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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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NUSCALE SUBCOMMITTEE

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OPEN SESSION

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TUESDAY

MARCH 16, 2021

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The Subcommittee met via Videoconference, at 9:30 a.m. EDT, Walter Kirchner, Chairman, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chairman

RONALD G. BALLINGER, Member

DENNIS BLEY, Member

CHARLES H. BROWN, JR. Member

VESNA B. DIMITRIJEVIC, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

JOY L. REMPE, Member

PETER RICCARDELLA, Member

MATTHEW W. SUNSERI, Member

ACRS CONSULTANT:

MICHAEL CORRADINI

STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

MIKE SNODDERLY

ALSO PRESENT:

DOUG BOWMAN, NuScale

MARK CHITTY, NuSCale

AMY D'AGOSTINO, RES

DAVE DESAULNIERS, NRR

SARAH FIELDS, Public Participant

KAYLA GAMIN, OGC

BRIAN GREEN, NRR

NADJA JOERGENSEN, NuScale

PATRICK LEARY, NuScale

CHRIS MILLER, NRR

SCOTT MOORE, Executive Director, ACRS

LAUREN NIST, NRR

JIM OSBORN, NuScale

MAURIN SCHEETZ, NRR

GREG SUBER, NRR

GETACHEW TESFAYE, NRR

TIM TOVAR, NuScale

JING XING, RES

P R O C E E D I N G S

9:30 a.m.

CHAIR KIRCHNER: This is Walt Kirchner and I think we're ready to start. With that, the meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, NuScale Subcommittee.

I am Walter Kirchner, Chairman of the NuScale Subcommittee. I am joined by my colleague, Dennis Bley, Chairman of the Future Plant Design Subcommittee.

I will now do a roll call of members in attendance. Ron Ballinger?

MEMBER BALLINGER: Here.

CHAIR KIRCHNER: Dennis Bley?

MEMBER BLEY: I'm here, Walt.

CHAIR KIRCHNER: Charles Brown?

MEMBER BROWN: I'm here, Walt.

CHAIR KIRCHNER: Vesna Dimitrijevic?

MEMBER DIMITRIJEVIC: Here.

CHAIR KIRCHNER: Jose March-Leuba?

MEMBER MARCH-LEUBA: Here.

CHAIR KIRCHNER: David Petti?

MEMBER PETTI: Here.

CHAIR KIRCHNER: Joy Rempe?

MEMBER REMPE: Here.

CHAIR KIRCHNER: Pete Ricardella? And Matt Sunseri?

MEMBER SUNSERI: Good morning, Walt, I'm here.

CHAIR KIRCHNER: Great, I think we have a quorum then. Mike Snodderly is the designated federal official for this meeting.

The Subcommittee will review the Staff's evaluation of NuScale topical report, TR-042069456, NuScale control room staffing plan. Today we have members of the NRC Staff to brief the Subcommittee.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. The NRC implements FACA in accordance with its regulations, found at Title 10 of the Code of Regulations, Part 7.

The Committee can only speak to its published letter reports. We hold meetings to gather information and perform preparatory work that will support our deliberations at a full Committee meeting.

The rules for participation in all ACRS meetings were announced in the Federal Register on June 19, 2019. The ACRS section of the U.S. NRC public website provides our charter, bylaws, agendas.

I think someone has their -- yes, if you would, please, everyone, mute your mic. We're getting some feedback. Thank you.

Let me pick up where I left off. The ACRS section of the U.S. NRC public website provides our charter, bylaws, agendas, letter reports, and full transcripts of all full and Subcommittee meetings, including slides presented there.

The agenda for this meeting was posted there. Portions of this meeting can be closed as needed to protect proprietary information pursuant to 5 U.S.C. 552(b)(c)(4).

As stated in the Federal Register notice and in the public meeting notice posted to the website, members of the public who desire to provide written or oral input to the Subcommittee should do so and should contact the designated federal official five days prior to the meeting as practicable.

We have also set aside 15 minutes for comments from members of the public attending or listening to our meetings. We have not received written comments or requests for a time to make oral statements by members of the public regarding today's meeting.

A transcript of the meeting is being kept

and will be made available on the ACRS section of the U.S. NRC public website.

It is requested that speakers identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

Additionally, participants should mute themselves when not speaking. A telephone bridge line has been established for the public to listen to the meeting. To minimize disturbances, the public line will be kept in the listen-in-only mode.

I know the Committee had the benefit of a July 2019 visit to NuScale's facilities in Corvalis, Oregon, and the opportunity to observe proposed control room displays and functionality with some sample demonstrations.

We thank NuScale for that visit.

In particular, today there's an interest in further exploring the upgrades in man-machine interfaces, qualifications, and task analyses that support the reduction in control room staffing from six of the recent design certification applications to three proposed in the NuScale TR, as well as qualifications that enable the combination of senior operator and shift technical advisor functions into one dual role position.

I've asked Dennis, my Co-Chair, if he had any comments. He declined, so with that --

MEMBER BLEY: Can I say mine?

CHAIR KIRCHNER: Okay, Dennis, go ahead, I'm sorry.

MEMBER BLEY: That was last night. I'll just start on this a little bit and will say a few words. When we first got the topical report and read it, it's very clean, it's a tight topic.

I started thinking about this and delving into the history. The STA I think was the part that got us concerned and very interested. And the topic, it sounds like, made a decision about the STA had come through very quickly and the lessons learned reports from TMI.

In fact, it took many years before the policy was written. There were a number of investigative reports and a number of NUREGs that were published. ACRS wrote more than 15 letters in summary related to this.

And to me, those were very interesting because there were a great many added comments by the numbers but no solid agreement really across all the numbers at the time.

Assuming we need to look at it today and

we'll be interested in the presentations from the Applicant and from the Staff. Because we're breaking a couple of traditions here that may be well justified.

The STA for most people see just a quick add-in to get some engineering expertise in the control rooms. And really for the first five to eight years, those had not much experience with the nuclear power system.

So, the idea was to have that expertise and somebody who really was in these systems. And part of the idea was to have an independent person looking over what's going on.

If one reads the reports of accidents not just in nuclear but in other fields, having that independent third look often can make a difference. And I saw that sort of thing in 1980 for quite a few years.

So, although the policy has been there since the STA wasn't necessary and maybe we should integrate these things, the fact has been to keep it, although it doesn't always stay an independent operation.

And my concern is losing that independence may cause us a problem at some time in the future. We

have a new design that looks very good, it looks like the human-machine interface is very good and the things we need to do are pretty straightforward.

But we have no experience and jump into those with no experience is a concern. So, we'll be real interested in tearing the depth of why the Applicant and the Staff have come to the conclusions they've reached.

Thanks for the chance, Walt, go ahead.

CHAIR KIRCHNER: Thank you, Dennis, I echo your thoughts as well. So, with that, we'll now proceed with the meeting and I'll call upon Doug Bowman of NuScale to begin today's presentations.

Do I have that right, is it Doug up first?

MR. BOWMAN: Actually, Jim Osborne is going to do it.

CHAIR KIRCHNER: Jim Osborne, sorry, my apologies, Jim.

MR. OSBORN: No problem, good morning. Can you guys hear me?

CHAIR KIRCHNER: Yes.

MR. OSBORN: Okay, good. So, good morning, this is Jim Osborne, I'm with NuScale licensing.

We appreciate this opportunity and I'm

here to present to the ACRS an overview of the control room staffing report and provide a summary of the report and how the applicable regulations and guidance has been addressed.

So, next slide. So, the presenters are listed here. Like I said, my name is Jim Osborne, you'll hear from Doug and we also have a couple of other people standing by if needed.

Next slide. So, this slide provides the agenda that we'll be using. We'll start out by outlining the regulatory requirements that relate to this topical report and then we'll provide the purpose of the report and give an overview summary of the topical report.

Then we'll provide an overview of how we performed the control room staffing evaluation for the design certification application, which consisted of a minimum of six licensed operators.

And then we'll describe how we revise that with the revised control room staffing, which again, we mentioned consisted of a minimum of three license operators.

And then we'll describe the analysis we performed to be able to sunset the separate shift technical advisor position. And then we'll have time

for some questions.

So, if there's no questions at this point, I will turn it over Doug Bowman. Doug?

MR. BOWMAN: Good morning, everybody. My name is Doug Bowman, I'm the Plant Operations Supervisor at NuScale Power.

Just a little bit of my history in industry, prior to coming to NuScale almost seven years ago I had spent 24 years in the nuclear commercial side.

I was SRO-licensed at both Byron and D.C. Cook and I started out in the industry as an engineer. So, I have been an STA a couple of times over now, just so we all understand where I'm coming from.

So, we'll walk through this real quick, regulatory requirements and guidance. We list three up here and the first one's a very important piece, really the backbone of our staffing plan and validation methodology.

That's NUREG-0800 Chapter 18 and in Chapter 18, which is the human factors engineering chapter, there is an Appendix B which was added in the last revision. We'll refer to the same report in a different format in a little bit.

But this is the pertinent piece. Appendix

Bravo is the accepted criteria for workload evaluation. This is out of Chapter 18 Table 1 in the acceptance criteria sources.

So, it provides a methodology to identify high workload, operational conditions, and analyze the associated workload. This methodology is rooted in past analysis and revises the identification of appropriate challenging scenarios.

We will talk about that in the closed session, about how we did that work. Realistic for trails of CATs performance, that's separate but often necessary and it includes both dependent and independent tasks.

So, realize that all the people who were involved in developing and running these scenarios were generally former training instructors and had experience running scenarios at commercial sites.

So, we spent a lot of work and time doing a lot of realistic portrayals. The third piece of this is we utilized the judgment of subject-matter experts to build this realistic workload estimation.

So, that's Chapter 18, NUREG-0800, Appendix B.

Other regulatory requirements --

MEMBER BROWN: Can I ask a question?

MR. BOWMAN: Go right ahead.

MEMBER BROWN: You said you used Staff and subject-matter experts to build these did you say scenarios? I'm trying to figure it out. What did they contribute?

MR. BOWMAN: They contribute a number of different areas. They would have performed the task analysis initially for human factors engineering.

We also use them to assemble the scenarios and build, essentially, a realistic portrayal of what goes on in the control room.

We've built in distractions, we had phone calls to the control room.

MEMBER BROWN: I understand that out of the specifics out of the topical report. But what's their background as being subject-matter experts? Were they operators for 25 or 30 years each?

MR. BOWMAN: Yes, I'm very much an example of the people who did the work for this. I think almost everybody -- even out of the group, there was often human factors engineers but the bulk of our work was done by former licensed operators.

So, somebody like me is very much an example of the kind of people that did this work.

MEMBER BROWN: Okay, I asked that question

just to let you know I don't want you or the rest of the presenters -- I am Charlie Brown, I was in the nuclear program for 35 years.

I read the TMI reports so I can relate to what Dennis was talking about, including the notes he presented to us also. But the fundamental focus of all of our training and our approach to plant operations was that the operators are the first line of defense.

That was just a mindset. Rick, I could use other words about what he beat out of us but every section, every engineer was constantly emphasized with that point, that the operators are the first line of defense.

I can attest to that because I incorporated the first computer-based systems with advanced graphic displays into the 688s, into the minutes class, to the sea wolf, the initial stages of the Virginia Class submarines and how they were utilized.

We actually had an experience on one, I won't tell you which one it was, where if it hadn't been for the training of the operators, we could have had a disaster on our hands.

Fortunately, we didn't rely on the

implementation in the displays, all the displays.

So, I just wanted to give you a heads-up that my background makes me somewhat of a sceptic. But I didn't want to sit here being like a rattle snake lurking in the desert, but just give you a heads-up that I'll be listening very carefully.

I read the report cover to cover and it's a very good report. I don't question the approach, the techniques, and all the stuff you did.

It's just that my background as being the operator of the main line of defense for all these nuclear power-plants, they are inherently dangerous from some standpoints.

They can get away from you no matter how safe you make them, no matter what type of displays you provide.

So, that's why I asked the question about the background of the people doing the test analysis themselves. But there is at least one sceptic sitting here on the Committee, just to be honest.

MEMBER BALLINGER: This is Ron Ballinger. I am also another snake in the grass by the way, but I'll wait to spring later on.

MEMBER BROWN: I should have opened up with that. My mind was thinking that I didn't go fast

enough so I apologize for interrupting you.

(Simultaneous speaking.)

MR. TOVAR: This is Tim Tovar, the Director of Plant Operations at NuScale Power. That's one thing that we're actually very proud of, is our ops experience within the Human Factors Engineering Program.

So, if you'd like examples of some of the experience we have, I can provide that.

MEMBER BROWN: No, I'm listening. I have a somewhat open mind but 3 operators for 12 plants, I worry that we've lost common sense.

And I'm not criticizing anybody because I think the analysis is valuable to go through and look at this. But I think you have to apply, in my personal opinion, you have to put some common sense into this and I worry that we've lost a little bit of the common sense.

And some notes that Dennis provided reminded me of some of those thought processes as well. So, I'll bring those up later and I'm sure Dennis will as well. So, I don't want to steal his thunder.

So, thank you very much, I appreciate the offer.

CHAIR KIRCHNER: Thank you, Charlie. I guess I should point out that we have several former operators amongst our Committee. I should have done that in my opening comments.

Let's turn it back to Doug.

MR. BOWMAN: All right, we'll continue on. Thanks for the comments and the warnings. So, 10 C.F.R. 5054(m) is our next regulation. This is the license operator staffing requirements in the Code of Federal Regulations.

We recognize that 10 C.F.R. 5054(m) does not address a design with more than three units on a site or more than two units operating from a single control room.

So, these regulations would not apply to our Commission where we have up to 12 units operated from a single control room. So, what we're doing is providing an alternative to that rule.

And then 10 C.F.R. 50.120(b)(2)(iii), this is the Code of Federal Regulations that requires the training program for the STAs to be established.

So, in light of the fact that we are requesting some citing of the STA position, we are going to exempt ourselves from that rule for the NuScale design.

All right, we'll continue. So, topical report purpose, and I'm going to go over a real quick big-picture view of what the topical report does. So, I just described to you three regulations that are applicable to our concern.

This topical report takes the guidance of NUREG-0800 Appendix B and uses it to validate a safe alternative staffing plan to 10 C.F.R. 5054(m) and thirdly, provides a justification for why we want to sunset the shift technical advisor and especially in the Code of Federal Regulations, its training program in 10 C.F.R. 50.120.

So, this topical report will be used by a future license Applicant referring to our design to develop an alternative minimum control room staffing requirement.

We would intend that a future license Applicant request and exemption from 10 C.F.R. 5054(m) or other alternative staffing regulations, in this case, the design certification rule for NuScale.

And 10 C.F.R. 50.120 so that we do not need that developer training program for the STA. This topical report would also inform the technical specifications for that licensee so that they could in their section describe the minimum staffing.

And we'll talk about what that section will look like in Tech Specs in a moment.

CHAIR KIRCHNER: Doug, this is Walt Kirchner. You just said the 3R to the STA.

I'm assuming that through the course of today's presentations, you'll make us aware of the requirements from that 10 C.F.R. 50.120 section, how you incorporated that in the training programs for your operators so that you can subsume or create that dual role in the staffing plan?

MR. BOWMAN: Yes, I will go briefly over it in the open session and we have a detailed section on exactly how all the task analysis fits together in the closed session.

So, we'll talk about that in relative detail.

CHAIR KIRCHNER: Thank you.

MEMBER BLEY: Dennis Bley. This is kind of an off-the-wall question but I'm just thinking about it.

Although, they don't get involved in the licensing, INPO does look over very closely operating plants. Has there been any involvement from INPO in your development of this approach to operations?

MR. BOWMAN: We've certainly had

discussions with INPO on various topics. Whether we've specifically broached this topic with them or not, I probably can't really answer that question cleanly right now.

I would say we've discussed it with them and are aware of what we're doing. So, that probably about as far as I can go right now.

MEMBER BLEY: That doesn't surprise me but I'm a little curious. It would be very interesting to know what they think of this but go ahead.

MR. TOVAR: Doug, I think Pat can correct me if I'm wrong. This is Tim Tover again.

I think it was November of 2020 that we had INPO visit and we provided them a tour of the simulator and discussion of our concept of operations. And we did talk about reduced staffing but they have not been involved in any of the details of how we came about to the revised staffing.

MEMBER BLEY: Okay, thanks, and I'm just thinking out loud here. I'm just wondering if the first owner, when they take their operating playground, would be reviewed by those folks that they had a problem with.

But that's not our concern here so go ahead.

MR. BOWMAN: Okay, thank you. All right, topical report timing, why did we do the topical report when we did? This topical report was obviously done to support the standard design approval, which will be submitted later.

But really, our number-one concern, there's a number of them but really, our biggest concern was ensuring that we were able to utilize the same NRC Staff that has been through both the original Staffing Plan Validation and integrated system validation.

So, that Staff is very familiar with our design, with our control room design. They've been out many times to Corvalis and have seen our simulator in active use by participants.

So, that was really a big piece was we wanted to ensure we had the same Staff available to review.

Also because it wasn't to be submitted until later and we had already performed the revised Staffing Plan Validation, it seemed prudent to go ahead and submit this topical report for review, which could be incorporated by reference into the STA.

And also importantly, because there is no certification rule for the shift, I'm sorry for the

standard design approval, we needed a different vehicle to provide a path from an exemption request for an Applicant using the standard design approval in the future.

And this topical report will be part of that taskforce.

MEMBER REMPE: Excuse me? This is Joy, could I ask a question?

MR. BOWMAN: Sure.

MEMBER REMPE: I am curious about the status of the simulator compared to the current plant design or future SDA designs.

When ACRS last visited your simulator, we saw for the scenario we were watching a containment water level showing up that would not be available to the operators.

Because I guess when I asked about that I was told, yes, this is from an older plant design and the way the instrumentation is currently configured, you might have a RELAP analysis and, yes, you might predict the water level and the RELAP code is showing that this water level existed in the containment.

But that's not what the operators would see because it's kind of a blind area for a while before they get a reading.

So, I guess I'm curious about, one, has the simulator been updated, two, the current plant design, are you showing in the simulator what the operators would see versus what a code would predict?

And I note that something that's not unique to NuScale's design, because recently a lot of the codes like MELCOR and MAPP were putting in water level sensors for PWR evaluations because they realized there's a significant difference due to decalibration that occurs during an event.

So, I'm kind of wondering are you going to be trying to show how that instrumentation might vary because of the conditions during some of these scenarios?

Does my question make enough sense or do I need to elaborate what I'm trying to ask here?

MR. BOWMAN: No, I understand your question. The way we answer this question is we obviously ran on an essentially relatively current version of the simulator based on the D.C.A design.

What we've done in the topical report is created a section called Conditions of Applicability, which describe essential design features of a future plant that would allow them to utilize this topical report.

So, the way we address that design change issue is to create conditions of applicability that allow a future licensee to evaluate their ability to utilize this topical report.

MEMBER REMPE: Again, the Staff, based on their conclusions based on what they saw at the simulator and what I'm trying to get to is what did they see at the simulator?

Was it showing what the RELAP code or whatever codes you're using would predict as the plant's state?

Or were you showing what the instrumentation that you currently envision for the plant would give cues to the operator? There's a difference.

And have you updated your simulator to show what's available to the operator?

MR. BOWMAN: So, again, we're utilizing a relatively current -- at the time, it was 2019 when we did the revised Staffing Plan Validation test. That design, it reflected the design certification design that we had discussed.

What an SDA design will look like, we still don't know because that design work is not complete yet.

So, what we've done in lieu of that is create a set of conditions of applicability and we'll describe those conditions of applicability in this presentation about how we would take this topical report and see if it was still applicable to a future design.

MEMBER REMPE: So, if you do a power upgrade, you will update it to reflect that? But I'm not hearing you say, yes, we went back and thought about that we're using what a code predicts.

And so we're seeing water levels that would give the operators confidence that the water level in the containment is increasing even though the sensors would just kind of have a blind area.

They wouldn't know for a while. Do you understand what I'm saying?

MR. BOWMAN: I do.

MEMBER REMPE: And are you taking that into account now with your solar? Because you weren't when we visited.

MR. BOWMAN: So, another way I'll try to answer that is we didn't utilize ANSI-35 but ANSI-35, we certainly reflect ANSI-35. So, ANSI-35 is intended to ensure that the simulator reflects what an operator will see in the plant.

Now, there's no plant reference because we don't currently have a plant but we have done our best job of trying to reflect what the design would show.

Of course, there's always deviations from that design simulator depending on where the design's moved to and whether the simulator has been updated or not. And we manage and list out those deviations the simulator has from the design at the time whenever we ran the test.

So, we really manage in light of how an ANSI-35 simulator would be managed. So, it's intended to be real to the operator and what they would see in the control room.

MEMBER REMPE: Okay, thank you.

MR. BOWMAN: All right, I'm done with that slide. So, contents of the topical report, regulatory acceptance criteria and requirements, one aspect of this, and we've gone over some of that already.

Conditions of applicability, we just discussed those. Input to our staffing plan from the Human Factors Engineering Program, primarily in the area of task analysis and staffing and qualification analysis.

Later on I had a slide that we'll talk about, really the key reference document in this

report. We provided an analysis of a shift technical advisor position.

There are some additional staffing considerations including Reg Guide 1.114, which describes the operator controls and also the senior reactor operator oversight of refueling.

To just go ahead and say that, we provide a separate senior reactor operator to provide oversight of refueling activities.

MEMBER BLEY: Doug?

MR. BOWMAN: Yes.

MEMBER BLEY: Go ahead, I'll come back to this.

MR. BOWMAN: And then we described the Staffing Plan Validation Trials and also the revised Staffing Validation Trials.

MEMBER BLEY: Well, I was going to ask you and I will now. You gave us an overview of the depth of the operating experience you had on your team, developing or sort of doing the testing.

And those of us with some operating background I suspect that appreciated that you had a number of operators.

Can you talk some about the integration of the operations experience with the human factors

engineering experience you had on your team and how that interplay worked?

MR. BOWMAN: I think I understand what you're asking. So, I guess the best way to describe this is we felt that a bit of a different approach was necessary. Obviously, my background personally was not human factors engineering.

I've learned a great deal about it through this process. But my background is regular engineering and a large amount of times spent operations.

We felt that it was important to ensure that the overall Human Factors Engineering Program was led by people with experience in plant operations. In a plant, we talk about being led by operations and we believe the same thing was necessary for this effort.

That being said, we still relied heavily on the experience of our human factors engineers in developing the staffing plan and in all the human factors engineering work we did.

But it was truly led and the bulk of the work was performed by experienced plant operators, previously licensed operators.

That was really what the bulk of the work was done by, with human factors engineering being a

consultant and providing and independent review of those efforts.

Often, human factors engineers are put in a position, for lack of a better term, being devil's advocate and saying, yes, I understand that's what you're used to doing but there's probably a better way to accomplish that.

So, I think that's what you're after, is how did that all work together? And it worked together with Ops leading the way and human factors engineering being a resource in helping out in doing that work.

Does that answer your question?

MEMBER BLEY: Pretty well, just be a little more specific.

You have to have that operations experience otherwise you come up with things that, from a practical point of view, just don't make sense.

On the other hand, those of us with operating experience suffered from a number of biases in recency and what we've seen with our own eyes is a big piece of that and none of us have seen the breadth of things we're trying to protect against.

And that, I think, is one of the places the human factors engineers come in because they are

saying those kinds of biases will help the operations folks get beyond them.

I was hoping to hear a little bit about something like that.

MR. BOWMAN: Okay, so, I'll give you an example and this actually happened a little before my time but I understand how we arrived at this position.

So, originally, for example, we proposed a Staff of six personnel, right, three SROs and three ROs. And an operator's thought process would be, oh, well, each of those three reactor operators will have four units to monitor.

