23 be pointing to more things the COL applicant
24 procedures need to consider.

25 And maybe they don't fall into Chapter 19,

1 but is there a better place other than to look at the
2 whole SE, all these assumptions? It just, I know the
3 applicant has said we've got a list of assumptions,
4 but I thought it was always in Chapter 19 context.
5 What are your thoughts about this? Because I think
6 it's going to be a difficult situation in the future.

7 MR. NAKANISHI: So I personally, and I
8 think from a staff standpoint, we agree. I think the
9 Chapter 19 has a list of key assumptions that have to
10 be reevaluated for, you know, future phases, you know,
11 COL application and beyond. So and then the COL item
12 that we have, there's a COL item specifically, you
13 know, identified to go back and evaluate those
14 assumptions.

15 So, and COL you know, action items are
16 something that, yeah, COL applicant has to address.
17 Whether, you know, they'll, there may be other
18 justification for doing, you know, proposed
19 approaches, but they certainly need to address those.
20 And so that provides some assurance from the staff
21 standpoint that, you know, issues, design or
22 operational issues, procedural issues, may be
23 addressed in the COL stage.

24 MEMBER DIMITRIJEVIC: And I want to action
25 this very much, even this is not called COE applicant

1 the COL holder who will deal with the procedures.
2 When I look at this PRA, this PRA was done as a most
3 PWR PRA side. It concentrates on things which we
4 know, not on the things which we don't know.

5 So the thing is what we notice here in our
6 review, there are some things which don't show in
7 other PWRs suddenly become a issue here, like this
8 boron dilution, steam generators, maybe even this
9 containment bypass. But that's maybe issue in others,
10 I'm not sure.

11 So we are discovering through this review
12 some things which we review of the PRA has a very
13 small chance to discover because they're used to
14 reviewing PWR, not the new design. So while we are
15 reviewing this design, we are discovering very
16 valuable things they should keep in mind. How to keep
17 this documented, that's the question, so somebody will
18 see it in the future, before the full load, which is
19 the main thing.

20 MR. NAKANISHI: Right, I think we agree.
21 And there's a lot of lesson learned potentially here
22 for future even non-light-water reactor PRAs, you
23 know. I think there's, you know, when you have to
24 recover from a otherwise a safe, stable state, you
25 know, that could get into some potential issues. So

1 I think the point's well taken. I think we probably
2 need to align, you know, internally and --

3 MEMBER DIMITRIJEVIC: You know when the --
4 brings, why didn't, why is this scenario not in the
5 PRA? Well, I have never seen this in the PRA. It's
6 a part of this design. So they haven't seen that in
7 PRA, so they didn't even consider it, see. The people
8 who will review it also didn't see that in the PRA, so
9 they would not consider it. So that's a thing which
10 we have to try to bridge somehow to keep this valuable
11 information mean some.

12 DR. SCHULTZ: Leads to a followup
13 question, Tony, and that, and Marie as well, is that
14 does the staff have a good process to capture those
15 things that you've learned from this experience, which
16 is in fact somewhat different than what the staff has
17 reviewed previously with LWRs?

18 It's certainly going to come up again,
19 perhaps in more difficult evaluations with other
20 designs, since this one is somewhat similar to light-
21 water reactors.

22 MR. NAKANISHI: Right, I agree. I think
23 we have some, you know, internal communities of
24 practice, if you will, for, you know, risk type of
25 activities. I think this is something that's probably

1 worth sharing in that group. And --

2 DR. SCHULTZ: Yeah, I'd certainly
3 recommend it.

4 MS. POHIDA: We appreciate the comment,
5 because it's, when you go through a review, it's not
6 what's in the PRA, it's not -- it's what's not in the
7 PRA. And should it be in scope.

8 MEMBER REMPE: Dennis brought up an
9 example with the sampling system from the hydrogen.
10 And Jose's brought up an example with respect to
11 situations where you might have some sort of increased
12 instability. Where do we catch those?

13 We can't tell the applicant to add it to
14 table whatever. Do we just have to put it wherever?
15 It would be nice if it were in a single location, you
16 know, just to make it easier for the future. Thoughts
17 on those ideas?