The human factor engineers have really kind of changed our view on that. They said why would you go about it that way?

Why wouldn't you have a single person providing oversight of 12 units and then have resources available for them to utilize to address issues?

The way we wound up with the way our concept of operations functions right now with a single person in oversight of the units and additional operators being available to assist really came out of the human factors engineering side rather than out of the plant operations side.

So, that's an example of how they certainly took what we would conventionally use and gave us what we view as very much an improved version of the concept of operations. There's an example I can provide you.

MEMBER BLEY: That's real interesting, that's a good example, thank you. I appreciate that one.

During the thermal test and during your development you must have done a lot of testing. Were you able to test these different concepts to convince yourselves of what the human factors folks recommended really does work better?

MR. BOWMAN: Yes, one of the interesting pieces is early on in the development of a simulator, we were utilizing some software that our vendor provided us, GSE, to provide the displays.

And we found it very cumbersome to change. So, our simulator engineers actually went through and built their own software package to provide a human system interface for the simulator.

That really allowed us to do rapid prototyping of various concepts. So, we were able to take for a long time the first couple of years I was here, we would sit in the room and have meetings and

talk about ideas.

So, simulator engineers would go and mock up and we'd actually test out those concepts. So, there were a number of different concepts that were built and abandoned and built and accepted and moved forward.

So, the ability to rapid prototype from the simulator engineers was are valuable to us in terms of being able to test out concepts and see what would work and what wouldn't in those early stages of doing development work, not really doing testing at that point.

MEMBER BLEY: Thanks, that's very helpful. Go ahead.

CHAIR KIRCHNER: Doug, while the slide is up, this is Walt Kirchner. On the SRO for oversight of refueling, we hadn't really in our DCA review as well as this topical report, there's not a lot of detail.

How do you envision this working? It would seem to me for rhetorical purposes 12 units functioning, you would almost be in refueling mode throughout the year so that suggests that the SRO would be available.

Did that person operate out of the control

room or so to speak in the reactor building and on the floor for the oversight of refueling?

MR. BOWMAN: We provided the additional SRO because I would never expect them to be in the control room.

I would expect that relationship to be very similar to how it works in the current industry, where you've got a refueling SRO that's out in the field wherever the most applicable location is at the time, providing oversight to activities.

So, moving a module, moving fuel, even to the point of once you're defueled and you're doing work on the upper module, they would be checking people in and out of work and making sure what's getting done and monitoring and tracking work.

So, we expect the SRO not to be in the control room, we expect the SRO to be in a place that's the best for them for the oversight of what the most critical refueling activities are at any point.

CHAIR KIRCHNER: So, those activities don't become a distraction for your crew in the control room, I'll just say this, this is going to sound kind of like not common sense but would that particular screen be blacked out so that those inputs and such are kind of de-energized or not?

Whatever's going on with moving the module and refueling it doesn't become a distraction in the control room? With the sensors or alarms, et cetera.

MR. BOWMAN: We currently show in the simulator if we had a refueling going on that actually displays that refueling in progress and that's really all they see.

So, we don't envision refueling activities coming through the control room almost at all. There are certain activities, if we had to tag out a feedwater pump, for example, that might have to come through the control room.

But we expect the bulk of the work from our refueling outage to be outside of the control room, so much so that we currently have a space in the reactor building where we have essentially an outage command center, which included for example the cleaning controls and the refueling machine controls, et cetera so that it would be separate space from the control room.

And that's actually reflected in our concept of ops. That Reactor Operator 1 position, they provide oversight for all the units under the control of the control room.

So, once we disconnect the module, that

module is under the control of the refueling SRO.

CHAIR KIRCHNER: Now, maybe this is a little too much detail, I can see that for the closed session, but to first start our review of the DCA, it looks like each module is kind of an island unto itself in terms of support systems and such.

There were a few areas, like Boron addition systems and such, where there was some commonality across systems.

The status of those particular systems, will that be apparent to the operators in the control room?

MR. BOWMAN: Yes. For example, we provide statuses on components that would show them to be tagged or in this case tagged out.

The shared systems you're discussing, for example, RIC closed cooling waters, the shared system, that obviously applies across all the units. Circ water generally shared, service water is shared as well.

So, all those items are shared systems and we would provide status on the control panel that shows that they're tightened out, closed, et cetera.

CHAIR KIRCHNER: Thank you.

MR. BOWMAN: Okay, so here's the key

reference documents and this is NuScale, internal NuScale documents.

So, the previously submitted documents we utilized was the human factors engineering task analysis result summary report. This is from the design certification generally, since this is what we're talking about.

Human factors engineering staffing qualification results summary report, the control rooms --

(Simultaneous speaking.)

MR. BOWMAN: -- methodology and the control room Staffing Plan Validation result. So, these all we utilized during the development of the revised Staffing Plan Validation with no changes.

The concept of operation was revised to reflect primarily the new roles and responsibilities and later on, we have a slide that will go through how that changed.

And then the new document for our topical report was the revised Staffing Plan Validation test report.

So, control room Staffing Plan Validation results you see evolve from the 2016 evolution and then the one below, the revised Staffing Plan

Validation report, is from the 2019 effort.

So quickly, we'll walk through a history --

MEMBER BLEY: Before you do the history, a more general question. And I know the onus here isn't on NuScale but I personally find -- and we've heard about some of this in much more detail when we visited the site.

The program you established early on of having good interplay between human factors engineering and the operations people and this ability to rapid prototype and test alternatives is something that I think all of the industry and not just nuclear, most industries, could learn from and could really be a great improvement for safety.

My experience in the past has been that it used to be engineers would design the control room and give it to the operators and they'd test it and see if it was okay or if had to actually pick something.

The approach here is really trying to optimize the human-machine system to the human action. It just seemed something very worthy of being shared.

Like I said, I don't think there's an onus on NuScale to do that but have you been sharing this in other forums, perhaps technical paper or

professional meetings, that kind of thing?

MR. BOWMAN: Yes, we have shared outside of the nuclear industry the human factors engineering side. There's been a couple of papers that our human factors engineers wrote and shared at some of those conferences.

So, we've been doing that.

MEMBER BLEY: I'm really glad to hear that because I think your approach is far better than any I've seen used in the past.

MR. BOWMAN: Thank you, I appreciate that. Sometimes you have to be not afraid to fail and learn from those mistakes in a safe environment. And that's one of the big things a simulator provides you, is the ability to do that.

So, I appreciate what you're saying and your use of optimization is very useful to me in my next slide. So, if there's no more questions I'll keep moving.

So, Human Factors Engineering Program at NuScale. And I tie this all the way back to 2012 when we built at our first commission of the 12-unit control room simulator.

Matt really kicked off the bulk of our work for human factors engineering and the first

mission of the simulator was always to do this staffing plant validation work. That was really the primary reason why it was initially commissioned.

So, in 2015, we put together a methodology. It was developed and actually, some aspects were actually also tested and validated on current safe plants.

We actually went to a couple of different plants and used portions of our staffing plant validation methodology and did workload assessments on existing control room staffs.

So, that was part of our validation when we did all that work. And also, it was of course reviewed and audited by the Staff. So, does that answer your question

MEMBER BLEY: I have another question. I'll just point out this Committee's first visit to NuScale was in 2015 and even by that time, you had made a lot of changes in your development for this control room.

So, we've been watching this for quite a while.

MR. BOWMAN: So, after we built our methodology in 2016 we did the staffing plant validation, the original one in support of the design

certification. In 2018, recognizing that human factors engineering submitted a process with an integrated system validation.

Now, staffing plant validations are a relatively small event, an integrated system validation is large. It covers a wide range of possible workloads and activities for a crew, everything from a day in the life.

We built a scenario that showed a day in the life of the crew up to scenarios that were very similar to what you saw on staffing plant validation with multiple accidents and incidents occurring.

So, a wide range and it's really intended to test human system interfaces, is the primary goal of integrated system validation, is making sure your human system interface works.

Based on all of that work, we recognize that we had the ability to further optimize our control room staff so this is really data-driven.

So, in 2019 we put together and redid a revised Staffing Plan Validation using a further optimized crew size, which we all recognize is this three-member crew. But I'll walk through in detail the next few slides a little more about this background.

So, the 2016 staffing plant validation effort, this was a performance-based evaluation of personnel using two crews of licensed operators. These crews were assembled from the SMEs that we're discussing.

People looked at previously held licenses in the existing fleet.

MEMBER BLEY: Doug, you answered it.

MR. BOWMAN: Yes. Essentially, we use folks internal to our Staff that held licenses previously. It verified that a crew of three SROs and three ROs can safely operate the facility.

Obviously, the NRC also audited these activities and there were no significant open items identified. And one of the really important pieces for what we're talking about is this demonstrated that this operator staffing validation methodology was sound.

So, our regulatory basis, I've discussed a bit of this but I'll go into some other documents that we certainly reviewed and utilized. We talked about NUREG-0800 Chapter 18.

Obviously, a large amount of the effort we put into assembling the Human Factors Engineering Program under NUREG-0711. NUREG-1791 is another NUREG

that helps with guidance for assessing the exemption requests from nuclear power-plant license operator staffing requirements.

We did utilize a SECY-11-0098 for operating staffing for small and multi-module nuclear power-plant facilities. Another NUREG that talks about the technical basis for regulatory guidance for assessing exemption requests, 10 C.F.R. 5054(m).

And this last document here is a Brookhaven National Laboratory technical report, the methodology to assess the workload of challenging operating conditions is for minimum staffing level reviews.

This document, in 2016 when we reviewed it, this document became NUREG-0800 Chapter 18 Appendix, the Appendix that we talked about in the first slide of the RIC regulatory requirement.

So, that recent revision to NUREG-0800 took this Brookhaven National Laboratory technical report and pulled it into the NUREG. So, the important piece to recognize is we didn't go on and create this methodology on our own.

We used regulatory guidance to develop this methodology. So, the DCA, the design certification control room staffing requirements, in

Part 7 we've proposed an alternative to 10 C.F.R. 5054(m).

It'll be codified in the design certification rule. We received that for the D.C. and that staffing is with no operating units we would need two reactor operators and one senior reactor operator.

And with any units operating, we would require three reactor operators and three senior reactor operators.

And there are allowances for temporary deviations provided in Tech Spec, very similar to what currently exists in the industry.

MEMBER BLEY: These are the old ones but rather than operating, I think, the words I saw somewhere was fuel in the reactor. Is that your definition of operating?

MR. BOWMAN: One part got garbled.

MEMBER BLEY: On this slide you talk about number of operating units and some of the other documents you talk about units with fuel in the reactor core.

Is that your definition of operating or do you actually need it on?

MR. BOWMAN: In this case for 522, I believe this operating means that you're in the mode

of being critical, yes, but I'd have to go back and take a look at that.

Maybe somebody else in the group can get that up for me while we continue on and we'll try to answer that question a little bit. But I believe that's the correct answer, is operating is critical.

There is requirements to have certain things. Any time you have fuel on site, that's a little different piece but we'll keep moving and hopefully be able to answer that question in just a moment.

All right, so I talked about Staffing Plan Validation and then the next effort I'm going to discuss in detail is after integrated system validation.

So, we get the entire effort and we brought on a large crew of individuals that, again, had some experience but looked at a lot like what you'd bring in for an ILT class. And we had an opportunity at the end of ISB.

We had already planned for some contingency time. We had three crews and we actually ran two trials on each scenario. So, every scenario had a crew that -- every scenario had one of the crews had not seen yet.

We took four of these very challenging scenarios from integrated systems validation, recognizing the information we had available to us was that we could operate with a further optimized number of crew, meaning three.

And we ran some informal testing at the end of integrated system validation using the people that were trained.

We ran four scenarios on three member crews, we met all of our ISV acceptance criteria and using that methodology gave us confidence that a three-person crew could safely operate the facility.

So, this would have been in late 2018, actually in the fall of 2018 when we did this. So, as a result of this and in a follow-up to ISB, we decided to pursue a revised Staffing Plan Validation.

Our concept was three licensed operators --

MEMBER BLEY: Before you do that, can I sneak in a question?

In the ISB, can you say something about cases you ran where you actually had problems of some sort with the human system interface, either some of it not working or getting wrong information, that sort of thing?

MR. BOWMAN: Sure, and actually, when we go through the scenario development we'll describe the three scenarios.

MEMBER BLEY: That would be good, you can wait for that.

MR. BOWMAN: So, we'll go into that in a little more detail when we get into the closed session.

But to answer your question quickly -- it's really not that big of a deal -- we generally ran a major loss of human system interface during almost all of these evolutions. But we'll go into detail on that.

MEMBER BLEY: But looking at new events in the past in nuclear and other places, you do a pretty good job of training people and designing for complete loss of maybe an indication system or an event that uses compressed air for controlling components for complete loss or greater.

Where we tend not to do as good a job is on things that gradually happen so that these go away pieces at a time or create misleading indications. I'd be interested in whether you tried to do any of those.

This is a place where we take operators

out of the range of what they expect and into things that once in a while mother nature throws out.

MR. BOWMAN: Okay, we'll talk about that in a little more detail in the closed session.

MEMBER BLEY: That's fine.

MR. BOWMAN: Okay, so based on that work we had done, recognizing the integrated nature of human factors engineering, we forged forward with the new staffing plant validation. Our concept was through licensed operators.

In the long run, that turned into two SROs and an RO. There was a strong reason for that, really, with two SROs and an RO you always fulfil the function of having at least one SRO and one RO in the control room, even with the loss of a single person due to an unexpected condition.

That's really why we utilize that staffing. We move forward with elimination of the SBA position and we utilized the same methodology as the original SPV.

I'll be careful about saying that, there are a couple of things we changed in the revised staffing plant validation and we'll go through those in detail in a moment.

But in general, the methodology was very,

very, very similar to the revised staffing plant validation methodology and very similar to the staffing plant validation methodology.

Okay, so again, same methodology was used. The minor differences are described in the report. I'll talk about those real quick right now.

One big piece was in the original staffing plant validation methodology, the observers we utilized to watch the cooling and provide comments and details about what went on.

They were essentially all members of the design team that built the human system interface. During ISB, when reviewing the guidance in 711, we recognized that it required independence for those observers.

So, we provided independent people from our Staff who were independent of the design process during ISB. And we took that piece, that independent observer and we rolled that into our revised staffing plant validation.

So we ensured we always had an observer on the team who was independent from the design process for the human system interface.

One other difference was when we did the NASA task load index, which is what we authorized for

workload measurement during both ISB and staffing plant validation, we used the weighted task load index.

However, the revised Staffing Plan Validation, we did not use the weighting factors because during all those previous evolutions did not see any significant influence to weighting.

And we can talk about that in a little more detail in the closed session.

MEMBER BLEY: You'll walk us through how you do those calculations at that time then, that would be helpful.

MR. BOWMAN: Okay, thank you. All right, so what did we wind up with out of revised control room staffing? We wound up a staffing plan that includes one RO and two SROs. That's implemented in the future.

We view that as being implemented in Tech Spec 522, that's the normal Section in Tech Spec where licensed operator staffing is talked about. And roles and responsibilities of these crew members will be discussed later.

There's obviously some adaptation that hasn't been done from where we were in both ISB and the original Staffing Plan Validation.

MEMBER BLEY: I've been focused on the control room, as you've been. In the staffing plan is there a requirement for licensed or unlicensed operators out in the plant?

MR. BOWMAN: Yes, and actually, that actual evaluation of staffing for non-licensed operators occurs as part of the non-operating license position. But we did assume for our conditions a limited staff of non-licensed operators.

In other words, the control room staff couldn't send out 20 non-licensed operators to do tasks. There was only four available to them during the revised Staffing Plan Validation.

That's our envisioned staff but that work to validate that Staff still needs to be done and that's part of the COLA, the combined operating license piece.

Okay, topical report conditions of applicability. So, this is obviously important in light of Joy's questions.

We built a set of attributes in the topical report that allows future license Applicants to use the topical report staffing plan.

There are two pieces to this. One part is design features is licensed operator training program

attributes. So, certainly questions we have already seen from the ACRS on these two topical reports.

The incident encompasses the staffing assumptions used by NuScale during the validation activities. So, there's actually some pieces of staffing that we'll talk about there.

And Applicants will be required to show compliance by evaluation or demonstration with this topical report.

So, design features, the important pieces of what we saw for the plant design are number one, no operator actions credited in the design basis events. So, that includes everything currently listed in our D.C. Chapter 15.

We must have two or less important human actions and based on the previous requirement, these really are going to be risk identified likely by the PRA. So, two or less important human actions, they need to be easily recognizable and can be completed from the main control room by one operator.

So, that's an important aspect of these important human actions. They can't be complex, they can't require multiple operators, this is easily recognizable and operators can identify the need for it.

And it can be completed from the main control room by one operator.

CHAIR KIRCHNER: This is Walt Kirchner. You're going to go over these IHAs in the closed session?

MR. BOWMAN: We can go over what the current ones are, recognizing that PRA's a living process and goes on throughout the design of the plant.

The condition of applicability is that we need two or less and they have to be able to be accomplished from the control room and they have to be easily recognizable.

So, I can tell you what our current ones are but the applicability is two or less and completed from the control room, easily recognizable.

CHAIR KIRCHNER: I'm just trying to think through and off the top of my head I can think of three but can you share those in the open session? I'm a little puzzled why you're actually constraining yourself to two or less.

MR. BOWMAN: Recognize what we're trying to do here is limit -- one of the big pieces of what this does is limit the workload of a future licensee, what a future licensee can do, right?

We're trying to keep that workload down very small, recognizing the Staff size. That's really what this is, what do I have to do in response to an accident? Well, this is really it.

No operator actions in the design and two or less important human actions. That's really what this is about. It's not so much about what the action is, it's about how much work there is as a part of that.

CHAIR KIRCHNER: And that is two or less per module?

MR. BOWMAN: Well, that's an excellent question. Yes, within the overall design, obviously these important human actions could occur on multiple units.

However, recognize right now with the way our PRA is, that would be a relatively -- the probability of that occurring is very, very low, is how I would characterize that.

CHAIR KIRCHNER: In my training and operational experience, full disclosure, that was the nuclear ships in Savannah and that was many, many years ago.

Perhaps I qualify as an ancient mariner.

The obvious one to me for each module is

to ensure that you had a scram when required. So, there's one action per module that I would identify.

I can think ahead to your design and probably come up with another one or two per module that I would be concerned about at least verifying, if not acting. So, that's how I'm coming at this.

So, I was just a little puzzled that you would limit yourself to just two.

MR. BOWMAN: I think I get your question a little better now. Let me try to explain this better.

The two important human actions we're discussing are beyond design basis events, in recognition of a beyond design basis event, and the actions taken to mitigate the consequences of those events.

Within design basis, a scram based on conditions, yes, we intend and we provide the operator with guidance to verify that was correct, but if the operator doesn't have to flip the switch to ensure the scram occurs, we don't view that as an action.

We're viewing conditions of ensuring the appropriate action has occurred. But we'll go into more detail in closed session.

MEMBER BLEY: Doug, I don't think you said

it here in the topical, maybe you do but I've heard it many times in other cases.

Your ability to have this minimum staffing and still keep things safe is kind of hinged on the ability to very quickly throw a plan into a passive cooling mode that you really don't have to monitor very closely after you've done that.

So, if you have things going on in multiple modules, dropping them into that state very quickly is kind of the basis for being able to keep control of what's operating.

Is that a fair statement?

MR. BOWMAN: That's certainly something we view as a potential.

Given the number of units and the impact, in many cases we believe it might be simpler for an operator to simply trip a misbehaving unit rather than allowing it to continue to operate.

That action is conservative. We would consider that a conservative action taken prior to achieving a trip condition but the safety of the design is based on automated features that do that very function.

Place the unit in a safe and stable condition.

We don't require the operators to take that action, we merely state that it's a possibility in terms of limiting workload.

(Simultaneous speaking.)

CHAIR KIRCHNER: Sorry, I didn't have my mic on. I don't know if we can talk about this in open session or we have to go to closed session.

But from what we've heard of your expected modes of operation, should you have a case where multiple units begin and want to sequentially have problems the way these are passed off to other operators and units are thrown into that, manually thrown into that, passive cooling mode was part of that plan.

So, we can wait until closed session to talk about that.

MEMBER BLEY: I have another question too.

CHAIR KIRCHNER: Doug, that was Walt again. Just to be clear then, what you're talking about here are beyond design basis events when you talk about two important unit actions.

And your PRA will be a guide to what those would be?

MR. BOWMAN: Correct.

CHAIR KIRCHNER: Okay, then for the normal

-- I shouldn't say normal but normal and not normal. But within the design basis event envelope then pretty much what you're saying is everything's automated to a first order?

MR. BOWMAN: Not directly. If I could go on with the rest of this slide I think I'll answer your question?

CHAIR KIRCHNER: Okay, go ahead, thank you.

MR. BOWMAN: So, beyond that, we've talked about that big piece, but the other piece is the human system interface design.

So, obviously, we're talking about a future design so what the HSI will look like, we expect that it will be very similar.

However, we recognize that we needed to also develop conditions of applicability for the human system interface design. So, these are the features that really tie down some of what you're talking about.

So, we must have the following features event, we must have critical safety function and the defense in-depth monitoring and display with direct links to response procedures.

So, this concept of we monitor critical

safety functions, when those critical safety functions are challenged the human system interface directs the operator to the appropriate procedure to address that challenge.

So, that really ties those two important human actions in and provides the operators with cues to perform them.

Also, it addresses defense in-depth so that's items like ensuring we have the ability to make it up to the unit, providing for an alternate secondary heat sink to restore the safety by our passive systems, being able to put back in standby, that kind of thing.

Also, we provide for a tiered alarm scheme so the concept, we currently have three tiers in our alarm scheme. Alarms and cautions of notices, and those computer-based response procedures are directly linked to the alarms.

And the final piece of the human system interface is 12 module trim monitoring, allowing for the operator in an easy manner to monitor all 12 units at a time.

So, when you talk about normal and off-normal conditions, this is really that whole tiered scheme that we have built in order to provide the

operator with the most important action at the time in an easily digestible format, right?

If they have a critical safety function to address, they have to address the critical safety function challenge. If they have a defense in-depth challenge they have to address that.

If they have none of those they can move down into their tiered alarms. So, now you're talking about off-normal conditions for you to address the tiered alarm schemes.

So, you start off with the alarm conditions and you make sure those have been addressed. And all of that is directly linked with procedures that tell the operator how to address all of those conditions.

And then the final piece is allowing them to provide their own monitoring ahead of the alarm scheme, trend monitoring to identify conditions that could potentially put them into those situations.

So, there's a whole tiered system to ensure they address off-normal through emergency conditions. So, that's really Part 1 of conditions of applicability, design features.

We're going to move on to license operator training program attributes since we don't have any

questions at this point. So, licensed operator training program attributes.

This is part of the topical report, conditions of applicability, they have to be developed using a systems approach to train. That's part of the code of federal regulations, 10 C.F.R. 55.

Much of what we're going to talk about below this all came out of NUREG-737, the TMI action plan. So, we must include math, physics, thermodynamics, and component design topics, specifically relevant to the operation of a nuclear power-plant.

We have to provide -- and this to me is one of the really important pieces that came out of post-TMI work. We have to provide training for mitigating core damage.

How does the operator assess conditions and mitigate damage to a core? And we have to provide plant-specific training.

As you've discussed and asked us about plant systems, plant-specific reactor technology, including core physics data, plant chemistry corrosion control.

Reactor plant materials, reactor plan thermocycle, another very important piece to my mind,

transient accident analysis allowing the operators to recognize conditions that are off normal and what actions they can take to mitigate those.

And then finally, really, one of the big pieces that came out post-TMI was the improvement to the emergency procedures and the training.

MR. OSBORN: Doug, you've got part of your screen obscured there.

MR. BOWMAN: Sorry.

MEMBER BLEY: And Doug, is it your view that a training program with these attributes will give us the equivalent of an engineering degree?

MR. BOWMAN: Well, I wouldn't say an engineering degree but it will provide them with those engineering fundamentals, both the general and the specific engineering fundamentals that are necessary for an operator to understand how their plant operates.

MEMBER BLEY: Well, the final policy statement on engineering expertise on ship, which came some years after the lessons-learned package went together for the umpteenth time was that if you choose the option of combining the STA and the SRO into one, you have to either have an engineering degree or the equivalent.

MR. BOWMAN: My point is that we're providing them with specific knowledge, engineering knowledge, of how the plant operates.

So, to say that I gave them all the attributes of an engineering degree, I'm saying that we provide them specific training that gives them the same level of knowledge that an engineer would have on how their plant operates.

(Simultaneous speaking.)

MEMBER BLEY: So, this training program would meet the conditions in the final policy statement rather than that NUREG for having a combined STA and SRO?

MR. BOWMAN: I'm going to see if Pat can answer this question better than I can. Pat Leary, are you available?

MR. LEARY: Yes, and thanks Doug. My name is Patrick Leary, I don't think I've introduced myself yet to the Board. I'm a NuScale SRO, which is an honor to be in that role without their being a plant.

I'm sure you folks with operating experience appreciate that title. And I do have a background in operations and operations training including with the AP1000 programs, so I've seen some of this stuff stand up before.

And then to your question about the engineering expertise, we're really pointing to the engineering expertise that's called out in the TMI regulation, NUREG-737.

So, we're careful about saying the equivalent, we want engineering expertise and it's in NUREG-737.

MEMBER BLEY: The reason I'm kind of challenging you on this is a NUREG isn't a regulation but the TMI plan identified this but it took another five years before the Commission issued a policy statement in trying this under their authority.

And at that point, they gave two options. One was to keep an SDA with an engineer's degree and an SRO. Or Option 2 was to combine those roles with a person who either has an engineering degree or I think the language is okay, I'll check it, the equivalent.

So, I think the policy statement is more directly relevant than the lessons-learned report.

The Staff might talk about that later when they come up, I don't want them to jump in now.

MR. BOWMAN: Okay, I'll keep moving. Thanks, I appreciate the question.

All right, so that was training, the next

thing we'll discuss is conditions of applicability, staffing assumptions used. We've talked a little bit about some of this and I think this answers some questions we had in the past.

We feel operations, module assembly, and disassembly are not directed from the main control room. A working drill center is available for work management so there's some degree of separation of work from the control room in terms of signing people in and out of work.

And a crew complement that includes one non-licensed operator to act as a communicator during emergencies.

So, this is specific to this report for conditions of applicability, recognizing we assumed there were four non-licensed operators. But this report requires a non-licensed operators to act as a communicator during emergencies.

CHAIR KIRCHNER: Doug, this is Walt again. So, that communicator is in the control room or from the work station or to be determined?

MR. BOWMAN: They're available on site to be recalled to the control room to serve the function of that communicator during a declared emergency. That's probably the clearest statement I can make to

you about their position.

CHAIR KIRCHNER: Okay.

MR. BOWMAN: So, as promised, concept of operations, we did submit a revised concept of operations report to support the revised staffing plan. The minimum license operator staffing, as titled, is as follows.

The control room supervisor, the reactor operator, one, and an additional reactor operator. And I'll go into some details about this. I'll try to be as clear as I can.

So, we require that we have an SRO who meets the requirements to be a shift manager and that's outlined in ANSI-31 2014. There are specific requirements that are required for the shift manager position.

So, one of your two SROs must meet those requirements to act as a shift manager. Generally, when you're at this minimum staff of three operators, that person would be the control room supervisor.

But we do not preclude any SRO from holding a control room supervisor position. But again, we must have an SRO who meets the requirements for shift manager.

Obviously, the shift manager's position is

a bit different from control room supervisors position. A shift manager is in charge of the plant, control room supervisors in charge of the control room, and again, those would generally be combined in minimum staffing, set up on three operators.

Obviously, the CRS is also responsible for authorizing activities for an impact plant operation and ensuring that appropriate Staff is available to manage the workload.

We talked about this a little bit earlier, the CRS has the ability to shut down units that are presenting an undue burden of the crew as a too little managed workload. And it always has the authority to direct resources associated with operation of the plant.

And then RO1, RO1's position really hasn't changed from much what -- if you were able to visit NuScale in 2019. That role we really view as really important.

RO1 is responsible and provides oversight for all the units under the control of the control room. Their role is really one of monitoring, not taking action, although we do allow them to take a limited amount of action to address simple conditions.

RO1 is generally the initial individual to

respond to all notifications and determine the appropriate level of action and they can hold either an RO or SRO license in light of our minimum control room staffing.

And then the final member of the crew is an additional reactor operator. They may be assigned to the control room, they do other work. Shift services, support required testing and maintenance, and also assists the control room staff in addressing off-normal conditions.

All right, any questions or comments on that?

CHAIR KIRCHNER: Doug?

MR. BOWMAN: Yes, go ahead.

CHAIR KIRCHNER: The way you just described it verbally is not quite I think the way I understood the concept of ops. Who's actually running the plant?

Who's monitoring the 12 units or modules?

Isn't that the RO1?

MR. BOWMAN: Correct. RO1 provides -- let me go back a slide.

CHAIR KIRCHNER: But you said oversight monitoring which is different than actually operating?

MR. BOWMAN: Well, from the standpoint of

operating at the controls, yes, the RO1 can take actions. We just don't want RO1 to become burdened with actions to the point where they can no longer monitor all the units in the control room.

So, that's really the position of that second operator, the additional reactor operator. So, for example, the best practical example I can give you I'll make one up.

RO1, there's a pump spill and a standby pump spill supposed to start. The standby pump didn't start, there was no alarm, RO1 responds to that alarm and says, oh, all I need to do is start this pump and I can respond to this. RO1 can take that action.

So, it really goes much more into depth than a single operation. RO1 needs to turn that over to the additional reactor operator so it does not limit their ability to provide monitoring of their remaining units.

CHAIR KIRCHNER: I was trying to think of scenarios of how you would manage load followings. In other words, you would be maneuvering individual modules and optimally, you would just want them to be running 24/7 at full rate of power.

But depending on what's going on in the grid and who you're connected with and who you're

supplying, you could be doing -- load following isn't the right way to say it but you could have multiple modules at different power levels and such.

So, while you're going through such a transient, so to speak, who's actually controlling that? The additional reactor operator or Number 1?

MR. BOWMAN: So, how we manage it right now, if there were actions to be taken to maneuver a unit, the additional reactor operator would take those actions.

Once they had completed and started that, for example, change of power, as long as that was stable and under control, that unit that's maneuvering could be turned back over to RO1 for monitoring depending on workload at the time.

So, if the additional reactor operator needed their maneuver in another unit, they could move on and start maneuvering that second unit while handing that unit back over to RO1 for monitoring during the power maneuver.

CHAIR KIRCHNER: It seems to me that what you're labeling here as the additional reactor operator is really the reactor operator, the main, the primary player in those kinds of scenarios where you're adjusting the multiple modules to whatever the

load requirements are.

MR. BOWMAN: In terms of taking action, yes. The additional reactor operator is the primary person who would take complex actions. For example, we allow RO1 in our current concept of operations to do normal evolutions on a unit.

So, that's currently under the purview of RO1. So, again, we're just trying to keep RO1 from becoming distracted by and getting drawn into an activity that's complex.

That's really our goal here and that's why we built this concept of RO1 and additional reactor operator.

MEMBER BROWN: So, fundamentally, one operator controls all 12 plants and another guy is sitting around waiting to help if he needs to?

MR. BOWMAN: Correct, it's a triage with a person to take care of those.

MEMBER BROWN: 1 operator for 12 plants?

MR. BOWMAN: Correct.

MEMBER BROWN: Load followed this adjustment, that adjustment and everything else? And anything that requires more than one or two operations you have to have a hand-off of some kind?

MR. BOWMAN: Correct.

MEMBER BROWN: I echo back to my earlier comments an hour and a half ago. This is Charlie Brown. I'm sorry, Walt, I had to interrupt listening to this.

CHAIR KIRCHNER: No, Charlie, that's fine. I just think -- let me keep my thoughts to myself. What I was trying to do was take myself through the scenario where you have multiple units going through a load following maneuver, so to speak.

And that could be fairly demanding should you have problems in the balance of plant in particular. And I would expect in a situation like that, that would engage the attention of probably all three of the operating staff.

Let me stop there. I just think a multiple-unit load following scenario is one where it would engage probably all three actively. Not an oversight matter but you can demonstrate, I'm sure, to the satisfaction of the Staff that's manageable by just a single operator.

But it could be taxing.

MR. OSBORN: This is Jim Osborn. So, I think later in the presentation we actually have some workload data that'll show the amount of workload and taxation as you may say of the operators.

So, if we maybe move on we can get to that detailed data.

MR. BOWMAN: I was going to go through it a little bit more, hopefully be able to answer that question and some of the scenario development and scenario discussion.

I'll hopefully be able to answer that question for you.

MR. OSBORN: Thank you, I'll wait.

MR. BOWMAN: So, we'll move on to our final topic and obviously, as I've been warned, this is an important one to cover. I'm going to give an overview right now of the shift technical advisor position and the work we did.

The sense of the position, again, there is more detail and that detail is upfront in the closed session. Okay, so the STA, shift technical advisor requirement, we've discussed this quite a bit already in the questions that have come up.

NUREG-737 states that the STA requirement was established at the TMI-2 accident as in initial measure.

And as NUREG-737 states that the STA position may be eliminated when the qualifications of the shift supervisors and senior operators have been

upgraded and the main machine interface in the control room has been acceptably upgraded.

So, a topical report walks through how the at the NuScale power-plant we have met those two conditions.

So, we've already talked about Piece 1, upgrades to the training of licensed operators. NUREG-737 training requirements are now incorporated into conditions of applicability for this topical report.

Our training must be developed utilizing a systems approach to training, as required by 10 C.F.R. 55 and include the generic fundamentals we discussed previously, maths, physics, thermodynamics, et cetera.

It must include training for mitigated core damage, must include plant-specific training, plant systems, a whole slew of items, especially core physics. And then, of course, transient accident analysis and emergency procedures.

Completion of all of this training is required by NUREG-1021. They specifically deleted the NRC Form 398 personal qualification statements of the licensee.

Okay, so Piece 2, control room upgrades.

So, NuScale control room upgrades, our HSI features provide adequate assessment of plant conditions and facilitates early detection of degraded conditions.

They can be supervised, condensed, and easily viewed on overview screens. Ease of navigation, it's very easy to walk through our systems. We've had people of almost no experience be able to quickly pick up on how we navigate.

Universal display of active processes, this is actually a piece we haven't talked about yet. Any process, meaning procedure, automation, et cetera, that's currently in progress is displayed on every human system interface station that's available.

So, everybody has live access to what the status of that process is. We include safety function monitoring as integrated into the man-machine interface, we've talked about that already.

Emergency operating procedures are directly embedded in the interface and directly linked through those appropriate safety functions.

And another piece that we haven't talked about yet but is important to the STA's function in general is active monitoring of emergency action levels in the emergency plant.

So, we provide, the HSI provides,

recommendations for emergency action levels to the crew based on the plant conditions that it can detect.

And I say that, for example, a challenge to a fission product barrier, obviously, the human system interface can detect and provide recommendation on that.

A security event, there's no link to the human system interface so that's not something that HSI can provide a recommendation on. That would be based on a crew performing that.

Okay, additional considerations. So, we have advanced design features in our human system interface that reduce the need for additional oversight. An example of that is the live display of all active processes.

We use passive safety features and I'm talking from a design level and also a substantially lower operational complexity. And that results in no operator actions for design basis events as well as an improvement in overall safety.

And again, importantly, the design only has two important human actions associated with beyond design basis events that had a very small probability of occurrence.

Both important human actions are simple,

straightforward human actions that can be completed from the main control room by a single operator, and also something we haven't discussed yet, they have large time margins to complete the tasks the historically would have needed to be performed without delay.

All right, I'm going to try to sum up this STA discussion with some personal experience. So, I show a picture of two different control rooms, the bottom one is easily recognizable for those of you who have been there.

The top one is actually another simulator, it's the D.C. Cook Unit One control room simulator, obviously a design that I spent 15 years on.

And I display these two pictures, it's certainly intended to be visually impactful and what we've done as an upgrade from what was previously in the legacy industry and what we currently show in NuScale.

So, what I want to walk through is not so much the visual impact but to me the real features of the HSI and what assists the operators. I'm going to walk back in to post-TMI.

So, in my experience, post-TMI, there were four fundamental changes that were made in how

operating crews functioned. I know this is one of the ones that was forwarded to me that really impacted how the operating crews functioned.

Number one, we added the shift technical advisor. We did a human factors engineering review modification to the control rooms. We made upgrades to the emergency operating procedures and we provided improvements in crew training.

To my mind, these last two items are the two changes that were highly effective and truly sustainable. The changes we made to the EOPs, given my background and experience, generally resulted in clearly used procedures and they were based on engineering analysis.

And the improvement in operator training really resulted in operators that thoroughly understood the engineering basis of their design.

They were provided training in both general engineering and specific engineering for their design so they could understand the progression of accidents and transients and what actions they needed to take to mitigate those.

If you go back and look at the human factors engineering review and modification to the control room, however, to me that was limited in its

effectiveness.

Because it really depended on the lifecycle of the plant, was this a pre-operational plant? In the case of D.C. Cook, D.C. Cook went critical, initially commercial in 1974 and 1978 on the two units, both for TMI.

So, when the human factors engineering review was done and the modifications were made, they were really limited in what they did. You can see the panels are old-style, really ADP is a coal-plant utility.

They're completely vertical panels, there are no benchboards. But honestly, the layout of Cook is difficult from a human factors engineering perspective in comparison to what we did for NuScale.

So, the last piece of that is the STA. And we're really looking at have we done the improvements necessary in the new design in NuScale to eliminate the STA?

So, our real upgrades are not so much in this visual impact I'm showing you but it's really the capabilities of NuScale HSI and especially in its ability to assess critical safety functions, provide operators with the correct path and prioritization of actions to restore account safety function or

transient inner accident.

And also in its ability to assess and recommend emergency action classification. That to me is really the upgrade that we made in the human system interface to really change the way that the crews function.

So, that to me is the big piece. We're holding on to improvements in operator training, we're going to provide the operators with clear EOPs, the operating procedures that really tell them where to go.

And so that really is what allows us to eliminate the STA position for our design.

MEMBER BLEY: Doug, just one comment.

I'd agree with most of your comments there, except if you were around back right after TMI and look at the first human factors reviews of control rooms around the country, you wouldn't have dismissed what they had said.

There were control rooms where operators were mixing up switches so they'd tie a beer can onto one of them so they got the right one. There were control rooms that had -- and there still are a couple of these -- absolutely no limits on the door so you just had a mass of switches.

There were even dual units where somebody had decided Unit 1 and Unit 2 were in the same control room and Unit 2 was a mirror image of Unit 1, which really screwed up people if they went from one to the other.

So, there were some massive improvements, even, as you said, the boards aren't all that great afterwards. But from what they were before, there was some real horror stories.

MR. BOWMAN: I understand. Cook had given the pre-TMI operational state of Cook and obviously this is not a safety system. But my example is always heated drain pumps on Unit 1.

The control switch to start the pump was at the top of the board and the valve you had to open immediately following that was at the bottom of the board down by your feet.

(Simultaneous speaking.)

Anyway, I appreciate that. I know there were improvements made, I don't argue that point.

I'm just saying I believe that our process of really doing human factors engineering and involving the operators very early on in the line process resulted in a substantial improvement of the human factors engineering of the control panels.

MEMBER BLEY: The one thing you don't talk about and I will acknowledge most of the NRC's review didn't talk about and the policy statement didn't talk about.

But a few of the comments in ACRS letters, especially from people who had operating experience or studied operating events a lot is the value of having an independent set of eyes who isn't in the midst of the action to catch things when, in those rare cases, things get really exciting.

And for me that's an important aspect and I had seen a lot of it in different ways this rule was carried out in the Navy when I was there.

And when you have a supervisor, maybe a reactor officer or engineer, who would come into the plant in the midst of an event, the ones who could stand back and be divorced from it saved the day a lot more often than the ones who jumped in and took over.

For the weird cases, I still see a lot of value in having that independent set of eyes and I know the STA hasn't always worked that and doesn't work that way at all plants but I think it's a very useful role.

MEMBER BALLINGER: This is Ron Ballinger. I'd like to build on that and I've been struggling

with this STA elimination. By the way, back when TMI happened, people were using Commodore 64 computers so things have really changed a lot.

And for those who haven't read it, I would encourage you guys to get hold of a book by Nicholas Carr which is called the Glass Cage, which is very insightful.

But I was qualified on every watch station in the plant and admittedly, it was a submarine, including what was called the steam plant supervisor.

And that role was a person who knew the whole plant and would step back and could recognize when trends were happening that an individual electric plant, reactor plant or whatever it was, even the engineering officer on watch, wouldn't notice.

And so it was a kind of guy that can anticipate a problem because he knew, in this case it was always he, the plant very, very well.

And so I'm wondering how that function, somebody that can see trends, if you will, even amongst a couple of plants, how is that function going to be achieved?

Because no computer can do that and no computer display can do that.

MEMBER BROWN: That was overwhelming.

MEMBER BALLINGER: We were operating in places where you really had to make snap decisions sometimes.

MEMBER BROWN: The thing that disturbs me when I look at that last picture is the vast stand of all the displays and one operator.

There's a lot of people in the room in this particular one and effectively, it looks like we've gone from the philosophy of the operator is the prime responsibility for reactor safety to where the instrumentation and safeguards systems are to be 100 percent relied on.

And I'm not arguing about the design of the plant but we're completely dismissing the need for more than 1 person to operate 12 plants. And whether you call it an STA, I started choking went you went from six in the analysis for three.

Six was difficult enough to deal with in your initial presentations and now we're down to three with one person as opposed to, say, one for every two plants and a control room supervisor and no STA.

You now have one person for everything and any combination of multiple alarms starting to go off on multiple plants will completely overwhelm.

Even though the argument is the plants

will take care of themselves, you can walk away and go have a beer somewhere, I think that's the wrong philosophy. That's just my impression of where we're going with this.

MR. BOWMAN: I'll provide a bit of a counterpoint to that. So, we're not discounting the role of the operator but we're changing the role of the operator a bit, I admit that.

For example, instead of us being focused on the idea that in order to perform properly, an operator has to beat the automatic systems.

We want the operator to understand the conditions of the plant and recognize that an automatic action will occur but it's not necessary for them to beat the automatic function.

It's necessary for them to understand it and ensure that it's occurred. That is really the safety of it.

(Simultaneous speaking.)

MEMBER BROWN: I was not arguing for that standpoint. It's just that when you have all 12 plants and all the load follows and everything else that has to go together and in SECY we've covered all possible things that could happen, I just think that's hubris.

I don't think we're smart enough to do that.

MR. TOVAR: This is Tim Tovar, I'm going to chime in, Director of Plant Operations at NuScale. Two points I would like to make out, the operator get overwhelmed when multiple alarms and so forth come in. I would say the data doesn't bear that out.

We've tested the operator performance and they're able to hadn't the situation and ensure nuclear safety in all conditions that we have tested.

The second point that I think is important is we're talking about the minimum licensed operator staffing, not the maximum.

So, when we have evolutions that tax the workload, say, for example, unit startups, load following, that type of thing, the licensee can certainly supplement the staffing as necessary.

MEMBER BLEY: I think fortunately enough -- (audio interference) the simulator and I (audio interference) really I think it's essential and --

MEMBER BROWN: Dennis, we're losing you.

(Audio interference.)

MEMBER BLEY: -- come up with multiple --

MEMBER BROWN: You're cutting in and out, Dennis.

MEMBER BLEY: -- visual signals to understand where there might be a problem that requires attention. I hope that (audio interference) panel and for those of us who haven't figured out how it works and how it helps the operator (audio interference) I saw in the process.

MR. BOWMAN: I'll try to help out with that. I think I understood what Dennis said even though it was pretty broken up.

One of the conditions of applicability we listed is that the Applicant has the ability of 12-unit monitoring. And that's not the person has to stand across this wide range of a horseshoe.

We have multiple versions of single screen 12-unit monitoring panels that allow an operator to see major parameters, see the status of all the safety functions, see the status of all the alarms and at a glance can review and see what the most important action is for them to take at any given time.

We heavily rely upon the HSI to provide the operator with prioritization but we still rely upon the operator to address those conditions.

Again, we are providing the operator with the best set of conditions we can to see what the most important thing for them to do at any given point is.

That's really what the HSI is doing.

We're not eliminating the operator from the position, we're providing them with information in a manner they can take in and properly interpret the information and take the correct action.

The one other thing I would highlight is the way our concept of operations works where we have an RO performing a task and not a reader-doer situation like I was used to in my previous design, we allowed the CRS to be truly an oversight.

They're more independent from the plant operator than in my previous design. They're allowed to provide an oversight function and be independent and ensure the correct action is taken on.

Their real role is making sure that prioritization is correct among the work the crew needs to do at the time.

MEMBER BROWN: This is Charlie again. Referencing back to the TMI, RIC insisted all its Section Heads and everybody else in the organization read the TMI report.

And one of the things that stood out in our subsequent conversations when we talked about it was tons of alarms going off, lots of them, the ability to integrate all that information.

Now, admittedly, there were more manual operations required to take account for those, which at this point doesn't have it maybe in necessarily all circumstances.

But still, data overload is a huge issue when it comes to making decisions.

And when you've got one person or even two people trying to focus on multiple alarms coming from multiple panels and circumstances that you have to start making decisions because why is something not working, it seems to me that's somewhat unsustainable with this particular concept of operations.

That's just the way I look at it from what you've gone through. So, I'm very much concerned about the data overload issue.

We did a real scrub of all our control panels for future plants to ensure that nothing was visible to the operators to the plant. It didn't pertain to their plant period.

No other miscellaneous information. All the rest of it was taken care of by somebody else, other operators throughout the plant.

MR. TOVAR: This is Tim Tovar, I'd like to chime in just one more time. I agree with you 100 percent that that's a concern.

We did some early benchmarking at AP1000 where we saw the concern for alarm avalanche, is what we called it. And the NRC actually expressed that as a concern as well.

So, that was from the very beginning of the human factor engineering design has been really kind of baked into the HSI solution.

So, we have come up with a tiered alarm system to help the operator with that. And the bottom line is, I would say, the test results, again, the data does not bear out that the operators become overwhelmed with information.

It's shown again and again that in various scenarios, if they can pick out the important information that affects nuclear safety quickly, consistently, and efficiently and take any actions or at least understand the plant condition, there's very few situations where the operators actually have to take actions.

But the testing that we have done has shown that nuclear safety is ensured in these conditions.

MR. OSBORN: This is Jim. When we get to the (audio interference) have a movie of either some of the tests or drill where those of us who haven't

been out there to see it can actually see how that center panel works and what kind of (audio interference) the operator. If that's possible and won't take too long, it would be very helpful I think.

MR. TOVAR: This is Tim again. I would say we're not prepared to show a video during the closed session at this time. If that is something that is desired, we can discuss that at some future meeting.

MR. OSBORN: This is Jim Osborn. So, I would just point out the Staff did review videos of these scenarios in some detail and quite extensively. So, those have been reviewed and maybe the Staff can speak to that when they come up.

(Audio interference.)

MEMBER BLEY: -- most of them, but a few of us didn't get that opportunity.

MEMBER MARCH-LEUBA: This is Jose March-Leuba. I'd like to put a concept out there for your consideration.