18 MR. NAKANISHI: So I think we need to go
19 back, get back within, you know, kind of discuss among
20 the staff and just kind of decide what we need to do,
21 if anything, relative to, you know, from a licensing
22 standpoint and documentation standpoint. I think we
23 probably need to, you know, think about how to best do
24 that.

25 MEMBER REMPE: Maybe our letter could

1 reflect that concern somehow.

2 CHAIR KIRCHNER: Tony, I don't have the
3 hard copy view graphs in front of me. How many more
4 view graphs have you?

5 MR. NAKANISHI: That's it.

6 CHAIR KIRCHNER: This is it. That's what
7 I thought. Okay, so at this point then, members,
8 further comments, questions?

9 MEMBER MARCH-LEUBA: Since my name was
10 just in vain a couple of times, well, it was used --
11 I'm glad to be useful. One concern I have is as we're
12 going doing the design certification, we are making
13 risk-informed decisions that are called risk-informed
14 based on a admittedly incomplete PRA.

15 So when we have the before logging fuel
16 PRA, which that will go through a very thorough review
17 and it will have much more completeness, because by
18 that time we'll know how the operating procedures
19 work, we'll know how the stimulator is designed, we'll
20 know who'll build the crane.

21 Yeah, so is there a step when we
22 reconsider those risk-informed decisions that were
23 appropriate? Or what would trigger that decision? Or
24 is it already been decided and forget it?

25 MR. NAKANISHI: Right, so I think, you

1 know, we would go back to some of the points I was
2 trying to make relative to how you use the PRA. I
3 think we're sort of trying to make sure we don't -- we
4 don't make risk-informed decisions that are not
5 supported by the current PRA.

6 So whenever you make certain decisions, we
7 would make sure that the PRA adequately supports it,
8 and things like completeness issues and, you know,
9 various assumptions will be evaluated for the impact
10 on decisions. So I guess what I'm saying right, I
11 think we have to be careful right now with the current
12 PRA how we use it.

13 MEMBER MARCH-LEUBA: And for future plans
14 that are going to make even higher claims for risk-
15 informed, like get rid of containment because I don't
16 need it, how do we -- I mean, something like that we
17 will not miss. But how do we ensure that as we know
18 more about the plant --

19 MR. NAKANISHI: So the non-light-water,
20 yeah, the non-light-water reactor process has a lot
21 more rigorous approach. You know, the licensing
22 modernization project and, you know, the associated
23 used of PRA. So I think that process has to sort of
24 address that.

25 MEMBER MARCH-LEUBA: It's a kind of a

1 chicken and the egg in the sense that you used the PRA
2 to define your design participants, which defined the
3 PRA. And somebody has to step in there and decide --

4 MR. NAKANISHI: There will be, yeah, a lot
5 more rigor in terms of review against the standard,
6 the non-light-water reactor standard. You know, peer
7 review requirements, you know, looking at
8 uncertainties and assumptions. I think that'll be a
9 lot more rigorous.

10 MEMBER MARCH-LEUBA: Thanks, Tony.

11 CHAIR KIRCHNER: Other comments?

12 MEMBER BROWN: I'm not sure. I'm kind of
13 responding to an email that Joy sent me, and I think
14 you brought it up a minute ago, but I didn't realize
15 something when you brought it up. You were talking
16 about the RPV riser level sensor, the issue on the
17 sensors.

18 And you made, and it triggers SFAS
19 functions. And so your last sentence said so it was
20 always just one sensor. Did you mean one sensor per
21 division, or one --

22 MEMBER REMPE: No, there's multiple ones.
23 But the, what I was trying to say was the pressurizer
24 sensor and the RPV riser, it's the same --