When we did the thermohydraulic correlations, we ran 200 data-points and then we used 100 of them to do the feet for the correlation. And we used the other 100 to validate and verify.

What I see you've done here, what I fear

you have done here is you're using the same data-points to generate your user interface and the computer displays that your operator uses for the dual validation.

And my complaint has always been completeness. What happens to that user interface when you throw it something that the engineers didn't consider when they designed it?

And at those points is when having a second pair of eyes, STA or not just someone pushing buttons, recognizes that something is wrong. And I think that's what my colleagues were trying to say intuitively.

I see very similar to this the thermohydraulic correlation issue. You need to use a separate set of experiments to verify that your correlation is good.

And I think here you're using the same set of experiments to develop this place and to test them. Okay, thank you very much.

CHAIR KIRCHNER: Members, we've gone almost two hours now. I suggest that we take a break. When we come back we'll turn to the Staff. I'm assuming this completes the open presentations from NuScale, is that correct?

MR. BOWMAN: That is the completion of our open presentation.

CHAIR KIRCHNER: Thank you, Doug. Okay, good, so let's take a break. We'll come back with the Staff's open presentations.

I think we've had good dialogs so keep your questions in mind and at this point let's take a 20-minute break. We'll reconvene at 11:50 a.m. Eastern Daylight Time.

(Whereupon, the above-entitled matter went off the record at 11:30 a.m. and resumed at 11:50 a.m.)

CHAIR KIRCHNER: It's 11:50 and we will come back into our NuScale Subcommittee meeting and turn to the NRC Staff. So, Dr. Tesfaye, Getachew, why don't you take over at this point.

MR. TESFAYE: Thank you. Thank you, appreciate it. Again, my name is Getachew Tesfaye, I'm the NRC project manager for NuScale's control room staffing plan topical report.

The technical reviewers are Maurin Scheetz, Lauren Nist and Jesse Seymour. Lauren will make a more formal introduction of the tech staff later on in the presentation.

I will present an overview of the topical

report and the review process, and the tech staff will present the detailed evaluation of topical report and the conclusion of the Staff's review.

Just for the record, a Revision 0 of topical report was submitted for NRC review and approval on June 11th, 2020. The topical report documents, the technical basis for minimum staffing contingent of three license operators from a single control room for up to 12 NuScale power modules and their associated plant facilities.

Subject to conditions of applicability discussed in Section 1.5 of the topical report. And also in Section 5 of the Staff safety evaluation and NuScale facility licensee or COL applicant may use a topical report as technical basis for non-exemption requests from the staffing requirements of 10 CFR 50.54 or the alternative staffing requirement in the design specification rule. And STA training requirement in 10 CFR 50.120.

On July 14th, 2020 the NRC Staff formally accepted a topical report for review by notifying the NuScale that, by notifying NuScale that the topical report application provides sufficient technical information for NRC Staff to conduct a detailed technical review.

From August 17th to September 10 of 2021, the Staff conducted audits to observe video recordings of the validation activities, a review of validation test data and results, and identify any information that could be required for docketing to support the regulatory finding.

Following the audits, on October 21, 2021 the Staff issued a request for additional information containing 15 individual questions. On December 17th, 2020, NuScale completed its response to the 15 RAI questions and submitted Revision 1 of the topical report with updated information.

On February 9th, 2021 the Staff completed its safety evaluation and submitted it to ACRS in support of today's meeting. Currently, the Staff is in the process of finalizing an information SECY paper for the Commission regarding this topical report.

The purpose of the paper is to inform the Commission of, one, NuScale's proposal to eliminate the shift technical advisor as the head position from its control room staff. And two, the staff's basis for approving NuScale's proposal, which constitutes a departure from existing Commission policy, as well as an industry, as well as Industry practice.

The paper is currently under division

management and legal review. We expect to complete the paper by the first week of April.

That concludes my remark. If there are no question for me, I'll pass on the mic to Lauren to start the technical review.

CHAIR KIRCHNER: On this informational SECY that you're preparing, again, do you expect to have that done on April?

MR. TESFAYE: By first week of April is the current schedule.

CHAIR KIRCHNER: First week of April.

MR. TESFAYE: Yes.

CHAIR KIRCHNER: Okay. Well, I'm just weighing here in real time whether that should be a consideration in terms of when we commit to a full committee presentations as needed, and letter writing.

We were currently planning to draft a letter for consideration at our full committee meeting in April. We'll need to come back to you on this then --

MR. TESFAYE: Okay.

CHAIR KIRCHNER: -- in terms of timing. Okay, go ahead, please. Thank you.

MR. TESFAYE: All right, thank you. Lauren, please proceed.

MS. NIST: Hi and good morning. I'm Lauren Nist. I'm a technical reviewer and operator licensing examiner in the operator licensing and human factors branch in the Office of Nuclear Reactor Regulation, Division of Reactor Oversight.

I am one of three staff members who reviewed this topical report. The other reviewers are Maurin Scheetz and Jesse Seymour, who are also in my branch.

We were assisted during our review by Dr. Brian Green, who is the human factors engineering team lead in our branch, and our branch chief, Chris Cowdrey. Maurin, Dr. Green and I also reviewed the NuScale human factors engineering design certification application.

Also, Jesse and Chris were previously licensed as senior reactor operators and worked as both control room supervisors and shift technical advisors at operating power reactors. As such, they provided valuable insights and perspectives during our review.

Also, Maurin and I worked together at an operator reactor as instructors for the license operator re-qualification program, which included shift technical advisor training.

Jesse, Chris, Maurin and I also served in the Naval Nuclear Power Program. Jesse and Chris were stationed on submarines and Maurin and I were stationed on aircraft carriers. Although we did not have the opportunity to work directly or be selected by Admiral Rickover, I believe that his values were definitely included in our training.

We also consulted with Dr. Dave Desaulniers, the NRC's senior technical advisor for human factors. And Dr. Jing Xing and Dr. Amy D'Agostino, who are two of our colleagues in the human factors and reliability branch in the Office of Research.

Maurin and I are the primary staff presenters today. And in attendance we also have Jesse Seymour, Dr. Brian Green, Chris Cowdrey, Dr. Dave Desaulniers, Dr. Jing Xing, Dr. Amy D'Agostino, Greg Suber, who is one of our deputy division directors, and our division director Chris Miller.

Our presentation today will include the focus areas we developed for our review and our review strategy, a summary of the activities we did during an audit that we conducted on August of last year, a summary of our findings and observations and a discussion of the factors that we assessed regarding

the elimination of the shift technical advisor role at the NuScale plant.

Before I move on in my presentation, I would like to address some of the comments I heard earlier from the Committee Members about being skeptical of this proposal, to no longer have a STA on shift at a NuScale plant.

When we saw this proposal, we too thought to ourselves, oh boy, this is going to be a challenge because there truly is a lot to overcome as we heard expressed earlier this morning.

Although few of us on this team lived through the events at Three Mile and Unit 2 and the years upon years after it in which the NRC and the Industry dealt with the impact of that event, we do still recognize the significance of the post-Three Mile and action items. And that was always in our mind throughout this review.

Next slide please. After we receive Revision 0 of the topical report in June of last year, we established three focus areas for our review and a review strategy, which are shown here on the slide.

The first focus area was NuScale's test methodology. So we wanted to understand what, if any, of the changes to, or excuse me, what, if any, of the

methods had changed from those that NuScale used for the initial staffing plan validation test and the integrated systems validation test, which were both completed in support of the design certification application.

We also wanted to verify that the new scenarios NuScale developed for the revised staffing plan validation test sufficiently challenged a three person crew. The second focus area was on the results of the revised staffing plan validation test which included data on the crew's task performance, workload measurements and situation awareness scores. The third focus area was task analysis.

A shift technical advisor was part of the initial staffing plan that was described in the design certification application. We needed to see how NuScale had, what NuScale had done with the tasks that had been previously assigned to the shift technical advisor to verify it was reasonable.

So we thought that if we found that, one, the test methodology was adequate and the scenarios were indeed challenging, two, the test results were supportive of the new minimum staffing level, and three, the task previously assigned to a shift technical advisor were reasonably reallocated, then we

would have sufficient technical basis to approve the topical report.

So I will now describe our findings and our observations related to each of these three focus areas in more detail.

Next slide please. We conducted a remote audit in August of last year, shortly after we received the topical report.

During the audit we watched recordings of all six of the scenario trials. We also reviewed the list of tasks that had been initially assigned to the shift technical advisor and NuScale's justification for the reassignment or elimination of those tasks.

We also reviewed the revised staffing plan validation test report, which included detailed task performance workload and situation awareness results. We also reviewed the workload measurements and independently confirmed the reported workload scores.

We also learned that NuScale had conducted a readiness assessment prior to the revised staffing plan validation test. This readiness assessment used the initial staffing plan validation test scenarios with a three person crew.

So we also reviewed those results, recognizing of course that this was not NuScale's

official validation test to see how the three person crew performed compared to the six person crew that originally performed those same three scenarios.

Next slide please. So I'd like to now begin discussing our findings and observations related to our three focus areas, starting with the revised staffing plan test methodology, which also includes the design of the scenarios.

Next slide please. As you heard Doug speak about earlier, NuScale used the same test design methods, data collection methods and performance measurements that were used during the initial staffing plan validation test and integrated systems validation test, which we were familiar with from the DCA review with two minor changes. And as discussed in our safety evaluation, those were acceptable changes.

During the August audit we also observed that the test trials were administered by NuScale in accordance with the test procedures, which were also the same as those we had previously reviewed for the DCA. We also focused on the contents of the test scenarios.

An acceptable minimum staffing level is one that can successfully accomplish the most

demanding tasks under conditions that reflect real-world challenges, including the demands of multi-tasking. Therefore, we assessed whether the scenarios created challenging conditions for the three person crew.

By design, scenario one simulated core damage. Which would be expected to increase the stress level of the test participants. Increased stress could challenge the crew to complete tasks satisfactorily.

Scenario two simulated an event described in the low power shutdown PRA, which also had severe safety consequences for a module. The scenario was made more challenging by design, by including additional events on another module to increase the workload of the crew. These events could also challenge the crew to complete tasks satisfactorily.

Scenario three simulated an event that affected all of the units at the same time and the crew needed to manually shutdown each of the modules. This scenario presented the challenge of performing a relatively high number of tasks, which increased workload for the crew and therefore could also challenge their ability to complete tasks satisfactorily.

These scenarios simulated events for which the safety consequences for one or more modules were relatively high compared to the consequences of other events. And also created situations where the crew had to perform a relatively high number of tasks.

These situations would be expected to challenge the crew by increasing both stress and workload. As such, we concluded the scenarios were sufficient to challenge the crew of three individuals to perform their assigned task satisfactorily.

Next slide please. So next I'll discuss our review of the test results, and also the results of the readiness assessment.

Next slide please. Successful task performance is the main criterion for evaluating a proposed staffing level. It is also important to measure workload levels and find they are not excessive because high workload may cause degraded task performance.

Another factor impacting task performance is situation awareness. The crew may not perform the tasks accurately or on time because they misunderstand the current plant state. Therefore, we reviewed the task performance data, workload scores and situation awareness scores, which are provided in the revised

staffing plan validation test report.

Appendix Alpha to this test report shows all of the tasks in the scenarios, whether the task was completed. And for tasks with a time limit, the time it took the crew to complete the tasks.

We found that all tasks in all three scenarios, expect for one task, in one trial of scenario three, were completed satisfactorily during the scenarios.

The one task that was not completed was considered an independent type of task. It was an administrative task with no time limit.

Independent tasks may be stopped when a plant transient occurs. Because these tasks will be of lower priority than any task the crew needs to perform to stabilize the transient.

In the scenario we observed that both crews stopped the task to address a transient that occurred on a unit, which was reasonable given that the independent task was lower priority. Accordingly, we found that the task performance results support the proposed staffing plan.

In the topical report, Table 5-1 titled RSPV average workload data, this table shows the average lowest and highest workload scores by crew

position. Workload was measured on a scale of zero to 100.

The lowest average workload was ten, which was reported by RO2, were the additional reactor, and the highest --

MEMBER BLEY: Can you tell us what a ten means?

MS. NIST: Say that again please?

MEMBER BLEY: Lauren, can you tell us what a score of ten means? I have no idea what it means.

MS. NIST: Oh, absolutely. So workload is measured using NASA TLX. They are, workload measurements are on a scale of zero to 100, where zero is no workload and 100 is the highest workload measurement to achieve. So a ten would be considered low on that scale.

MEMBER BLEY: Okay. And are there some kind of markers that help one decide what that means?

MS. NIST: I'm sorry, Mr. Bley, you're breaking up. Are there markers? I heard you say, are there markers to help someone --

MEMBER BLEY: Yes. Is it just, ah, out of the 100 that's a ten or are there some words that go along with the scale that help the person doing the testing evaluate that? Or do the operators themselves

evaluate that?

MS. NIST: So, both. To answer your question about the actual product that's reported with workload, the NASA TLX methodology, which was used here to measure workload, your output, or the product of that method is a numerical value on a scale, that falls on a scale of zero to 100.

And so, there are certainly, certainly there is some level of subjectivity here because in the NASA TLX methodology, the people who are doing the test themselves, so in the case the operators, are responding to, I want to say a questionnaire but it's really not a questionnaire, it's more of asking about six domains that are related to workload.

For example, cognitive and physical domain and how much demand they felt in that situation. So in that way it is a subjective report of workload.

So it's, like I said, it's six subscales and the operators report on how high they felt their workload was on each of those subscales.

And you can also tell from those workloads, scores and how the operators self-report, where they felt that workload was coming from. For example, was it coming from frustration or was it coming from lack of knowledge that this was a new

situation that they had never approached before.

So the criteria that, I guess you could say the threshold for workload, one that we have used in the past is, say anything, I think we even discuss this in our safety evaluation, that, for the NuScale control room design certification application, that anything above 75 was considered high workload. And certainly 100 would be excessive.

Did I answer your question?

(Audio interference.)

MS. NIST: I'm sorry, is that yes?

CHAIR KIRCHNER: Dennis, you're breaking up. Yes, you're breaking up, Dennis.

MR. SNODDERLY: Dr. Blew is on mute.

MEMBER BROWN: Okay. Can I ask one question. This is Charlie Brown again.

MS. NIST: Yes.

MEMBER BROWN: Can I ask a question while we're waiting for Dennis?

I may have misinterpreted, or not understood what you said. Was the workload determination based on the operators assessment of what his workload was or a auxiliary or somebody else that's more objective standing off and evaluating what things need to be done in the time things are being

actually accomplished?

MS. NIST: So, the answer to that both is yes. It just, there is a nuance here in the different methods that NuScale used.

So to measure operator workload, the NASA TLX that I discussed was used where the operator self-reports their perceived workload at various points in the scenario.

Now, during the test, during the scenario trials, NuScale also had observers standing back observing the crew and providing comments on any kind of issues that could have been related to high workload.

There was also the objective criteria in the -- each scenario, the scenario's acceptance criteria. And Doug and NuScale, I'm going to ask your help here because I don't want to get into proprietary information so please back me up.

But there was objective criteria about task performance that the crew had to meet. We consider, like I said initially, task performance, did the crew do everything that we expected them to do during this scenario, from NuScale's perspective. Did the crew do everything they were expected to. That's the top acceptance criteria.

If that doesn't happen or if there were challenges with that, having these workload measurements can help identify what the cause was. So, workload and situational awareness are both considered diagnostic measures. Because ultimately they help you, can help you determine whether there is a workload issue or some kind of other problem that's preventing the crew from understanding what's going on in the plant that could have negatively impacted task performance.

MEMBER BROWN: Another question was, during the scenarios or the running or obtaining this data, what, and this is something I'm not familiar with in the commercial world, what is the crew shift operation?

I mean, are they on and off every two hours or is it every four hours, every eight hours?

MS. NIST: Are you asking what is a shift cycle like for the individuals --

MEMBER BROWN: Right.

MS. NIST: -- who participated in --

MEMBER BROWN: Yes.

MS. NIST: -- this test that NuScale ran?

MEMBER BROWN: What is the actual shift schedule in an operating plant today?

MS. NIST: Oh, in an operating plant today.

MEMBER BROWN: That's my question.

(Laughter.)

MS. NIST: So most plants will do 12 hour shifts. However, some plants do eight hour shifts.

MEMBER BROWN: Okay. So an operator is there for eight hours. Let's just use the eight hour one.

So he is on duty for eight hours for the stuff he's operating, he's doing, that he's got to pay attention to?

MS. NIST: In an operating reactor, yes, work 12 hours. That's correct.

MEMBER BROWN: Okay. Now, when you ran these tests, were they eight hour tests or 12 hour tests?

MS. NIST: So I didn't, again, I'm staff, I did not run the test, NuScale --

MEMBER BROWN: NuScale ran --

MS. NIST: -- ran the tests.

MEMBER BROWN: Were they eight hour tests or 12 hour tests?

MS. NIST: These test lasted approximately two hours.

MEMBER BROWN: So they --

MS. NIST: Because the focus, go ahead.

MEMBER BROWN: No, that's, I'm not interested, well, I don't want to say I'm not interested. My concern here is that operators are on shift for eight hours. Pick an eight hour time. Or any time of that nature.

And so, by compressing the scenario evaluations into a two hour period, doesn't that give a false sense of the ability to maintain that performance level for an eight hour or a 12 hour period?

MS. NIST: Well, this goes back to what I was about to say about the focus of a minimum staffing test. It's, primarily the focus is on the most demanding task that can occur in the time in which the minimum staffing crew is only able, because they're the only ones there in the control room, to respond to the event.

So typically, generally speaking, that is deemed to be the first hour of an event because once the event occurs there is going to be a delay in, say, implementing the emergency plan and calling the emergency response organization staff to come back on site and man the technical support center.

They don't get help, essentially, for generally an hour after the event starts. So they need to be able to handle it on their own.

So I would say also, just on an unrelated note, and unrelated to this test, that in the integrated system validation, if I recall correctly, there was a scenario that lasted several hours. And again, those test results were reviewed as part of the DCA. And again, showed acceptable task performance and workload results as well.

So it's not, I wouldn't think it would be all that realistic to discount the fact that after some amount of time the crew does get extra help, in severe events at least, from the offsite organization.

MEMBER BROWN: Is that people coming into the control room or is that just people going to the technical support center?

MS. NIST: It might be staff coming into the control room as well as into the TSC.

MEMBER BROWN: Is a response time noted in any period in order to get people into the control room?

Are there any regulations that govern that say they need to be there within an hour or two hours or four hours?

My concern here is that these tests were run in a somewhat non-similar matter to a real work operation when you're sitting there. Have you ever had to sit at your desk for eight hours and your eyes stay open?

MS. NIST: Oh yes, actually. Certainly in the Navy I did have to do that. And it's challenging.

But again, we're talking about here, what we're looking at is, is a three person crew going to be able to handle the most demanding circumstances that realistically could occur. And so, to stimulate that is what we at least, as the staff, are interested in.

MEMBER BROWN: But it was a task oriented not a prolonged shift operation that three people can reasonably respond to?

I mean, your alert level, I mean, I'm old so I know my alert level is not eight hours constant. It goes up and down.

(Laughter.)

MS. NIST: Yes. But that's why --

MEMBER BROWN: It's a lot different --

MS. NIST: That's why even operating reactors today, and certainly as part of this NuScale design, it's important to have a notification system

that alerts the operators when something needs attention.

MEMBER BROWN: I'm just questioning the validity of anything that's operated on a test scenario that runs about two hours. And everybody determines that they performed the tasks, multiple tasks, as they were sequenced in during a two hour period vice and eight or 12 a hour period without the breaks, with simulating an actual plant scenario or circumstance. Operating circumstance.

It just seems to me the test data is skewed in that circumstance. That's just my observation. I'm finished with that.

MS. NIST: Okay, thank you. I'm going to move on here. So let's see, where was I.

Okay. Workload was measured on a scale of zero to 100. The lowest average workload was ten for, was measured by one the additional reactor operators, also known as RO2. And the highest average workload was 28, that was measured by RO1.

The topical report also states that the maximum workload measure during all trials was 80, which occurred during one scenario for one control room supervisor.

The subscale was frustration, which is

reasonable considering that the crew was, by design, not able to do anything to preclude core damage for a module during that scenario. And this was initially part of the scenario design to increase stress and make the scenario more challenging.

Given the relatively low workload scores overall, the workload results support the proposed staffing plan.

The topical report, Section 5.3.5 describes the situation awareness scores in states. The range of scores were 90 percent to 100 percent. The average situational awareness score was 97 percent.

Given these high scores and that they remained high during the challenging high workload conditions, the staff concludes that the situation awareness scores support the proposed staffing plan.

Taking these results together shows that even when measured workload reached relatively higher levels, test performance was not negatively affected and situation awareness remained high. Therefore the test participants maintained awareness of the condition of the plant even during the most challenging situations.

Accordingly, the staff concludes that

these results show that the three person staffing proposal is acceptable. Additionally, we reviewed the results of the readiness assessment.

NuScale explained to us that it was possible, though not very likely, that the test participants could have looked at the initial staffing plan validation scenarios in the initial staffing plan validation results test report.

Based on our discussions with NuScale, we did agree with them that although not entirely beyond the realm of possibility, it was highly unlikely that the test participants studies the initial set of scenarios before they did their readiness assessment. And so we did consider those results in our review since it allowed us to do an apples-to-apples comparison of the six person and three person crews for the same scenarios.

We saw that task performance for the three person crew during their readiness assessment was comparable to that observed during the six person test. Also, average workload scores during the readiness assessment were relatively low and were generally comparable to those measured in the six person test.

The average situation awareness results

were also relatively high and comparable to those for the previous test. As such, they also showed support for the three person staffing proposal.

Next slide please.

MEMBER BLEY: Well, before you move on --

MEMBER BROWN: Normally -- yes.

MEMBER BLEY: This is --

MEMBER BROWN: Go ahead, Dennis.

(Laughter.)

MEMBER BLEY: I've been gone for a while. My internet crashed here.

Back when I was still with you I was about to ask more about the workload scale. And I'm not familiar with NASA's TLX, but I'll look at it after this meeting.

There is many kinds of workload, and measures of workload, but two of the most obvious are either cognitive workload is high or just your mechanical workload is high. You're doing a lot of things, but it's pretty easy to do.

If you get a high score on this kind of mechanical thing it probably doesn't mean it's very challenging. If it's cognitively challenging though, that's a different situation.

Is there any discrimination between

different kinds of workload in the scoring method and in the testing?

MS. NIST: So, I would have to say that in this general environment with the operators mainly sitting here at their computer monitoring the displays and using the computers and the screens primarily to take actions, there is a subscale for physical demand. So that gets factored into the workload calculation.

So in general you would expect that here you would see lower scores related to the physical demand. There are certainly subscales that relate to the cognitive demand.

Off the top of my head I'm going to ask one of our, phone a friend and ask someone to chime in and look up the six subscales since we keep talking to them. But I --

(Simultaneous speaking.)

MS. NIST: Go ahead.

MS. D'AGOSTINO: This is Amy. Okay. This is Amy D'Agostino. I can provide those subscales. It's mental demand, physical demand, temporal demand, overall performance, effort and frustration level.

MEMBER BLEY: Amy, are they weighted?

MS. D'AGOSTINO: Are they weighted? They can be both weighted and unweighted, depending on how

you use the NASA TLX.

I believe, and Lauren can correct me if I'm wrong, I believe that they were unweighted in this particular usage.

MS. NIST: That's correct. That's correct.

MEMBER BLEY: Thank you.

MS. NIST: And the weighting doesn't necessarily, the weighting is actually, somewhat subjective as the weighting is done by subject matter experts before the test is administered to the test participants.

MEMBER BLEY: Yes, but it isn't weighted so I'm interested in your, Amy's thoughts on that because Amy's studied this and you've lived it. It seems to me there is a real difference between those four subscales. On their impact, on the likelihood of people doing things right.

MS. D'AGOSTINO: So, this is Amy again. So in general, the unweighted NASA TLX is a validated measure that's been used across domains.

And so, honestly it's the more typical usage to use unweighted scores. So I think it's an appropriate usage here.

I believe, and this is stretching my

memory, but hopefully Lauren can chime in, in the original staffing plan validation there was both weighted and unweighted. And they looked at the scores and we weren't seeing, there was no, I believe there were no differences really seen there. Is that correct, Lauren?

MS. NIST: Yes. There was really no significant difference at all.

MEMBER BLEY: Of course, not having really looked at it my first comment would be, well, it probably depends on how you did the weighting. But before you go on, I'm just going to say something that aligns with what Charlie was saying.

But I don't really want to say the tests aren't useful, I think they're extremely useful. But we're using these tests to make some kind of radical shifts in practice so they come up.

When you do test, I don't think there is any way to create any sense of economic pressure. If you're in a real plant there is some pressure to keep making megawatts even though we always say there is not. We're not worried about that.

There is knowledge that we can't hurt anybody or anything in the simulator. So the kind of things that can really spin one up might not really

occur here.

And the other thing is, you know some things coming on the aircraft business, after worrying about this, they actually put pilots in the simulator for a whole flight, and they don't do anything. So that when they're in the simulator and something goes wrong, it's more like the real world then it's a surprise. Here you know pretty sure something interesting it going to come at you very quickly.

I'm interested in how you thought about these things, and maybe other ways testing isn't exactly like the real world, and why your comfortable saying from these test results, more willing to make, I'll so call it a radical change in practice, before we have any real operating experience with a plant like this.

MS. NIST: I understand. So, one thing I would say is, first and foremost, that these, I mean, these test results are a large part of providing our confidence as well. There is a lot of margin.

So there of course, our artificiality is in the test environment, as you've pointed out. And that's a reality that we all need to consider, anyone needs to consider, when using simulators for coming up with a staffing plan or licensing operators for a

license, for example. That's another area where we rely on simulation a lot to make licensing decisions.

And so, the fact here, I think one thing I would add, and I'll ask my colleagues to jump in if they have any other ideas, or anything to contribute, is that there, what I see, at least in these test results, is a lot of margin to acceptability. The lower levels of, or what would be considered not acceptable.

So, the situation awareness scores showed that the crew was able to understand what was going on in the midst of everything else that was going on around them. The task performance. All the tasks that they were expected to complete were completed within the times that they needed to be completed that were dictated in the scenario guide.

The workload scores. There's a lot of margin in the workload scores. There is really very few points of even reaching what would be considered high workload.

So on that I'm going to just add, let my colleagues have a moment to chime in if anybody has anything else to say. I don't know if they do or not.

MR. GREEN: Hi, this is Brian Green, the human factors team leader. I think Lauren has made

some great points there.

And to kind of build on that, I just wanted to point out that there are a series of number, a number of tests that are run and a number of measurements that are used. And one of the points we're trying to make is that they're kind of triangulating towards a consensus. Towards a certain point that the plant can be safely operated under these conditions.

So while I agree that the workload measurement tool, it's a single measure. It has been validated in many, many studies.

But it's not the only part that's supporting the case so we're going to try and continue to paint this picture about how all of these measures are supporting our claim.

MS. NIST: Yes. And that was another reason too, Dr. Bley, why we, when we were told by NuScale they had done another test and used the same scenarios that they had used for the staffing plan validation test, we wanted to see those as well so that we could have additional data points.

I would also say that we went back and looked at the results from the staffing plan validation test and the interrogated system validation

test, and again, there was a lot of margin in those tests as well, in all of the performance measurements. Low in general. Very low workload scores, high situational awareness scores and acceptable task performance.

MEMBER BLEY: You told us a bit about the workload score. Can you tell us a little bit about the situational awareness score and how that, what it looked at and what added up and who judges it?

MS. NIST: Yes. And I'm going to let NuScale jump in if I get into anything proprietary since they were ultimately the ones that used the technic here. But generally speaking --

MEMBER BLEY: If we need to defer this to the closed session that's fine.

MR. BOWMAN: Lauren, this is Doug. We will talk about situational awareness scores in the closed session, and we have some examples we can talk about.

MS. NIST: Okay. And then if that's acceptable, I'd like to defer that to the close session and move on.

MEMBER BLEY: Yes.

MS. NIST: Thank you.

MEMBER DIMITRIJEVIC: I have a question

about units. Those tests were performed for one unit?

MS. NIST: The tests were performed across a variety of units. The tests simulated all of the, the maximum size the NuScale plant could be with the maximum number of units operating that would be realistically operating.

MEMBER DIMITRIJEVIC: My question is, if the test is run on one unit and nothing else is happening on other units, that's what I was --

MS. NIST: No. No, there were multiple units, events occurring during the scenarios.

MEMBER DIMITRIJEVIC: Okay. So this (inaudible) measures situation where you could have like things are cooling on all units?

MS. NIST: Yes, ma'am.

MEMBER DIMITRIJEVIC: All right.

MS. NIST: Yes. There were, across the scenarios, which if we want to discuss more details with them my understanding is we're going to have to do that in the closed session.

But during each of the scenarios there were points or breaks where the workload and situational awareness where questionnaires were given to the test participants to take those measurements.

MEMBER DIMITRIJEVIC: All right. We will

see this more, I guess, in closed session. Okay.

MS. NIST: Okay. Let me see here. I'm just going to get my bearings again.

CHAIR KIRCHNER: I think you're going on to STA. Before you do, Lauren, this is Walt Kirchner. Just again, following up on Charlie's observations, and Dennis'.

You know, if you're on that midnight to eight shift and it's early in the morning, there is a certain amount of fatigue, compensated by coffee I supposed. That's the way it was done in my world.

But seriously, sometimes at 0 dark hundred that things go wrong. It could be a competition between matching a demand for load to provide energy. And that would be maneuvering multiple units. And at the same time then you have, and as Dennis said, there is that implied pressure.

You're in the business of generating electric. Keep the modules up, not to take an unnecessary scram, if in doubt.

And if you're in that situation then you, much like TMI, you've got some failure out there in a component. At first it may not be very serious at all, but it could evolve.

I think the NuScale design has significant

improvements in terms of safety so I'm not going to try to get into the design features. But just those kind of scenarios, do you think these three scenarios sufficiently bracketed the demand that will be put on the three person's crew?

MS. NIST: So that was --

CHAIR KIRCHNER: Under real operating conditions.

MS. NIST: Sure. So as I said previously, there is always going to be artificialities in the test environment.

We did consider, primarily, that's what we were looking for was, are these scenarios representative of what could potentially be the most demanding. And the fact that they looked to the events that are relatively the most severe, could have the most severe consequences, that's going to put pressure on the crew.

So I think that the events that were selected for ideal for simulating very severe, important conditions for the crew. To the extent that you can do that in the test environment.

I'd also like to add that, and I said this before, but we did observe all of the test trials. And so we watched recordings of the test trials as

part of our audit.

So in our observations we, it appeared to us that the crew was managing very well to perform their tests. Their tasks.

There were a couple of incidents where we had some discussions with NuScale about resource management, which were resolved. Our concerns were resolved.

But all in all, our observations also landed, or provided us with confidence in the acceptance of the proposal. Before I go on I'm going to check --

(Simultaneous speaking.)

MEMBER BLEY: This is Dennis again.

MEMBER BROWN: Go ahead, Dennis. I'm sorry.

MEMBER BLEY: Were you going to respond to anything more there?

MEMBER BROWN: Yes. I had a question on this.

MEMBER BLEY: Oh, then let me go ahead then.

MEMBER BROWN: Yes, go ahead.

MEMBER BLEY: I want to ask you a couple of things about the STA. And I don't usually focus on

the legal and rule base side of things but here I'm a little --

MS. NIST: That's fine. Yes.

MEMBER BLEY: -- a little off by the way this is being presented.

In the topical report it points to NUREG 0737, which is the clarification to TMI action plan requirements, which was published a year and a half after the accident, roughly.

But it was five years more, well, four years, four to five years more, before the Commission came around to coming up, finalizing their policy statement in this area. And I want to read it to you.

And then my question is going to be, kind of, why aren't we focused on what's in the policy statement. Because I think that has more weight. I think it should give more weight on the Staff then the NUREG the Staff prepared.

So, under the policy statement they gave two options. One is to continue with the STA as a separate item, and the other one is to have a combined STA and SRO.

And I actually want to read part of this because I don't know why it slipped away and why it's not being referenced.

In Option 1, this option is satisfied assigning an individual with the following qualifications to each operating shift crew as one of the SROs, as required by 10 CFR 50.54.

A, a licensee or operator on the nuclear power unit, to which assigned, and b, meets the STA training criteria of NUREG-0737, which they talked about, and one of the following educational alternatives. There are four. Bachelor's degree in engineering, professional engineer's license obtained by a completion of DBE examine, a Bachelor's degree in engineering technology or a Bachelor's degree in physical science.

And there isn't a fifth. Why is everybody ignoring that?

MS. NIST: So let me say, we are, very clearly, we're not ignoring it, we have not ignored it. And the next, the remainder of our presentation actually goes into a lot more detail about the portion of this proposal that eliminates the shift technical advisor.

And I think that if we continue with the presentation we might address, we will address, this very issue of the policy statement and where the Commission was, has come down on the shift technical

advisor.

MEMBER BLEY: Okay. I'll be quiet and listen, with one last point. I'm wondering if you felt the need, or not, to go back to the Commission for --

MS. NIST: Yes, sir. That's why we --

MEMBER BLEY: -- involved?

MS. NIST: That's why we're writing the information SECY. Is to inform the Commission that this policy is not going to be implemented at this design. That's the purpose of the SECY paper that Getachew touched on. And we can certainly talk more about that paper today.

MEMBER BLEY: Lauren, thank you very much. And, Walt, back to what you said at the beginning. I don't see how we write a letter until the policy paper goes up.

CHAIR KIRCHNER: Yes. Write --

(Simultaneous speaking.)

MEMBER BLEY: -- policy paper.

CHAIR KIRCHNER: I agree with you, Dennis. I think, I don't know that there is, how should I say it, a short-term need for this letter. I think we need to wait for that, that informational SECY, as part of our deliberations.

MR. SNODDERLY: So this is Mike Snodderly from the ACRS Staff. If I could ask Hitachi to please confirm that we had discussed in previous interactions that the information SECY is still under development, but the Staff's plan is that there is no new information in there that is not within the SE, is that correct or not, Getachew?

MS. NIST: Mike, I believe that's correct.

MR. SNODDERLY: Thank you, Lauren.

MS. NIST: I had just reviewed it.

MR. SNODDERLY: Okay. And someone from the Staff. I'm sorry, I didn't mean it to be Getachew, whoever is, yes. So hopefully that will assist the committee in their decision.

MEMBER BROWN: Okay, I waited till after Dennis. Dennis, are you done?

MEMBER BLEY: Yes, Charlie. I said I'd shut up but I have to answer you.

(Laughter.)

MEMBER BROWN: Okay. Thank you. Just an observation relative to tests.

You went through and discussed in the topical about running DBEs and beyond DBEs and BBEs or whatever, of the alphabet soup. And if the tasks were performed without overwhelming everybody and all that

kind of stuff.

But the reality of this plant is that 12 plants, they could all be operating, correct? At one time, providing power to the grid.

And that you could have a design basis earthquake where part of the plant is shutdown, part of them keep operating and one has a design basis accident. And I'm trying to figure out how one person plus a substitute, an additional reactor operator and a the CRS, the control room supervisor, you don't have an hour to do anything. You've got almost no time at all.

Do you want all the plants to shutdown, how fast can you do that?

How do you establish that they're all on a decent satisfactory state while you're handling, even though your passive plant is design basis, I mean, your protection systems are shutting the other plant down and your passive systems are going into operation, that's a realistic scenario you can have. It's not like we don't have earthquakes.

MS. NIST: Absolutely.

MEMBER BROWN: And so I have, it's just running these tests with isolated circumstances like that without a full shifts worth of fatigue, it just,

for some reason, seems, to me, to skew the data.

And even stepping back from forget the data but look at the actual configuration of these 12 plants all operating, all supplying power in parallel to the grid, an earthquake occurs, some shut down, some don't, and one you have accident in. An admittedly, no operator action is required for that but you've got a lot of crap, excuse me, a lot of stuff to deal with and you've only got one, maybe two people, to deal with it.

That just seems to me, that's where I lose the commonsense test. And it's not that I disagree, that I don't like the analysis and the stuff you all put together, and that NuScale put together, it's just, I've lost it on the commonsense test right now.

MS. NIST: Well, I --

MEMBER BROWN: So I'm just letting you know where --

MS. NIST: No, I understand. And I think for us, me speaking on behalf of the staff here, is that yes, there, I don't know that I agree that there is so much more stuff to do with this plant.

And so I really hope that we'll discuss this more in the closed session. We can go into more detail about the actual scenarios. And maybe NuScale

can talk more about the kinds of tests that operators do do and would maybe do during such an event.

But there just isn't a whole lot of stuff that, tasks that need to be done and need to be done even within an hour.

So let's move on now to, I think the part of the presentation that has been the most anticipated, and talk about the shift technical advisor. And Maurin is now going to talk about our review, the shift technical advisor task analysis that NuScale performed, as well as additional information that we considered in our review of the proposal to eliminate the shift technical advisor for the NuScale plants.

So now I'm going to turn it over to Maurin.

MS. SCHEETZ: Thanks, Lauren. Can you hear me okay?

MS. NIST: Yes.

MS. SCHEETZ: Great. All right, good morning. I am Maurin Scheetz and I'm going to talk about this STA elimination piece for the NuScale design, as proposed in this topical report control room staffing.

Getachew, can we go to Slide 13 please?

Thank you.

So during the August 2020 audit we reviewed how NuScale dispositioned the tasks that had been previously assigned to the STA when they eliminated the position from the staffing plan.

We observed that task TSA previously performed were, one, eliminated because the task was a duplicate task and was already assigned to the control room supervisor and reactors. For example, evaluate plant conditions during transients.

Or two, reassigned to the control room supervisor and/or reactor operators. For example, monitor parameters on the safety display indication system.

We found that NuScale's disposition of the tasks was reasonable with a few exceptions that did not seem logical to us. There was several tasks previously assigned to the STA that involved assisting and making recommendations to the control room supervisor and shift management about whether an emergency action level has been exceeded and about the operability of plant equipment in the technical specifications. These were listed as tasks consolidated with the control room supervisor tasks.

In the revised staffing plan, the control

room supervisor and the shift manager roles can be combined, therefore we did not understand how an individual in the combined control room supervisor and shift manager position could assist or make recommendations to himself or herself.

So we issued a request for additional information to ask NuScale to explain why when the control room supervisor and shift manager positions are combined, there is not a need for an additional individual who is trained on operability determinations and emergency action levels to provide independent assessment and advice to the control room supervisor.

NuScale's response was that the second SRO on shift, as one of the reactor operators, will be available to help the control room supervisor with these kinds of tasks. Because the second SRO on shift is trained on the emergency plan, operability and technical specifications, the same as the SRO and the CRS role, NuScale's response was reasonable to us.

While reviewing the revised staffing plan validation test trials, we also observed that the second SRO on shift was available to assist the control room supervisor in this capacity. And that their workload as a crew member did not preclude

acting in this backup role. This was the only discrepancy that we found in the reallocation of the STA tasks.

MEMBER BLEY: Maurin?

MS. SCHEETZ: Yes.

MEMBER BLEY: My memory is maybe a little off. I thought in their topical they required three operators, one SRO and two ROs. Where does the second SRO come from?

MS. SCHEETZ: So they do require, the positions are, one control room supervisor who is an SRO licensed individual and then two reactor operators. One of those reactor operators has to hold an SRO license. So there are two SRO licensed individuals and one licensed RO individual in the NuScale minimum staffing claim.

MEMBER BLEY: Claims. I think I forgot that.

MS. SCHEETZ: No problem. That's very helpful to understand how this works here so I'm glad you asked that question.

Okay. So, as we watched the video recordings of the revised staffing plan validation test trials, we observed that the test personnel were able to perform the tasks that had been reassigned

from the STA to them. For example, reactor operator number two completed safety function status checks using the available interfaces in the main control room.

As Lauren just discussed, the results of the revised staffing plan validation and readiness assessment showed that the tasks were completed successfully in these scenarios without the STA. Therefore the test results support the elimination of the STA position by demonstrating that the tasks previously allocated to the STA can be performed by the other crew members while maintaining task performance workload and situation awareness at acceptable levels.

Next slide please. So now I'm going to talk about the factors that the staff considered as we looked at this STA elimination.

The STA position was established as an interim measure following the accident at Three Mile Island Unit 2, to improve the ability of the on shift operating crew to recognize, diagnose and effectively respond to plant transients and abnormal conditions. The long-term action was to improve the qualifications of shift managers and senior operators and upgrade the maned machine interfaces in the main control room.

It was intended that the use of a dedicated STA could be eliminated once the long-term goals were achieved. Even with the completion of the long-term actions, commission policy supported the continued use of the STA position to provide engineering and accident assessment capability and enhanced plant safety.

And that's 1985 Commission policy statement that we've been talking about a little bit earlier.

And in that 1985 Commission policy statement, the Commission specifically says, accident assessment is the immediate actions needed to be taken while an event is in progress.

We recognize that the STA is a valuable position that has been in place for over 40 years at nuclear power plants in United States. As such, we carefully examine NuScale's proposal for eliminating the STA.

Although we initially focused on what happened to the task previously assigned to the STA, we also had discussions with NuScale during the audit about other factors they identified that supported elimination of the STA position. These other factors, other than the design of the NuScale plant and main

control room human system interfaces, the reduced reliance and operator actions on a NuScale plant and improvements to the licensed operator training programs that had been implemented over the years following the accident at Three Mile Island.

Also, we searched for relevant studies and operating experience that we might be able to use to inform our review.

Next slide please. Now I'm going to talk through each of these individuals. Or more specifically.

NuScale control room HSI design. As discussed in Chapter 18 of the final safety evaluation report, we concluded that the NuScale control room design reflects state of the art human factors principles in accordance with 10 CFR 50.34(f)(2)(iii).

This is a regulation that was established after the accident at Three Mile Island. And its purpose is to ensure that human factors, engineering principles are implementing during the design of the control room HSIs to support safe plant operation.

Additionally, during the staffing plan validation integrated system validation and revised staffing plan validation tests, we observed that the test personnel could interpret plant indications to

understand the condition of all the units and what actions to take. And that situation awareness was high for the test personnel.

These observations that we had are consistent with the overall situation awareness measures that NuScale measured in validation testing.

A significant task that the STA performs at operating large light water reactors is monitoring the status of the critical safety functions during abnormal events. The STA has to use multiple indications to determine the status of each critical safety function for each unit.

In the NuScale design, each unit has a system that provides automated and continuous critical safety function monitoring. The main control room HSI design includes a unique feature for monitoring critical safety functions that provides, at a glance, assessment and understanding of critical safety function status.

This means that control room operators do not have to determine the status, the status is provided by the HSIs. However, I want to note that operators can check critical safety function status using diverse indications.

And they are able to easily and rapidly

determine critical safety function status for up to 12 units. And we observed that the crew is able to assess the critical safety functions well within the time that was established in the time related performance criterion for that task in the validation test scenario guides.

Next slide please. No immediate actions. The initial reason for having an STA was to provide engineering expertise during abnormal operations to ensure the effectiveness of the operating crew in responding to abnormal events.

For the NuScale design, there are no operator actions required in the response to any of the analyzed design basis events. And there are also no immediate operator actions required for any of the beyond design basis events that have been analyzed.

Because of this reduced reliance in operator actions, the staff concluded that the role of an STA and supporting operator actions during an abnormal and emergency conditions is less significant of a NuScale plant when compared to large light water operating reactors.

Next slide please.

MEMBER PETTI: Maurin, can I ask a question?

MS. SCHEETZ: Yes?

MEMBER PETTI: You know, there is an odd officiality to the design basis Chapter 15 events. Did you guys -- How do you -- It's really a question of completeness, that there wasn't some small event that tends not to be analyzed in Chapter 15 that could lead to something bigger but somehow you didn't, you know, you wouldn't see it if you just, you know, followed your regular course.

Did you guys think a little bit outside the box about any of that type of a scenario?

MS. SCHEETZ: Right. So you bring up a good point. So we call those the unknown unknowns, so what else is out there, but we don't have to, you know, regulate to that level.

It is a reality, you know. We definitely thought about that as we went forward. I guess we would point to, you know, these are going to be trained operators, you know, with procedures.

They have the availability, they have time to respond to, you know, situations outside of procedures based on the passive design of the plant. So we would, you know, think that the availability of that time to respond they could get additional help when they are in a situation where they are, you know,

plant conditions are not covered by training or procedures what do they do. Does that answer your question?

MEMBER PETTI: Yes. No, the time thing is a really important thing. Thanks for reminding me that is a critical component. Thanks.

MS. SCHEETZ: Okay.

MEMBER MARCH-LEUBA: Hey, since this is my favorite topic can I add something. In my opinion there is available study, I mean and it's available plant, right.

But there is a complete and absolute reliance on delivering what the computer says. So the operators are able to perform all the actions that the computer tells them to do because the computer is the one that processes the procedures and tells them this is the step you are now on and here is what you need to do.

And that's how they are going to be trained and that's how the things are going to work for the first 20 years of operation in the plant. The computers want to be right every single time.

But what we have to consider is at Year 25 something unusual happens, some instrumentation failures have creeped up and we have to remember that

most instrumentation and support equipment is non-safety grade because operator action is not required for DBEs so you don't have redundancy or diversity.

So it is the concern on Year 25 when you have this unusual condition and the operator will still believe the computer and we, by "we," I mean some members during the review, because ACRS never wrote the letter, recommended that the Staff and the Applicant their form evaluation of operator actions when the computer purposely and maliciously collides to that.

Everyone laughed and I haven't seen any result I guess, but this is going to happen. This is software based. Software makes mistakes. So I'm just putting the concept out and you don't need to answer unless you have thought about it, but the problem is over-reliance of the computer. Thank you.

MS. SCHEETZ: Thank you, Dr. March-Leuba. I think my response in this area I could point to the diversity of indications in the main control room.

So there is the safety display indication system which provides a redundant but independent set of indications for the crew. It also has alerts for the crew.

So if something in the plant monitoring

system or the model control system was different from the safety to plant indication system the crew could understand that or notice that.

There is also other capabilities of self-monitoring or monitoring other systems to provide the operator's information that something is off or not matching what the other systems are saying.

And we can maybe get, maybe NuScale can get more in the closed session to talk about degraded --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: My complaint is the display will have a red light and a green light and if the model is green everything is okay and you don't have to do anything with it and 99.9 percent of the time the green light will be correct, but occasionally you get a bad day.

My monitor, you have this like this, you know, and if the operators are not trained to do not believe the green light, oh, we rely on it but don't believe it, verify it, then you are asking for trouble.

By eliminating members of the control room that are supposed to be in the back thinking instead of pushing buttons you are making this problem worse.

Thank you.

MS. SCHEETZ: All right. Well, I would also say that from my observations of how this concept of operations and kind of operations works for the three-person staffing is the control room supervisor is still in that oversight role and before a reactor operator has to actually take an action on the plant they are providing backup and an independent look at what needs to be done or what the HSI is telling them.

So it's not just one person making a decision, it's the HSI telling the reactor operator and then the control room supervisor backing that up, so there is other layers in there.