25 MEMBER BROWN: Well, it's containment

1 level high and RP level low --

2 MEMBER REMPE: Containment levels are
3 different --

4 MEMBER BROWN: Are triggers for actuation
5 of ECCS.

6 PARTICIPANT: No.

7 MEMBER BROWN: Well, that's what --

8 MEMBER REMPE: No, the containment-level
9 one is a different one.

10 MEMBER BROWN: I understand that.

11 CHAIR KIRCHNER: The letter is probably
12 out of date.

13 MEMBER BROWN: But the RPV riser level
14 sensor --

15 MEMBER BLEY: And pressurizer level.

16 MEMBER BROWN: And pressurizer level,
17 those both trigger, or one of them the sensors.

18 CHAIR KIRCHNER: No, no they change their
19 --

20 MEMBER BROWN: It's the same sensor.

21 CHAIR KIRCHNER: It's the same sensor.
22 It's a safety-grade sensor.

23 MEMBER BROWN: Yeah.

24 CHAIR KIRCHNER: Its functionality and the
25 applicant's here and can correct me, is just for the

1 pressure riser. They're not doing the riser --

2 MEMBER BROWN: They're not doing the riser
3 level anymore for ECCS.

4 CHAIR KIRCHNER: Level, the trigger. No.

5 MEMBER BROWN: It's only the containment
6 level? Okay, I missed that, I wanted to clarify that.
7 That's, but there are -- is the containment level, I
8 didn't read far enough, is that one also a radar-
9 based?

10 MEMBER MARCH-LEUBA: Yes.

11 MEMBER BROWN: Okay, so that runs into,
12 it's not quite as bad as the, I don't think, I'm not
13 sure. Well, you're not as bubbly on the containment
14 level as you are on the pressurizer, I would think.

15 MEMBER REMPE: The pressurizer and the RPV
16 --

17 MEMBER BROWN: No, you're overflowing now.
18 So I mean, there's a, and you're cooling to the pool.
19 So I mean, it's going to be a slightly different
20 environment by the time it rises up some.

21 MEMBER REMPE: So at the beginning of this
22 session, the applicant discussed a little bit about
23 the various sensors, and I pointed out that tomorrow
24 we're going to have Chapter 20 and we're going to talk
25 about the changes made to Chapter 20.

1 But the staff is going to come and also
2 talk about some of the questions raised about the RPV
3 riser and the pressurizer water level sensor. So
4 we'll have time to read over this Rev 2, and we can
5 have any questions we want to have by tomorrow.

6 MEMBER BROWN: I'm going to read Rev 2
7 tonight.

8 MEMBER REMPE: Only 70 pages, you can make
9 it Charlie.

10 MEMBER BROWN: Yeah, right, in your
11 dreams, Joy, okay.

12 MEMBER REMPE: But anyway, well, if you
13 want to you can read through it and ask any questions.

14 MEMBER BROWN: I'll sit down and I'll stay
15 up till four in the morning to do it.

16 CHAIR KIRCHNER: Okay, we're off the PRA,
17 but yes, tomorrow we will hear more on sensors.

18 MEMBER BROWN: Yeah, that's fine.

19 CHAIR KIRCHNER: So last chance, any other
20 comments of the staff, questions?

21 DR. SCHULTZ: Just one more on the --
22 excuse me, just one more on the PRA side, just a
23 follow-on here. We were talking about how you would
24 capture things going forward for the advanced plants.
25 And the other thing that you might want to try to

1 focus on is for this plant, which as we've seen from
2 the presentations and so forth, the numbers associated
3 with core melt frequency and large early release are
4 very, very low.

5 And so, and yet we have in the licensing
6 stage the COL activities, the COL PRA. And then four
7 years later, the revised PRA. So how, the question is
8 how do you keep appropriate attention and focus for
9 those teams that are going to be working on those
10 things many years hence?

11 And the influence of what they're going to
12 have in terms of findings may be somewhat lower than
13 what we've seen from, in other areas. Or they may
14 need to be looking at things which are not typically
15 looked at today, specifically human performance,
16 errors of commission, and the importance of those
17 influencing the safety of the facility. And how does
18 that get captured and pushed by the regulator going
19 forward, and by the licensee, of course?

20 MR. NAKANISHI: Right, I mean, that's a
21 great question. I think it kind of comes down to
22 ensuring sort of the bench strength, if you will, of
23 the staff. I think, you know, when the staff will
24 look at the PRA, that's typically when there's an
25 application of that PRA for some use.