MEMBER MARCH-LEUBA: And that's how the operating reactors today work. You have the supervisor in the back of the room telling John to go look at a feedwater and Pete to go look at containment, but he stays behind, he is not pushing buttons, he is up looking at the whole.

When you start reducing the staffing there is need of fingers to push buttons and there is not enough time -- I am asking when you reviewed all these situations is there enough time to think about what could possibly go wrong? Just think about it.

MS. SCHEETZ: Thank you. I will. Okay.

If there is nothing else on the immediate actions piece I am going to talk about license operator training programs now.

So the topical report prescribes the elements of the license operator training program for an applicant using the staffing plan. The training program will include training on generic fundamentals, which are the math, physics, thermodynamics, and component design topics that are of specific relevance to the operation of a nuclear power plant and also training on mitigating core damage.

These were NRC-mandated subjects for operator training in the aftermath of the accident at Three Mile Island to improve their ability to identify and respond to abnormal events.

Although the Staff has not reviewed and approved the training program for a NuScale licensee or applicant, which is a combined operating license item, we know it will be based on a systems approach to training and involve training and examination on a simulator. This is because of the existing regulatory requirements.

We agree with NuScale that training on generic fundamentals and mitigating core damage, use of a simulator during training, and implementation of

a systematic approach to training-based training programs are significant improvements to operator training programs that have been implemented following the accident at Three Mile Island.

These training program elements help provide assurance that operators will effectively identify and respond to abnormal events in the plant.

Current industry qualification standards for license operators do not require an SRO or an RO to have a degree. However, current qualification standards require that the on-shift STA has a technical degree or a professional engineer's license.

The Staff asked NuScale if there is any impact from not having at least one person on shift who has a technical degree of a PE license. We asked that in an RAI, Request for Additional Information.

In response to that RAI NuScale stated that there is no impact and that the license operator training program requirements listed in the topical report provides sufficient engineering knowledge for a NuScale main control room operator.

We agreed with NuScale that for their design the training program provides sufficient technical knowledge for safe operation and we concluded that the additional defense in depth

provided by an on-shift operator who has an engineering degree is not needed for the NuScale design because there are no operator actions during any of the design basis events and the on-shift operating crew has time to get engineering-related assistance from off-shift personnel, such as plant system engineers, reactor engineers, or other subject matter experts when they are faced with a situation that is not covered by training or procedures.

The Staff concluded that the license operating training program alone doesn't provide justification to eliminate the STA, but we found that the training program when combined with the other factors here in this diagram support the elimination of the STA at a NuScale facility. Next slide, please.

MEMBER BLEY: Lauren? I'm sorry, Maurin.

MS. SCHEETZ: Maurin.

MEMBER BLEY: I forgot who was talking. If we go back to 1979 and the TMI event the thing that led to this was the idea that when the plant gets in a condition that hasn't been examined in the training program and isn't expected then having someone who can creatively using their deeper knowledge base figure out what's going on.

I was giving testimony before an ASOB on

some other issue and the technical judge asked me, he said he didn't understand how the operators couldn't have known they had been in a saturated condition.

He said that he used to give exams to people at test reactors and when he'd ask a question like that they would reach in their back pocket and pull out the steam tables and say, well, I'll look right here, I can tell.

So how come that wasn't in the plant? So I know the training programs have pushed in that direction, but the idea of the STA wasn't to take care of the things we expect to happen, it was to help us out under a condition that we didn't expect to happen and to be able to respond to that.

So nothing I have heard addresses that piece of the issue.

MS. SCHEETZ: Right. So I think we're going back to the unknown unknown piece. So like I just said the crew has time to get engineering-related assistance if there is something that they face that is not covered by training or procedures, so they have, you know, an --

MEMBER BLEY: They did at TMI, too, but they didn't know what to tell people to help them.

MS. SCHEETZ: Right. Right. Okay. Well,

hopefully we can, you know, answer this for you. I am going to talk a little bit about finding some research and other operating experience next.

So we searched for relevant research and operating experience that we might use to inform our review. We found two studies that evaluated the effectiveness of the STA position of operating reactors in the first few years after the position was mandated.

After we completed our safety evaluation we also became aware of some studies that had been recently performed at the Halden Reactor Project. The Halden Reactor Project is an organization for economic cooperation and development and nuclear energy agency project maintained by the Institute for Energy Technology in Norway.

Halden Reactor Program's human technology organization research uses licensed crews to perform scenarios on various nuclear power plant simulators with advanced control room designs.

In the past Halden typically used Swedish operators for their human performance studies and in more recent years they have started using United States crews more frequently.

We reviewed two Halden studies that

concerned the shift technical advisor and one study that covered the use of large screen overview displays.

Now I will provide a brief summary of the results from these studies that concern the STA position and how we related them to the NuScale design.

The STA studies showed that the STA helps reducing workload. For NuScale the workload level and the NuScale control room is already very low as shown by this series of validation tests.

The STA studies show that the STA helps redundancy in operations, such as the STA helping the control room supervisor monitoring plant status and verifying operator actions.

For NuScale the control room supervisor maintains an overview of plant status and can verify operator actions using various displays at the control room supervisor work station and also displays that are centrally located in the control room. There are also very few operator actions for the NuScale design.

The STA studies shows that the STA gave independent recommendations when he or she was separated from the crew but lost their independence when placed in a position next to the control room

supervisor.

Groupthink, a psychological phenomenon, which in this study refers to a similar and incorrect way of thinking and reasoning between crew members, was observed three times when the STA was positioned next to the control room supervisor.

But none of those led to negative performance of the crew, suggesting that the crew had ways to break groupthink. Here we see that tradeoffs exist between the STA independence and the other crew members trusting the STA recommendations.

These tradeoffs were also identified in some of the early studies that the STA position performed for the NRC. For NuScale there is no STA, but that does not mean that there will be no or less groupthink.

Operators do have longer amounts of time to consider plant indications and respond to actions. Operators also have time to access -- Excuse me. Operators also have access to diverse information displays.

The availability of diverse information and more time to make decisions are ways to break groupthink as mentioned in this Halden study.

Finally, the large screen overview display

study shows a significant reduction in workload for crews when using large screen overview displays and that these types of displays support detection and performance of controlling actions and build a shared situation awareness.

For NuScale the control room design includes several different large screen overview displays and the Staff has observed similar benefits of these displays.

Next slide, please. The Staff --

MEMBER BLEY: Maurin?

MS. SCHEETZ: Yes?

MEMBER BLEY: I have a comment.

MS. SCHEETZ: Okay.

MEMBER BLEY: The fact that they were able to get out of these groupthink situations in the test that Halden did doesn't mean you'll always get out of it, you know.

When you read lots of accident and incident reports you see this problem cropping up and depending on the complexity of the situation people either find a way out of it or sometimes they don't.

So the dismissing of that problem seems premature to me.

MS. SCHEETZ: Dr. Bley, I don't think I

was dismissing it. It's definitely, you know, something that could occur and I think the point of the study was that the STA was actually involved in the groupthink when they were there in the control room positioned next to the control room supervisor so they weren't able to be independent.

And where we can go here is that, you know, the Commission Policy Statement in 1985 allowed the use of a combined SRO and STA position, actually the Commission preferred that option for implementing the STA.

You could still do the dedicated STA but the Commission preferred the combined SRO/STA role. So, you know, the study shows that that, you know, the STA, you know, contributed to groupthink in that position, in that situation.

However, I will point that there was no impact, no performance impact of the crew, so, you know, they were able to break the groupthink. Okay.

CHAIR KIRCHNER: Maurin, this is Walt Kirchner. I looked carefully at that particular Halden report. I guess I would have characterized it slightly differently.

It seemed like from the exercises they did that when the STA was in the control room with the

crew, the shift crew, things went better and that helped the crew overall.

But I thought their assessment of the STA in his or her function of independent advice was rated better when the STA was not there in the control room working with the crew.

MS. SCHEETZ: Right. From that study the crew preferred the STA in the control room, but the STA performed better when they were not in the control room, so that's where we are showing the tradeoffs.

CHAIR KIRCHNER: Yes.

MS. SCHEETZ: There is tradeoffs between, you know, being independent or having, you know, trust with the crew or situation awareness by being in the control room and that's a reality in operating reactors today with an STA.

CHAIR KIRCHNER: Yes.

MS. SCHEETZ: That's all we were trying to say there. Okay, I am going to move on. So this is kind of our summary or our conclusion on this STA elimination proposal.

So, again, we recognize that the STA position has been a valuable addition to operating reactors for over 40 years. However, the Staff found that the following elements as a group support the

elimination of the STA for a NuScale plant.

A NuScale control room HSI design which reflects state-of-the-art human factors engineering principles and includes features that alert the crew when a critical safety function is challenged and plant parameters have exceeded an emergency action level and if the system or component may be inoperable.

Next, the NuScale plant design which reduces operational complexity as compared to operating reactors does not require operator actions during design basis events and it provides an overall improvement in safety.

The results of the revised staffing plan validation which have demonstrated that operators can interpret the indications provided on the HSI with adequate performance across a variety of measures, the availability of a second SRO on shift who can provide advice, assistance, and an independent assessment of events, the license operator training program as detailed in the topical report which prepares operators to effectively identify and respond to abnormal events in the plant, and, finally, the on-shift operators have time without challenging plant safety functions to get assistance from off-shift

resources when faced with a situation that is not covered by training or procedures.

Given this combination of all of those elements I just stated the Staff found that the STA position is not necessary to ensure the safe operation of a NuScale plant.

We believe that the regulatory basis for the shift technical advisor has some flexibility and we are informing the Commission via an information SECY on this matter of eliminating the STA for the NuScale design since what NuScale proposes is different than what is intended by the Commission's 1985 Policy Statement for engineering expertise on shift.

Okay, next slide, please, Getachew. So that concludes the STA portion of this. In summary, we conclude that there is sufficient technical justification to provide reasonable assurance that the proposed minimum number of license operators is adequate to ensure safe operation of the plant. This concludes the Staff's presentation.

CHAIR KIRCHNER: Thank you, Maurin. Members, further questions of the staff?

Okay. We'll have another opportunity when we have our closed session after lunch.

At this point if there are no more comments from members I think what I would like to do is open the line to take any public comments. Could we do that, Mike, at this time?

MR. SNODDERLY: Yes. Makeeka, could you please open the line and then we'll ask if there is anyone from the public on. I believe there are members of the public on the line.

CHAIR KIRCHNER: Okay. Thank you.

MS. COMPTON: The public bridge line is now open.

CHAIR KIRCHNER: Thank you, Makeeka. To members of the public listening in, if you wish to make a comment please state your name and make your comment, please. I see one -- Okay.

Again, for members of the public if anyone wishes to make a comment please state your name and make your comment. We'll pause for a sufficient interval.

If there is anyone on the public line could you just acknowledge that you heard this request.

Hearing no comments, Mike, are we sure that the public line was open? I didn't detect any attempt --

MR. SNODDERLY: Yes. I'm a little concerned because as I said I know there were members of the public on the line. I have been getting requests for slides and I have been giving them.

CHAIR KIRCHNER: Yes.

MR. SNODDERLY: So --

CHAIR KIRCHNER: Well, let's --

(Simultaneous speaking.)

MR. MOORE: This is Scott.

CHAIR KIRCHNER: -- and just check again and make sure we have an open line.

MR. MOORE: This is Scott. I just called into the public line. I spoke, but nothing came out on your end.

CHAIR KIRCHNER: No, we did not get a transmission, Scott. Thank you for doing that.

MR. SNODDERLY: Scott, is there anything you think we should do further or troubleshoot?

MR. MOORE: I mean you could try to troubleshoot it during lunch and come back right after lunch and open it for comments.

CHAIR KIRCHNER: But there is someone trying to I think break in. It's a 1-3 number.

(Simultaneous speaking.)

MEMBER SUNSERI: Hey, Scott, this is Matt.

Scott, this is Matt. At one time you had kind of done a bridge, you talked to the people that were on the line and then you relayed that back to us through your Teams line. Can you do that?

MR. MOORE: Right. At that time you could hear me on the line but this time I spoke on the line and you couldn't hear.

CHAIR KIRCHNER: Could we just take a moment more and try to establish that public connection because once we break for lunch and go to closed session I am anticipating that we will adjourn from the closed session and that way we wouldn't be asking the public to standby indefinitely.

MEMBER BLEY: Scott, when you were on the public line were there people there?

MR. MOORE: There are five parties in conference right now.

MEMBER BLEY: Did they -- Maybe somebody could call back on the public line and see if any of them want to make a comment.

MR. MOORE: I'll try it now.

MR. SNODDERLY: Okay.

CHAIR KIRCHNER: Thank you.

MR. SNODDERLY: While Scott is doing that, Walt, I would like to add something concerning my

comments on the impending information SECY.

Kayla Gamin from OGC is on the line and perhaps she can weigh in on this, but the info SECY will provide a mechanism to the Commission that if they, they could direct the Staff to revise the existing 1986 Policy Statement.

There is not going to be a recommendation to do that, it's an information SECY and it's just going to relay what is in the safety evaluation as Laura Nist said, but I just thought I wanted to add that on the record or to make sure the Committee was aware of that, so it is a possibility.

MS. GAMIN: Yes, this is Kayla Gamin from OGC. That is correct. It is an info SECY but if a Commissioner chooses to convert it to a voting paper that could be done.

The Commission could also revise or rescind the Policy Statement if they choose.

CHAIR KIRCHNER: Okay. Thank you.

MR. MOORE: Member Kirchner, this is Scott.

CHAIR KIRCHNER: Yes, go ahead, Scott.

MR. MOORE: So I am talking to you through the public line right now.

CHAIR KIRCHNER: Excellent. So with that

let's once again ask are there any members on the public line who wish to make a comment, if so state your name and please make your comment.

MR. MOORE: Are there any members on the public line that would like to make a comment right now?

MS. FIELDS: Yes. This is Sarah Fields.

MR. MOORE: Okay. So right now the people in the room can hear you but you cannot hear them. You can go ahead and make your comment. Please repeat your name and then go ahead and make your comment.

MS. FIELDS: My name is Sarah Fields. There are a number of things that the NRC and the ACRS should take into consideration.

The only reason to reduce the number of operators in the control room is to save the licensee money. This is not something that is being proposed to increase reactor safety.

Right now there are certain operator actions under certain event scenarios that have not yet been determined. These aspects of the design in operator actions will be determined during the combined license application.

So all of the information about required operator actions under certain design basis events

have not been determined. During the NRC Staff's presentation the NRC stated that no immediate operator actions are needed in a design basis accident, of course that doesn't take into consideration non-design basis accidents.

However, there are scenarios related to boron dilution that would require immediate operator actions to prevent core damage and the ACRS is well aware of this and has done a lot of work on this.

So since many of those operator actions have yet to be determined I think it's premature for the NRC Staff to state that they can reduce the number of operators.

The NuScale design is a new design with no operational history. The design is based on certain design fabrication construction and other assumptions and those assumptions have yet to be tested by the real life operation of this proposed design.

Right now the only company in the U.S. that has plans to submit a combined license application is the Utah Associated Municipal Power Systems, or UAMPS.

UAMPS has no experience whatsoever in the licensing construction and operation of a nuclear reactor. If things go wrong it's the ratepayers in

small municipal communities in Utah and a few other states who will ultimately bear any financial responsibility.

The ACRS should take some of these factors, or all of these factors into consideration. Thank you.

CHAIR KIRCHNER: Thank you, Ms. Fields.

MR. MOORE: Thank you, Ms. Fields. I said room, but this is a virtual meeting so everybody on the other line heard what you just said. Did the court reporter get all that?

COURT REPORTER: I did.

CHAIR KIRCHNER: Excellent.

MR. MOORE: I just wanted to see if the court reporter got at all that and if he heard that.

CHAIR KIRCHNER: Yes.

MS. FIELDS: Thank you.

MR. MOORE: Is there anybody else on the public line? You're welcome, Ms. Fields. Is there anybody else on the public line that has any comments?

Okay, hearing none, Makeeka, can you please close the public line.

CHAIR KIRCHNER: Okay. Thank you, Scott, for your assistance, and Makeeka. Okay, with that we are coming up on the lunch break. It is now 1:25

Eastern Daylight Time.

I propose that we take a break until 2:30 Eastern Daylight Time and we will resume in closed session with the Applicant and the Staff. So this would conclude the public portion, open portion of our meetings.

Does any member wish to make a further comment before we close the open session?

MEMBER BROWN: Yes. Walt, only that I guess we're going to close the meeting out of the closed session so we should close out of this meeting, is that correct?

CHAIR KIRCHNER: Yes. That's my --

(Simultaneous speaking.)

MR. SNODDERLY: Yes, Charlie.

MEMBER BROWN: Okay, that's what I thought.

MR. SNODDERLY: If I could add a couple to help us to, a couple logistical things for the closed session. So, yes, all members and participants should leave this session, close out.

You had a separate invitation for the closed session. In that invitation I did have a control in there that I have to admit everyone into the meeting.

So when you first come in I am going to do

my best to admit everyone, but it's so I can better control who is coming in, so just be patient or realize that that is an impediment that we didn't have for this meeting but it's something I think we need for the control of the meeting.

After that we'll have a few minutes for me to go through the list of invitees and confirm with NuScale that we recognize everyone, because there is some people with just numbers that we might have to validate.

CHAIR KIRCHNER: Okay.

MR. SNODDERLY: And then we'll get started. So I will be there 15 minutes before 2:30 at 2:15 to start that process. I ask that you just be patient and then we will begin the closed session. Thank you.

CHAIR KIRCHNER: Yes. For members, just try and get back on the closed session around 2:15 so that Mike and the Staff can let you in.

With that then we will close this. I guess that is more correctly we'll be in recess and we will start again at 2:30 Eastern Time on our closed session with the Applicant and the Staff. Thank you everyone who participated this morning.

(Whereupon, the above-entitled matter went off the record at 1:28 p.m.)

March 9, 2021 Project No. 99902078

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Submittal of Presentation Materials Entitled "ACRS Presentation: NuScale Control Room Staffing Topical Report," PM-100281, Revision 0

The purpose of this submittal is to provide presentation materials to the NRC for use during the upcoming Advisory Committee on Reactor Safeguards (ACRS) meeting on March 16, 2021.

The enclosure to this letter is the nonproprietary presentation entitled "ACRS Presentation: NuScale Control Room Staffing Topical Report," PM-100281, Revision 0

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Jim Osborn at 541-360-0693 or at JOsborn@nuscalepower.com.

Sincerely,

Carrie A. Fosaaen
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Anna Bradford, NRC
Michael Snodderly, NRC
Michael Dudek, NRC
Getachew Tesfaye, NRC
Bruce Bavol, NRC

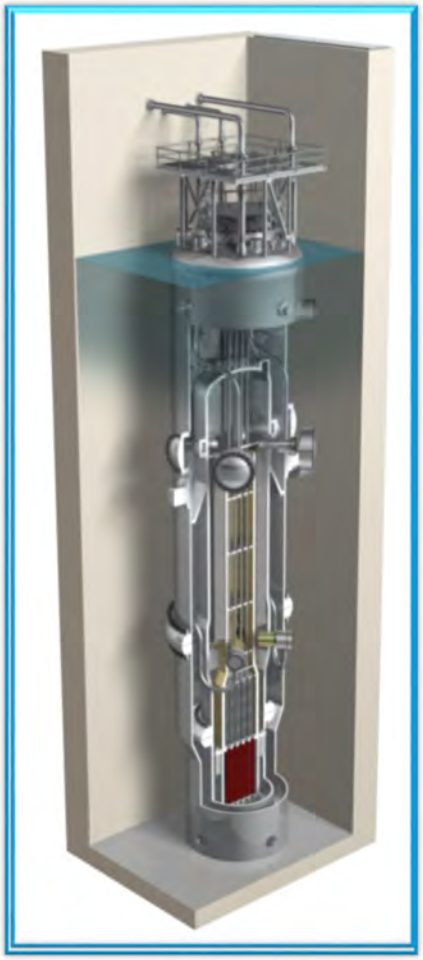
Enclosure: "ACRS Presentation: NuScale Control Room Staffing Topical Report," PM-100281, Revision 0

Enclosure:

"ACRS Presentation: NuScale Control Room Staffing Topical Report," PM-100281, Revision 0

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvallis, Oregon 97330 Office 541.360-0500 Fax 541.207.3928
www.nuscalepower.com

ACRS Presentation



NuScale

Control Room Staffing Topical Report

March 16, 2021

Presenters

Jim Osborn
Licensing Engineer 4

Doug Bowman
Plant Operations Supervisor

Patrick Leary
Senior Reactor Operator 5

Nadja Joergensen
Licensing Supervisor

Agenda

- Regulatory requirements
- Topical report purpose
- Topical report overview
- Design certification application (DCA) control room staffing
- Revised control room staffing
- Shift technical advisor (STA)
- Questions

Regulatory Requirements and Guidance

- NUREG-0800 Chapter 18
  - Appendix B- Methodology to Assess the Workload of Challenging Operational Conditions in Support of Minimum Staffing Level Review
- 10 CFR 50.54(m)
  - Minimum staffing requirements per shift for on-site staffing at nuclear power units
- 10 CFR 50.120(b)(2)(iii)
  - STA training program

Topical Report Purpose

- The topical report is intended to be used as an alternate method for a future licensee to establish minimum licensed operator control room staffing.
- A future license applicant will use the approved topical report as a technical basis to support an exemption request from:
  - 10 CFR 50.54(m), or
  - Other alternative control room staffing regulations (e.g., design certification rule)
  - And, 10 CFR 50.120(b)(2)(iii)
- This future licensee would adopt the control room staffing levels from the topical report as part of their Technical Specifications

Topical Report Timing

- Maintain same NRC Staff to review changes
  - Participated in multiple audits and visited the simulator several times
    - Knowledgeable on NuScale design
    - Familiar with the human system interface
    - Knowledgeable of the unique concept of operations
- Standard design application (SDA) to be submitted at a later date, and will incorporate by reference the topical report
- Provides pathway for future applicants to request exemptions and establish minimum staffing requirements