1 So it may be, you know, maintenance rule,
2 for example, down the line that as part of an
3 inspection for maintenance rule implementation there
4 will be some staff engagement relative to the risk
5 assessment.

6 DR. SCHULTZ: Yeah, those are good
7 questions.

8 MR. NAKANISHI: Right. And I would expect
9 that there would be additional risk-informed
10 applications, you know, for the NuScale design by the
11 COLs. So each of those opportunities I think would
12 provide a chance for the staff to engage.

13 MS. POHIDA: Yeah, I was going to add if
14 the PRA is going to be used for a risk-informed
15 application, then the staff would have to do a PRA
16 acceptability review in context of that application.

17 DR. SCHULTZ: Thank you.

18 MS. POHIDA: You're welcome.

19 CHAIR KIRCHNER: Okay, we are in an open
20 session, so therefore, I'm going to turn to the
21 public.

22 MR. SNODDERLY: I'm sorry, well, before we
23 do that, I just, I had some notes and I wanted to make
24 sure, well first of all, what was the Committee's --
25 the Subcommittee's expectations for a possible staff

1 presentation on PRA at the full committee on April 8?
2 That's, well, so --

3 CHAIR KIRCHNER: Yeah, we're writing a
4 letter.

5 MEMBER MARCH-LEUBA: If we are writing a
6 letter, our process has been lately the staff will
7 need to give us, for the public on the phone line or
8 whoever wants to show up, a summary presentation of
9 what we've done. And it has to be 20 minutes, I mean,
10 high level and non-proprietary so that the public
11 finds out what your position is. And then we're going
12 to write a letter.

13 MEMBER DIMITRIJEVIC: Or you can just tell
14 us what are the changes in the SERs since the last
15 version.

16 MR. SNODDERLY: Well, I also had a note
17 that they were also, they said that they were going to
18 consider possible mechanisms for documenting some of
19 the insights they've gained in part of the PRA.

20 MEMBER DIMITRIJEVIC: What's the status of
21 this containment bypass, the day, on the 19.2?

22 CHAIR KIRCHNER: We're going to hear about
23 that tomorrow. I was going to share our agenda for
24 tomorrow before we close.

25 MR. SNODDERLY: And then the only other

1 note I had was that the staff said that they went back
2 and forth with the applicant as far as the CVCS being
3 included in a DRAP, but it ultimately they agreed that
4 it did not meet the criteria from DRAP.

5 And then I had, Vesna said that you also
6 agreed that it looked like it didn't meet the Fussell-
7 Vesely imports measures of 20%, but it was close. You
8 mentioned several sequences that were seven percent,
9 four percent contributors for several sequences. But
10 you didn't think it exceeded 20%. But you were
11 surprised that the sensitivity analysis, it didn't
12 exceed 20%.

13 MEMBER DIMITRIJEVIC: Yeah, I would like
14 to know the Fussell-Vesely on that, yes.

15 MR. SNODDERLY: And I didn't hear anyone
16 from the staff or NuScale say that they were going to
17 come back do that critical --

18 MEMBER DIMITRIJEVIC: Only NuScale can
19 give us that.

20 MR. SNODDERLY: Right, only NuScale can do
21 that. So I'm just trying to get, so right now I leave
22 it as an open item for NuScale to consider whether
23 they're going to come back and answer that on April 8
24 or not.

25 MEMBER DIMITRIJEVIC: They can send us

1 the, these are just two numbers we are asking,
2 Fussell-Vesely on human action to start charging with
3 the current model and with this change in ECCS failure
4 rate. That's all.

5 DR. CORRADINI: Careful, we're crossing
6 closed to open, so make sure what we're talking about.

7 MEMBER DIMITRIJEVIC: That's all right, it
8 should be open, it's a PRA.

9 MR. SNODDERLY: Then --

10 MEMBER DIMITRIJEVIC: No, no, it's a PRA
11 --

12 MR. SNODDERLY: The last thing I had was
13 that how could operator action to initiate CVCS be an
14 important action, but the CVCS system not be. And I
15 didn't know if you wanted any followup by the staff or
16 NuScale to respond to that further or, okay.