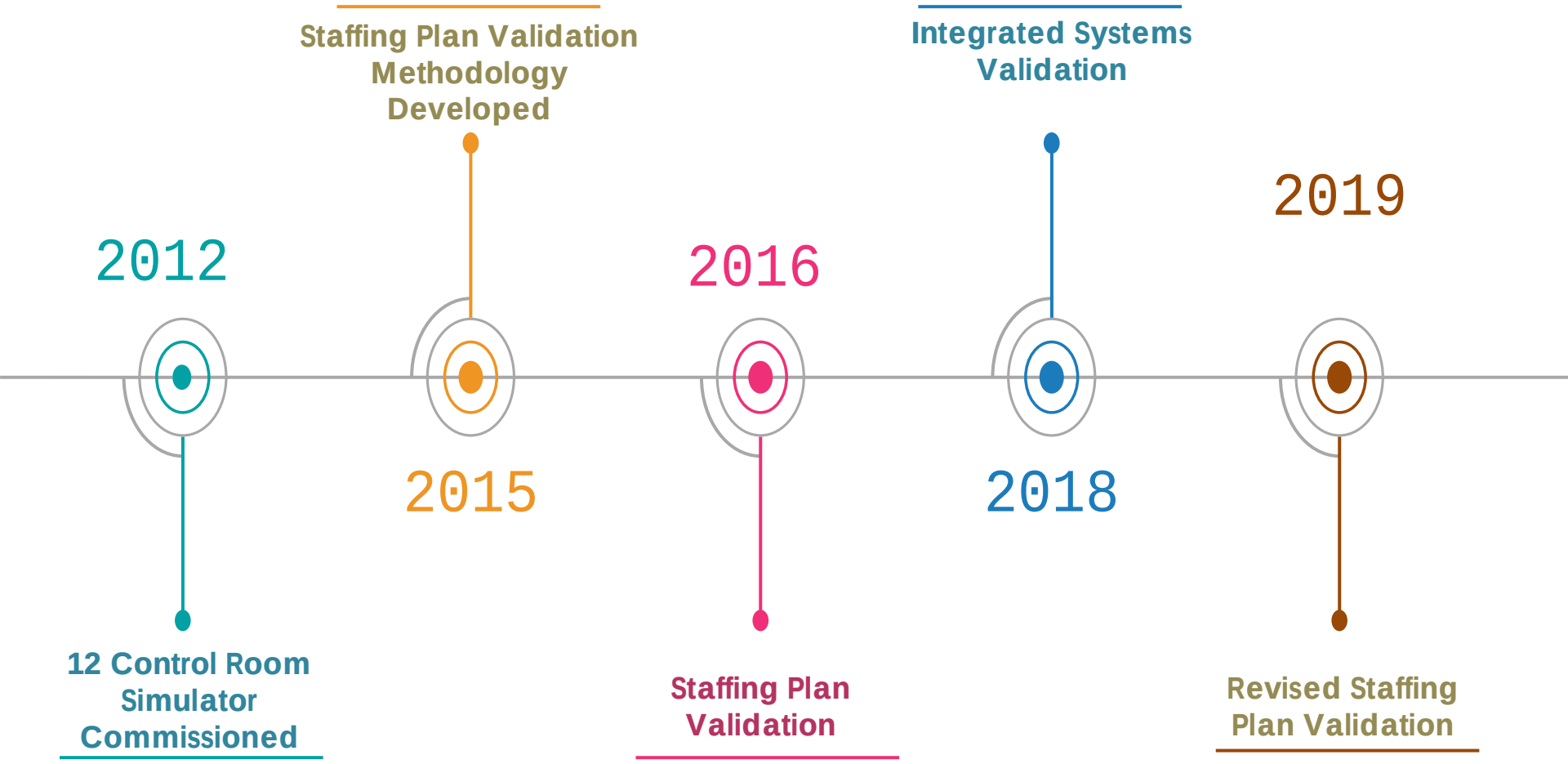
Contents of Topical Report

- Regulatory acceptance criteria and requirements
- Conditions of applicability
- Input to staffing plan from Human Factors Engineering Program
  - Task Analysis
  - Staffing and Qualification Analysis
- Analysis of the STA position
- Additional staffing considerations (RG 1.114 and senior reactor operator (SRO) oversight of refueling)
- Staffing Plan Validation (SPV) Trials
- Revised Staffing Plan Validation (RSPV) Trials

Key Referenced Documents

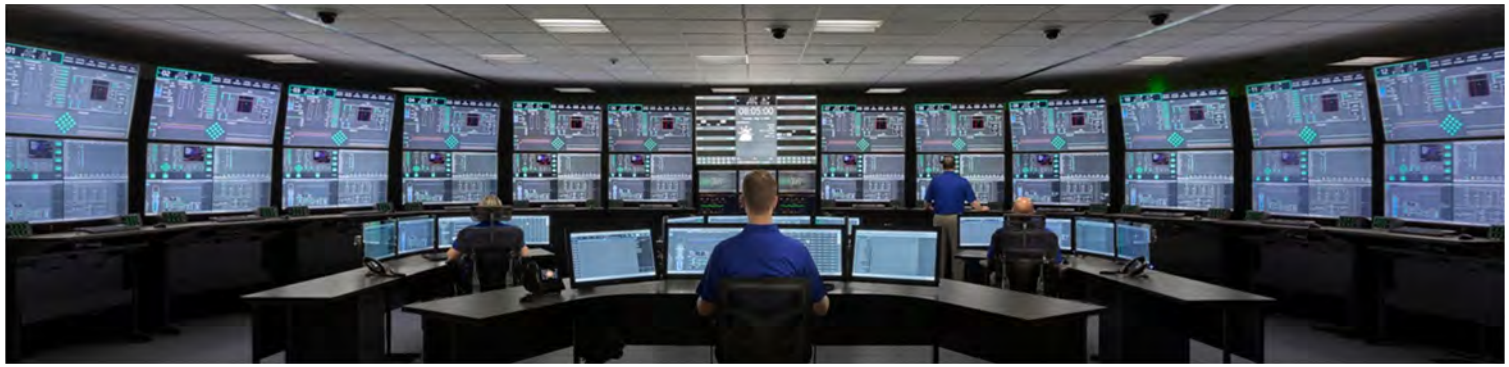
- Previously submitted documents
  - Human Factors Engineering Task Analysis Results Summary Report (no change)
  - Human Factors Engineering Staffing and Qualifications Results Summary Report (no change)
  - Control Room Staffing Plan Validation Methodology (no change)
  - Control Room Staffing Plan Validation Results (no change)
  - Concept of Operations (revised)
- New document for this topical report
  - Revised Staffing Plant Validation Test Report

HFE Timeline



DCA Control Room Staffing

- In 2016 NuScale completed a Staffing Plan Validation (SPV) to support the DCA
  - Performance-based evaluation of personnel using two crews of licensed operators
  - Verifies that a crew of 3 SROs and 3 ROs could safely operate the facility
  - NRC audited SPV activities, no significant open items identified
  - Demonstrated that the operator staffing validation methodology was sound



Regulatory Basis of Staffing Methodology

This validation was performed using the NuScale control room staffing plan validation methodology. This methodology was developed and conducted in accordance with the applicable NRC and other guidance contained in:

- NUREG-0800 Chapter 18 - Human Factors Engineering
- NUREG-0711 - Human Factors Engineering Program Review Model
- NUREG-1791 - Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)
- SECY-11-0098 - Operator Staffing for Small or Multi-module Nuclear Power Plant Facilities
- NUREG/CR-6838 - Technical Basis for Regulatory Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)
- Brookhaven National Laboratory Technical Report, “Methodology to Assess the Workload of Challenging Operational Conditions in Support of Minimum Staffing Level Reviews”

DCA Control Room Staffing

- DCA control room staffing requirements
  - DCA Part 7 proposes an alternative to 10 CFR 50.54(m) Control Room Staffing
  - Alternative staffing requirements to be codified in the design certification rule, applicable to applicants referencing the NuScale DC
  - Requirements implemented in Tech Spec 5.2.2

Number of Units Operating	Reactor Operator	Senior Reactor Operator
None	2	1
One to twelve	3	3

  - Allowances for temporary deviations provided in Tech Specs

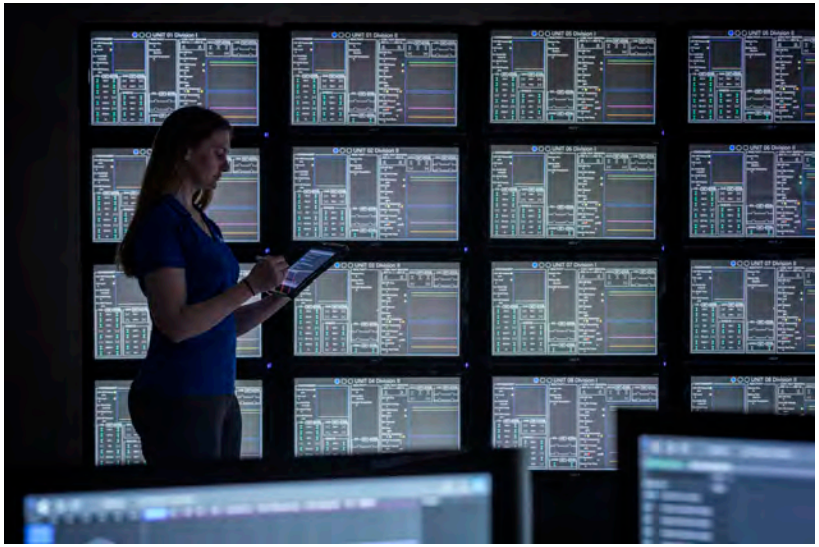
After Integrated System Validation (ISV)

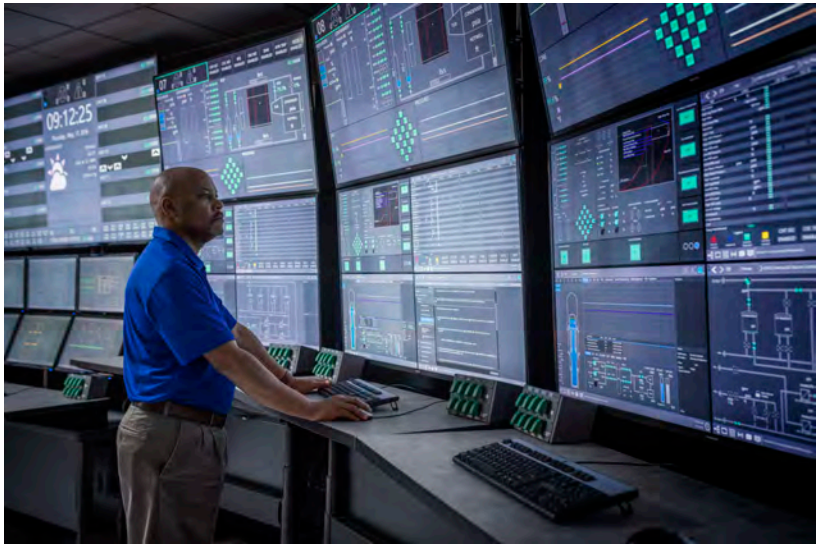
Additional staffing analysis; trial scenarios on three-member crews

- Four of the most challenging and workload intensive ISV scenarios were tested on a three-member crew
- All ISV acceptance criteria were met in all cases
- Using a proven methodology it can be shown that nuclear safety can be assured with three licensed operators

Inception of Reduced Staffing Plan Validation

- Two SROs and an RO
- Elimination of the STA
- Utilized the same methodology as the original SPV





Revised Control Room Staffing

- The same methodology was used for the original Staffing Plan Validation (SPV) and the Revised Staffing Plan Validation (RSPV)
- Minor differences between the SPV and RSPV are described in the RSPV Test Report

Revised Control Room Staffing

- Revised Staffing Plan Validation
  - One (1) RO and two (2) SRO
  - Implemented in Tech Spec 5.2.2

Reactor Operator	Senior Reactor Operator
1	2

Roles and responsibilities of the crew are discussed later

Topical Report Conditions of Applicability

- The set of attributes that allow a license applicant to use the topical report staffing plan
- Two parts:
  - design features
  - license operator training program attributes
- Encompasses the staffing assumptions used by NuScale during validation activities
- Applicants will be required to show compliance by evaluation or demonstration

Topical Report Conditions of Applicability

- Design Features
  - No operator actions credited in design basis event (DBE)
  - Two, or less, important human actions (IHAs)
    - Easily recognizable
    - Can be completed from the main control room (MCR) by one operator
  - Human-system interface (HSI) design retaining the following features
    - Critical safety function and defense-in-depth monitoring and display, with direct links to response procedures
    - Tiered alarm scheme
    - Computer-based alarm response procedures directly linked to alarms
    - Twelve-module trend monitoring

Topical Report Conditions of Applicability

- License Operator Training Program Attributes
  - Developed using a systems approach to training (10 CFR 55)
  - Include math, physics, thermodynamics, and component design topics specifically relevant to operation of a nuclear power plant
  - Training for mitigating core damage
  - Plant specific training, including:
    - plant systems
    - plant specific reactor technology (including core physics data)
    - plant chemistry and corrosion control
    - reactor plant materials
    - reactor plant thermal cycle
    - transient/accident analysis
    - emergency procedures

Topical Report Conditions of Applicability

- Staffing assumptions used validation
  - Refueling operations and module assembly and disassembly not directed from the MCR
  - A work control center is available for work management
  - The crew compliment includes one non-licensed operator to act as a communicator during emergencies

Concept of Operations

- NuScale submitted a revised concept of operations to support the revised staffing plan of the topical report
- Minimum licensed operator staffing
  - Control Room Supervisor (CRS)
  - Reactor Operator 1 (RO1)
  - Additional Reactor Operator

Shift Technical Advisor

- STA requirement established after the TMI-2 accident as an interim measure
  - NUREG-0737 states that, "… the STA position may be eliminated when the qualifications of the shift supervisors and senior operators have been upgraded and the man-machine interface in the control room has been acceptably upgraded."
- The topical report presents how these two conditions have been met for the NuScale Power Plant

Shift Technical Advisor

- Upgrades to training of licensed operators
  - NUREG-0737 training requirements now incorporated:
    - developed using a systems approach to training (as required by 10 CFR Part 55)
    - Includes the (generic fundamental) math, physics, thermodynamics, and component design topics that are of specific relevance to the operation of a nuclear power plant
    - training for mitigating core damage
    - plant specific training, including:
      - » plant systems, plant specific reactor technology (including core physics data), plant chemistry and corrosion control, reactor plant materials, reactor plant thermal cycle, transient/accident analysis, emergency procedures
  - Completion of the training is required by NUREG-1021, and specifically delineated on “NRC Form 398, Personal Qualification Statement-Licensee”.

Shift Technical Advisor

- NuScale Control Room Upgrades
  - HSI features that provides 'at-a-glance' assessment of plant conditions and facilitates early detection of degrading conditions
    - condensed and easily viewable overview screens, safety function displays
    - ease of navigation
    - universal display of active processes
  - safety function monitoring integrated into the man-machine interface
  - emergency operating procedures are embedded into the interface and directly linked to the safety functions
  - active monitoring of emergency action levels in the emergency plan

STA – Additional Considerations

- Additional Considerations for NuScale Power Plants
  - advances in design features reduce the need for additional oversight
  - the use of passive safety features and lower operational complexity have resulted in no required operator actions for design basis events, as well as improvement in overall safety
  - the design only has two IHAs associated with beyond design basis events that have a very small probability of occurrence
    - both IHAs are simple, straight-forward actions that can be completed from the MCR by a single operator
    - these IHAs also have large time margins to complete tasks that historically would need to be performed without delay

Human System Interface

Questions?

Acronyms

CRS	Control Room Supervisor
DCA	Design Certification Application
HFE	Human Factors Engineering
HSI	Human System Interface
IHA	Important Human Actions
MCR	Main Control Room
NRC	Nuclear Regulatory Committee
RO	Reactor Operator
RSPV	Revised Staffing Plan Validation
SDA	Standard Design Application
SM	Shift Manager
SPV	Staffing Plan Validation
SRO	Senior Reactor Operator
STA	Shift Technical Advisor

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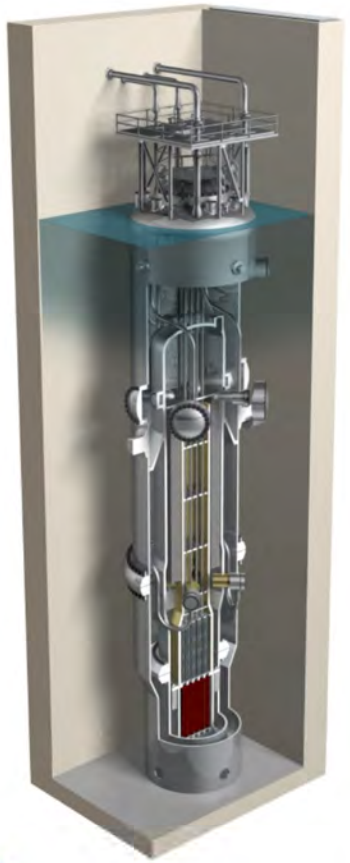
Suite 230
Charlotte, NC 28217
980.349.4804



http://www.nuscalepower.com
Twitter: @NuScale_Power

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Power for all humankind

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Protecting People and the Environment

Presentation to the ACRS Committee

NuScale Power, LLC (NuScale)

Safety Evaluation
NuScale Control Room Staffing Plan
Topical Report (TR)-0420-69456, Revision 1

March 16, 2021

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Technical Reviewers:

Maurin Scheetz

Lauren Nist

Jesse Seymour

Project Manager:

Getachew Tesfaye

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Content

- Topical Report Application Review Overview (PM)
- Technical Evaluation and Conclusions (Tech Staff)

Topical Report Application Review Overview

- Topical Report Application
- Audit
- Request for Additional Information
- Revised Topical Report
- Information SECY

Introduction and staff review team

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United States Nuclear Regulatory Commission
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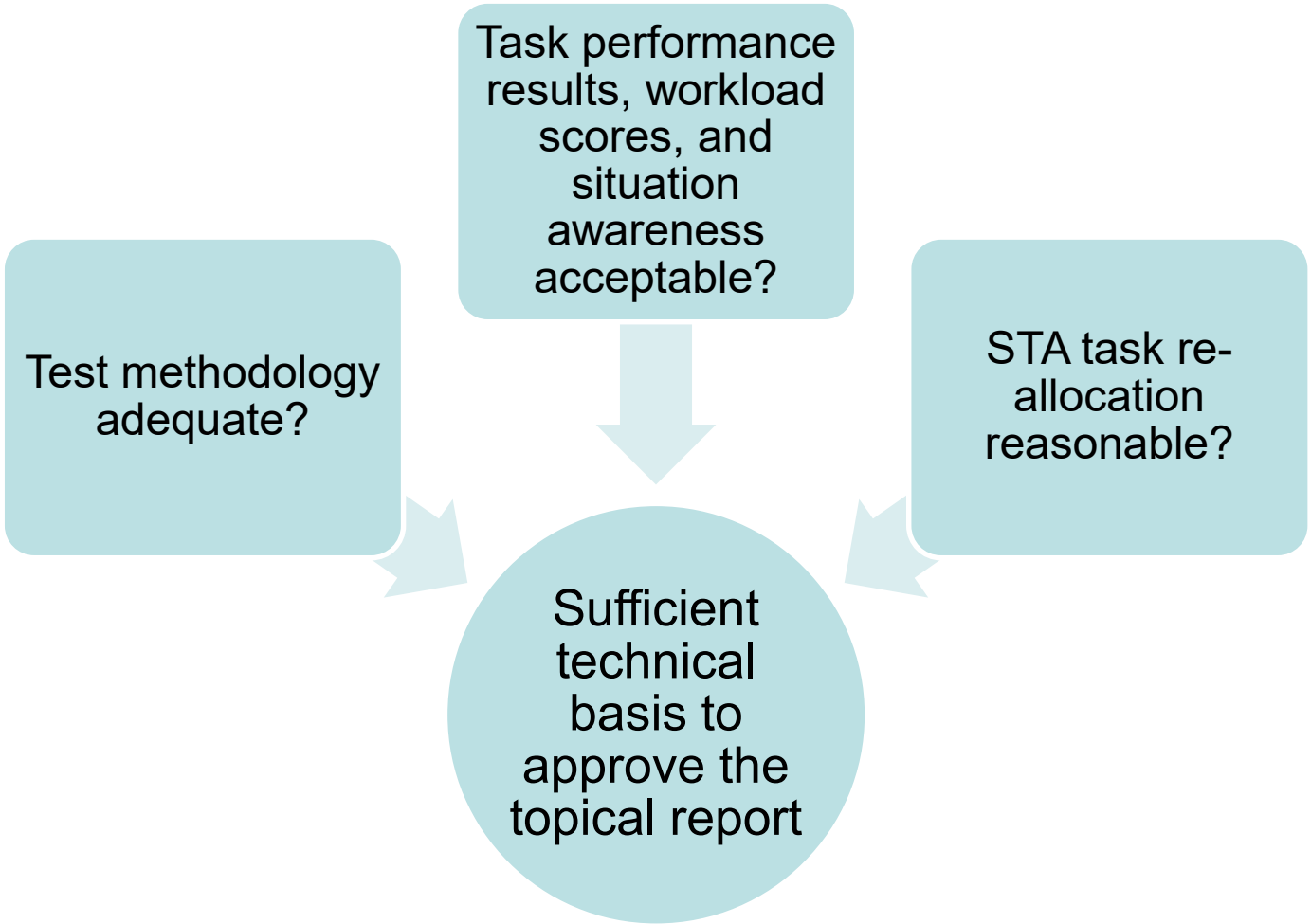
Maurin Scheetz

Lauren Nist

Jesse Seymour

The staff identified 3 focus areas for the review.



The staff observed the test scenarios, reviewed test results, and reviewed the task analysis.

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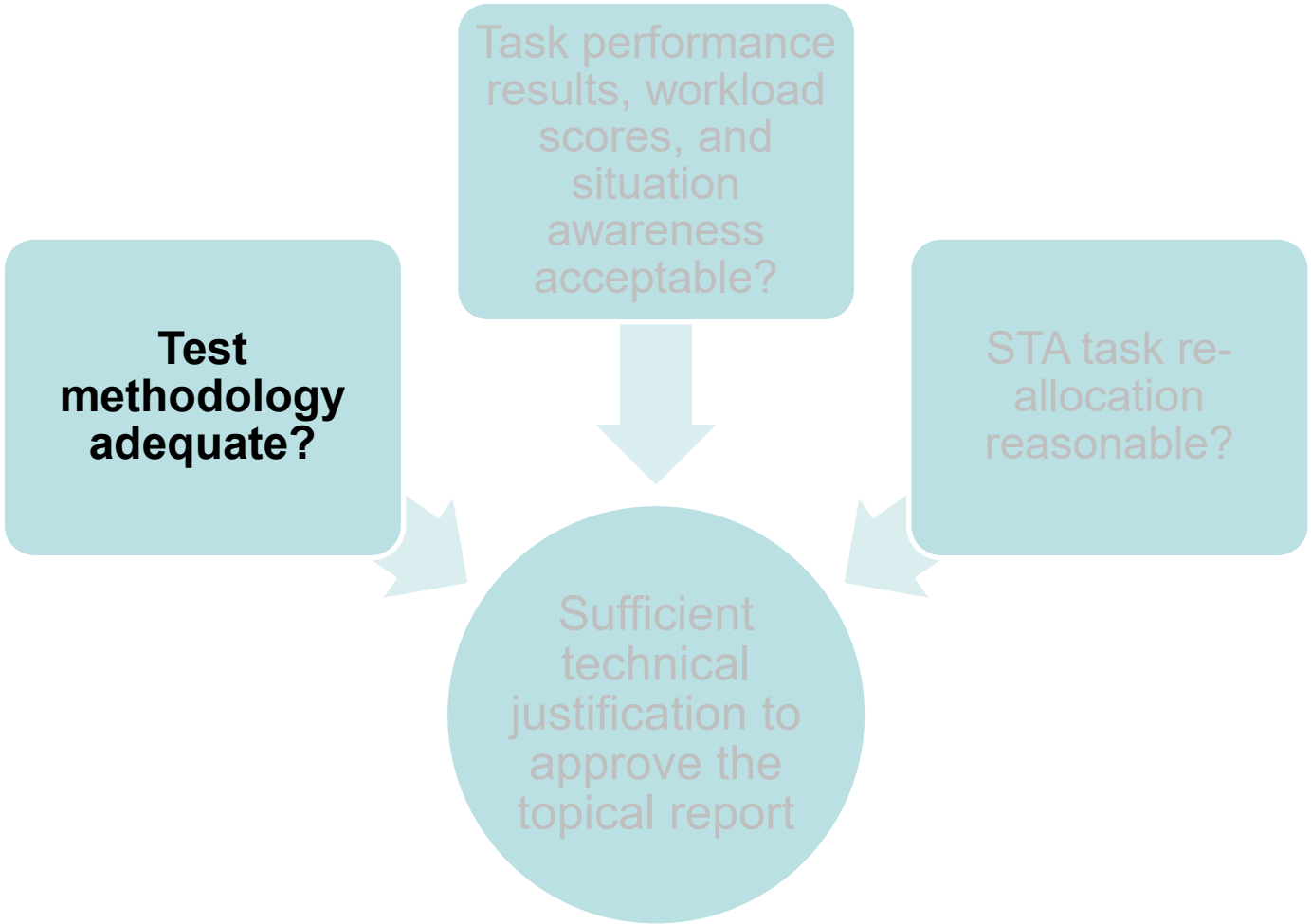
Staff's audit activities

- Observed Revised Staffing Plan Validation (RSPV) scenarios (recordings)
- Reviewed task analysis
- Reviewed RSPV test, task performance results, workload measurements, and situation awareness scores
- Considered results of a readiness assessment

The staff identified 3 high level focus areas for the review.