17 So that's all I had. With that I'll go.

18 CHAIR KIRCHNER: Thank you, Mike. Okay,
19 so now I'll turn to the public, if there's any member
20 of the public in the audience, if you would wish to
21 make a comment, please come up to a microphone, state
22 your name, and make your comment.

23 Seeing none, we'll wait for the bridge
24 line to be opened to the public. Okay, if there's any
25 member of the public listening in, if you wish to make

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1 a comment, please state your name and make your
2 comment.

3 MR. LEWIS: Marvin I. Lewis. Can you hear
4 me?

5 CHAIR KIRCHNER: Yes, Marv, go ahead.

6 MR. LEWIS: Thank you. I've been
7 following these public meetings for an awful long
8 time. I have even been following back to '79,
9 wondering have you ever tried to get tags under
10 control so they don't block the view of operators,
11 which was the causation, supposedly, of Three Mile
12 Island Number Two accident.

13 Also, as I go along I don't hear any
14 really approaching looking at problems from day to
15 day. I don't hear anybody looking at, just looking at
16 the surface of anything to see if there's good
17 workmanship. I don't hear, I don't hear an awful lot,
18 and I'm done with it. Thank you very much for
19 listening to my comment, bye.

20 CHAIR KIRCHNER: Thank you, Marv. Is
21 there any other member of the public who wishes to
22 make a comment?

23 MS. FIELDS: Yes, this is Sarah Fields.
24 My first comment is the only prospective NuScale COL
25 applicant is the Utah Associated Municipal Power

1 Systems, or UAMPS. UAMPS has no experience whatsoever
2 in nuclear reactors. I'm sure they'll be getting some
3 help, but in the end they will be the responsible
4 party, and they do not have any nuclear reactor
5 licensing, construction, operation, decommissioning
6 experience.

7 My second comment is when the ACRS looks
8 at the NuScale standard design approval application,
9 which will be based this DCA, which is currently under
10 review, the ACRS should take a hard look at the multi-
11 module aspects of the design. From today's discussion
12 it's clear that there may be aspects related to the
13 multi-module construction operation that have not been
14 addressed by NuScale and the NRC staff.

15 The ACRS should go back and bring up
16 issues that have not been satisfactorily addressed in
17 the DCA review, including PRA and other
18 considerations. Thank you.

19 CHAIR KIRCHNER: Thank you. Is there any
20 other member of the public who wishes to make a
21 comment? Hearing none, we'll close the bridge line.
22 And at this point, any comments, further comments from
23 members, question?

24 So if not, I think tomorrow, I'm, I've
25 talked with both the applicant and the staff. I think

1 we will probably finish in the morning, by lunchtime.
2 So that's the plan going in. We'll keep some
3 contingency, but that's my estimate at this point of
4 the material to cover tomorrow. So we may have the
5 afternoon free to do other work on committee business.

6 With that, we are recessed for the day.

7 (Whereupon, the above-entitled matter went
8 off the record at 4:07 p.m.)
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Probabilistic Risk Assessment

NuScale Design Certification Application

ACRS Subcommittee Meeting
March 3, 2020

Topics

- DC PRA uses and review
- ECCS model
- Sensitivity and uncertainty analyses
- Reactor building crane operations

DC PRA Uses

- Identify and address potential design features and plant operational vulnerabilities
- For new design, reduce or eliminate significant risk contributors identified at operating plants
- Identify risk-informed safety insights based on systematic evaluations of the risk
- Determine how risk compares against Commission's goals of less than 1×10^{-4} per year for CDF and less than 1×10^{-6} per year for LRF
- Demonstrate whether design represents a reduction in risk compared to operating plants
- Use results and insights to support programs such as RTNSS, ITAAC, RAP, TS, COL action items, and interface requirements

Availability of Information at Various Licensing Stages

Information Availability	<u>Licensing Stage</u>		
	DC Applications 52.47(27) COL Applications 52.79(46)	COL Holders 50.71(h)(1) “fuel load PRA”	COL Holders 50.71(h)(2) 1st four-year update
• Site-specific information	Unknown for DCs	Known	Known
• Layout, cable routing, equipment capacities	Not fully known	Known	Known
• Plant-specific operating guidance	None	Available	Available
• Plant operating experience	None	None	Available
• Trainers or operations staff with plant-specific experience	None	None	Available
• Walkdowns	Not possible	Possible	Possible
PRA acceptability guidance	<ul style="list-style-type: none"> RG 1.200, as modified by DC/COL-ISG-028 	<ul style="list-style-type: none"> RG 1.200 Portions of DC/COL-ISG-028 are still relevant 	<ul style="list-style-type: none"> RG 1.200 DC/COL-ISG-028 not applicable

NuScale DC PRA Review

- PRA acceptability is to be commensurate with its intended use
- Staff findings are made to support Commission's objectives for use of PRA in design; findings are not made on specific numerical results
- PRA acceptability is sufficient to support PRA uses for design certification
- Established regulatory framework will ensure PRA reflects as-built, as-operated plant for operational phases
- Staff applied Enhanced Safety Focused Review Approach during its PRA review to focus on information needed to reach a safety finding

ECCS Model

- Modeling is adequate for DC purposes
 - Model is sufficiently consistent with DC/COL-ISG-028 and SRP 19.0
- Assumptions are used to address issues associated with level of detail, completeness, and data
- System/component reliability data is uncertain due to unavailability of design-specific operating experiences
- Staff evaluated assumptions for impact on safety findings made for the DCA and found them acceptable

Sensitivity and Uncertainty Analyses

- Sensitivity and uncertainty analyses have been performed to support regulatory findings
- NuScale identified important SSCs, operator actions, and risk insights to support programs such as DRAP and human factors engineering
- Focused PRA showed Commission goals met without credit for SSCs that are not safety-related
- Additional analyses are not expected to alter risk insights or inputs to operational programs expected at DC stage

Reactor Building Crane Operations (1)

- Calculated drop probability dominated by:
Operator errors (over speed, over raise, etc.)
AND
Failure of instrumentation (interlocks/switches) for safety stop
- Key Assumptions for the LPSD PRA added to DCA Table 19.1-71
 1. Movement of the RBC is modeled as being operator controlled
 2. Administrative controls will ensure that RBC safety features (e.g., limit switches, interlocks to prevent undesired movement) are functional during module movement
- Validity of RBC assumptions in DCA and crane data supporting the PRA will be confirmed by COL applicant per COL item 19.1-8

Reactor Building Crane Operations (2)

- DCA Table 9.1.5-1 documents max. speeds and lift heights
- RBC is single failure proof, consistent with operating plants
- COL applicant will describe process for handling and receipt of critical loads including NuScale Power Modules per COL Item 9.1-5
- RBC is within scope of human factors process during COL per “Human Factors Engineering Design Implementation Plan” (Report RP-0914-8544)
- Risk significance of RBC resulted in additional ITAACs
 - Rated load test of module lifting fixture and module lifting adapter
 - Inspection of as-built module lifting fixture and module lifting adapter
- Postulated single module drop does not lead to a large release

Abbreviations

- **ASME** – American Society of Mechanical Engineers
- **CDF** – core damage frequency
- **CIV** – containment isolation valve
- **COL** – combined license
- **CVCS** – chemical and volume control system
- **DC** – design certification
- **DCA** – design certification application
- **DHRS** – decay heat removal system
- **DRAP** – Design Reliability Assurance Program
- **ECCS** – emergency core cooling system
- **EPZ** – emergency planning zone
- **ITAAC** – Inspection, Test, Analysis, and Acceptance Criteria
- **ISG** – Interim Staff Guidance
- **LPSD** – low power and shutdown
- **LRF** – large release frequency
- **PRA** – probabilistic risk assessment
- **RAP** – Reliability Assurance Program
- **RBC** – reactor building crane
- **RG** – Regulatory Guide
- **RSV** – reactor safety valve
- **SER** – safety evaluation report
- **SRP** – standard review plan
- **TS** – Technical Specification