The RSPV test methods are acceptable.

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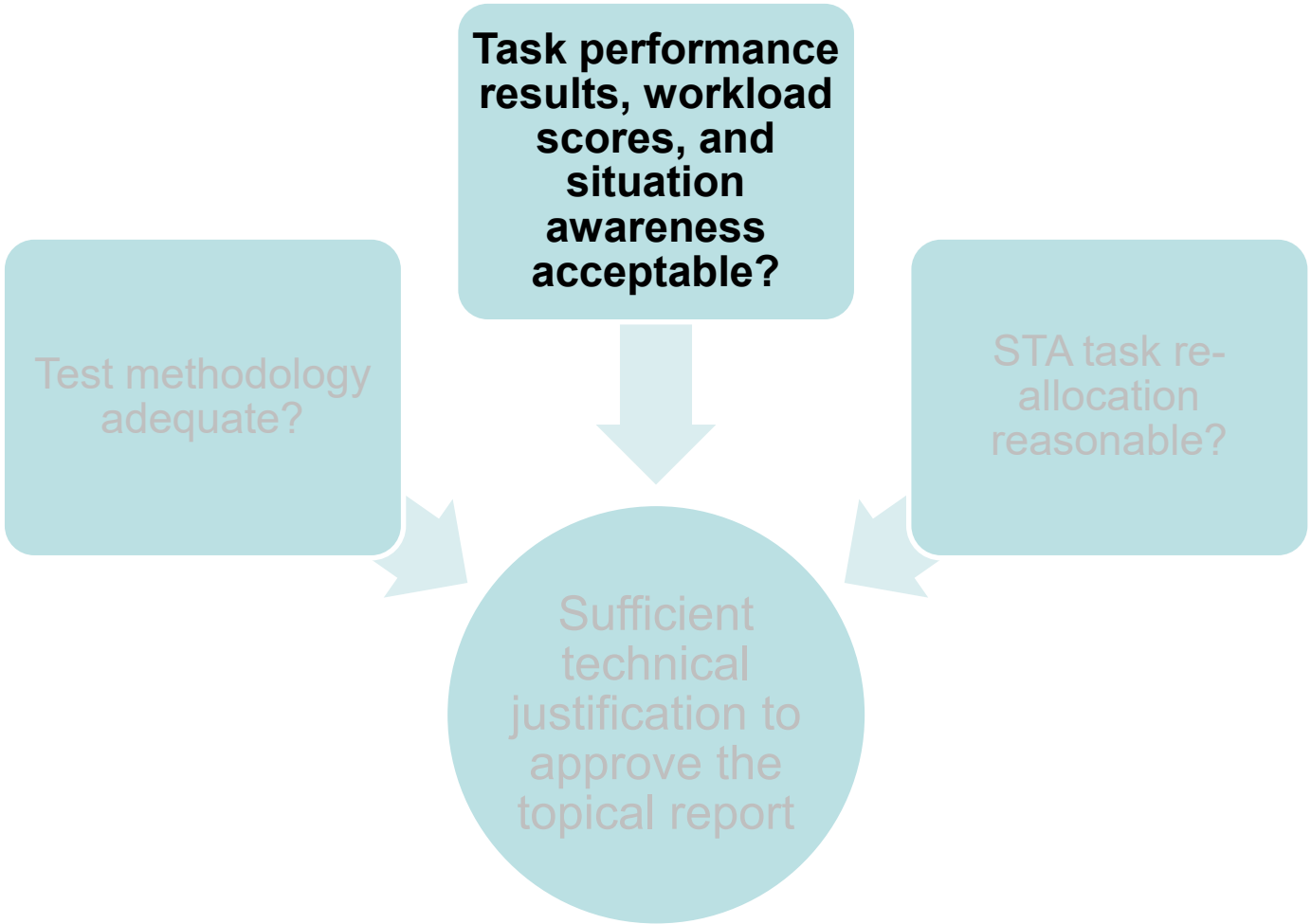
- ✓ Two minor deviations from previously accepted test methodology
- ✓ Tests were administered in accordance with acceptable test procedures
- ✓ Scenarios were sufficiently challenging

The staff identified 3 high level focus areas for the review.



Task performance, workload, and situation awareness results are acceptable.

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- ✓ Task performance criteria met
- ✓ Workload measurements were generally low with some peaks (expected)
- ✓ Situation awareness scores were high
- ✓ Readiness assessment results generally comparable to initial Staffing Plan Validation (SPV) test results

The staff identified 3 high level focus areas for the review.

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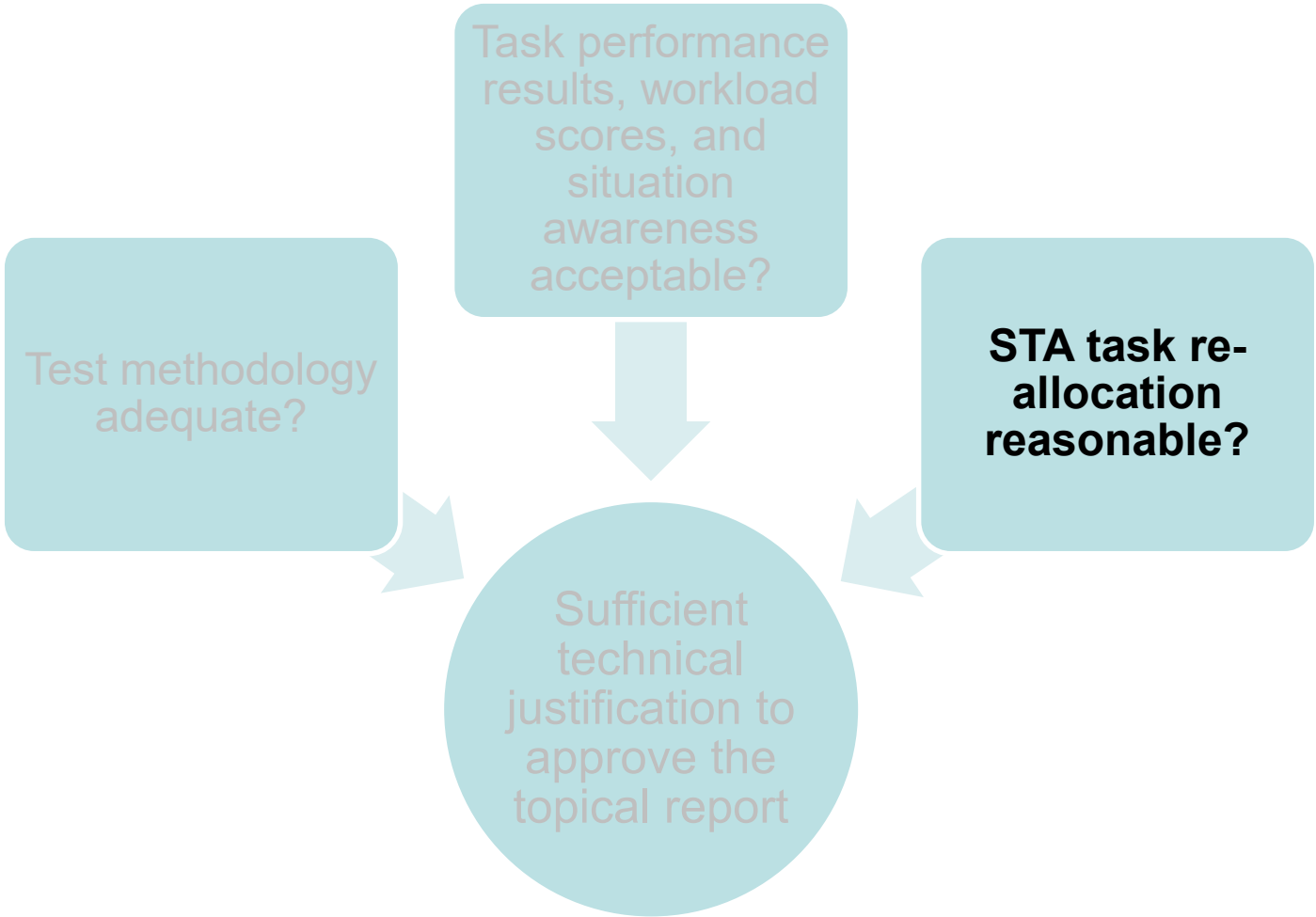

STA tasks are reasonably reallocated.

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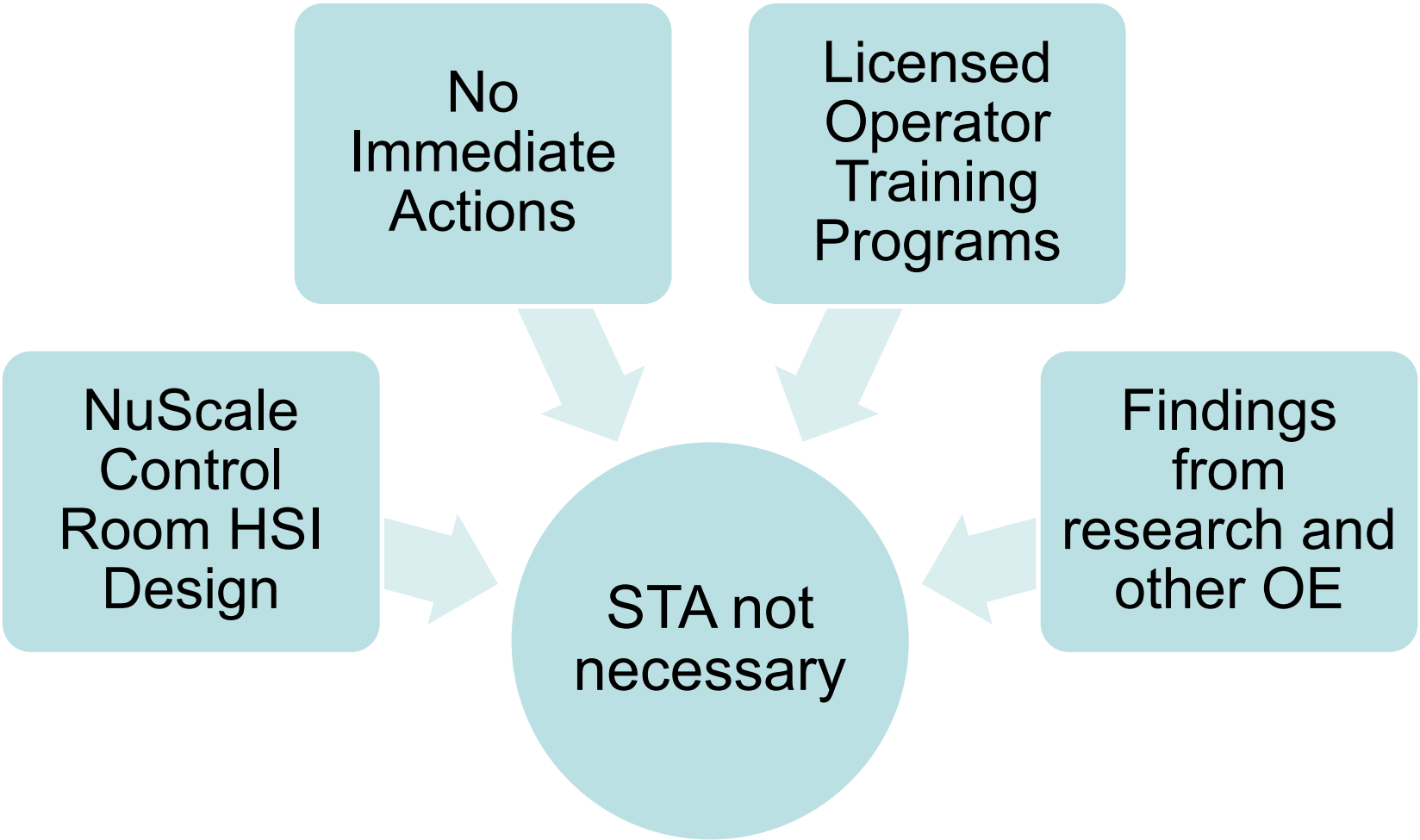
- ✓ Tasks were generally re-assigned in a logical manner
- ✓ RSPV test results and staff's observations of the scenarios show task re-assignments are manageable

The staff considered additional factors that support STA elimination.



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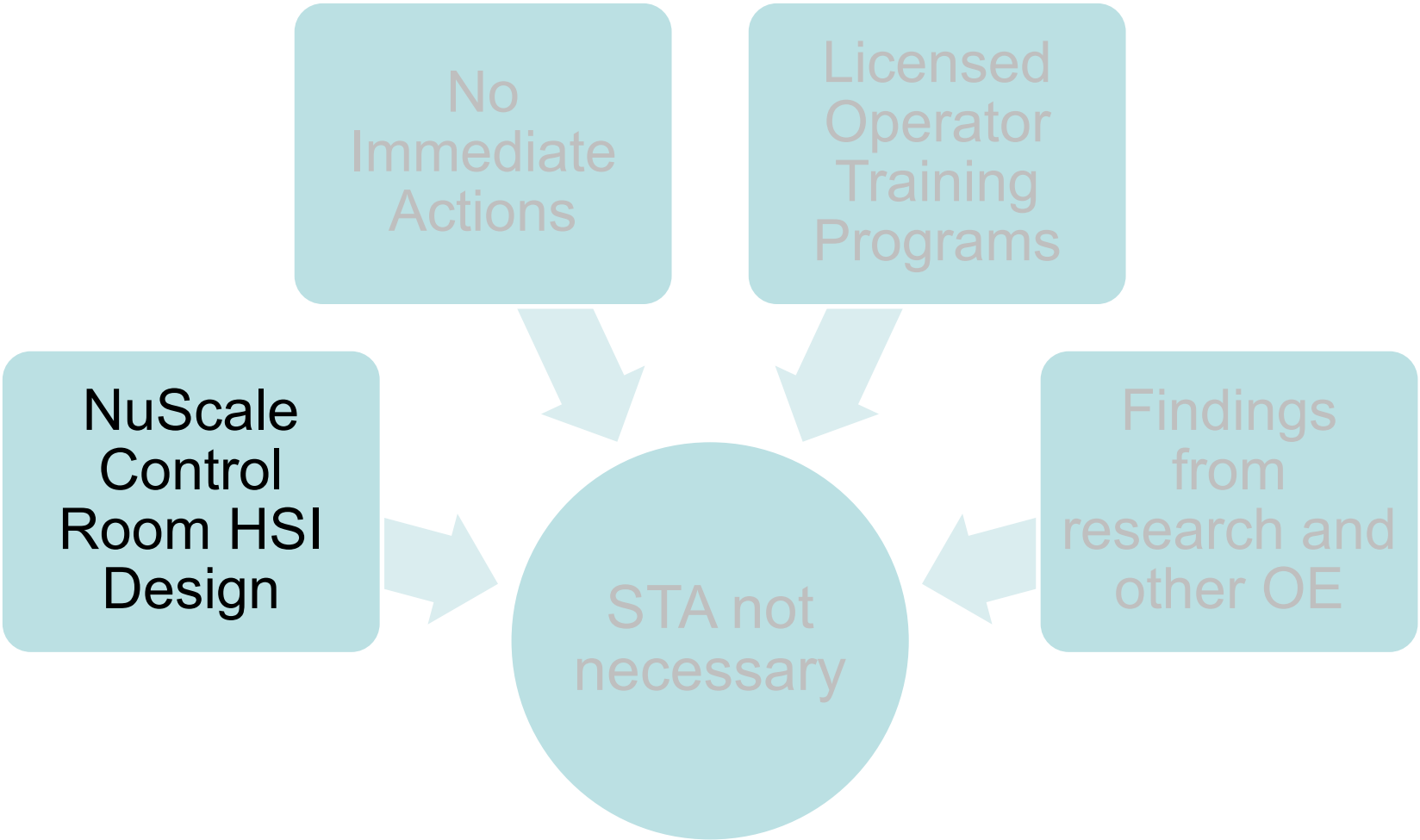

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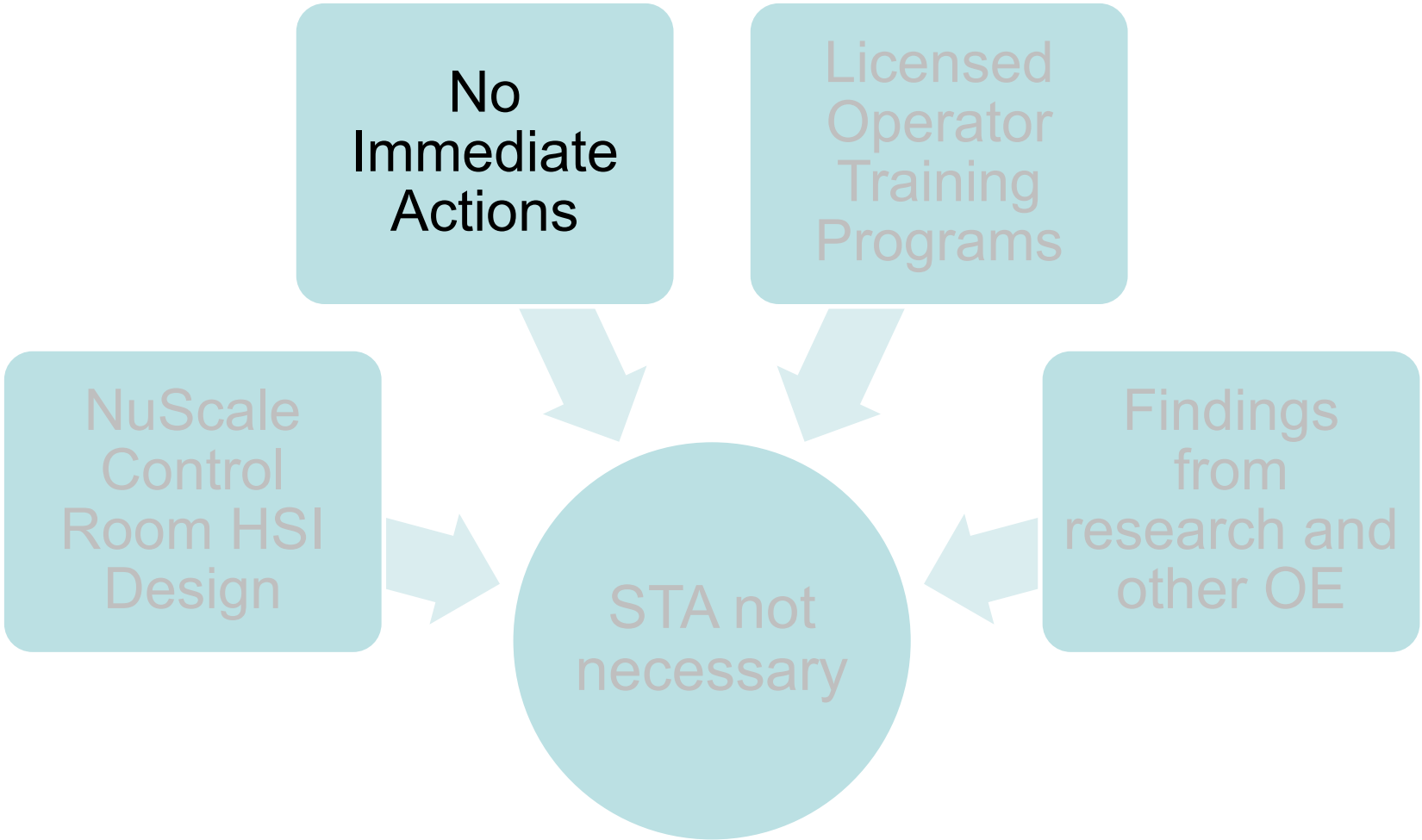

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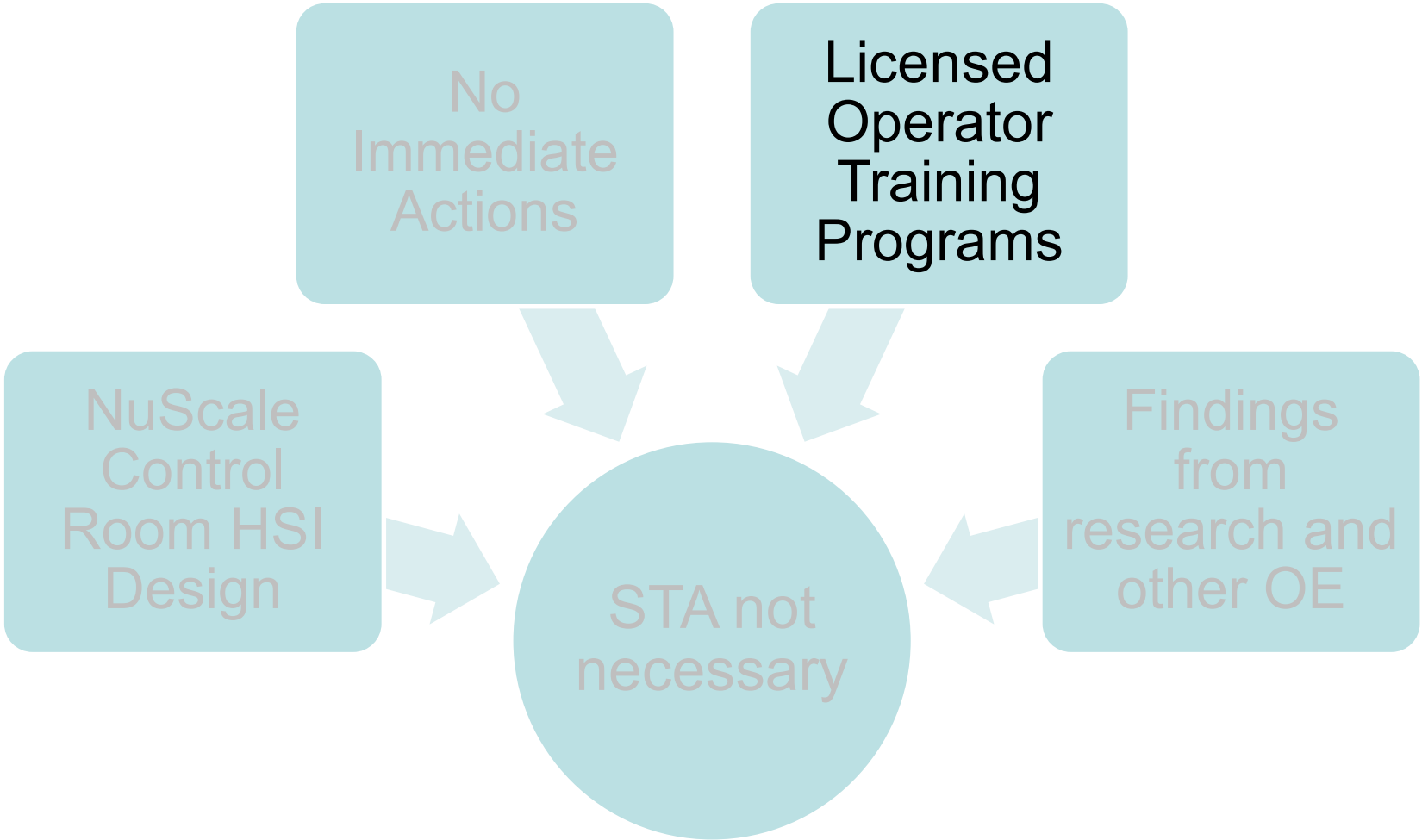

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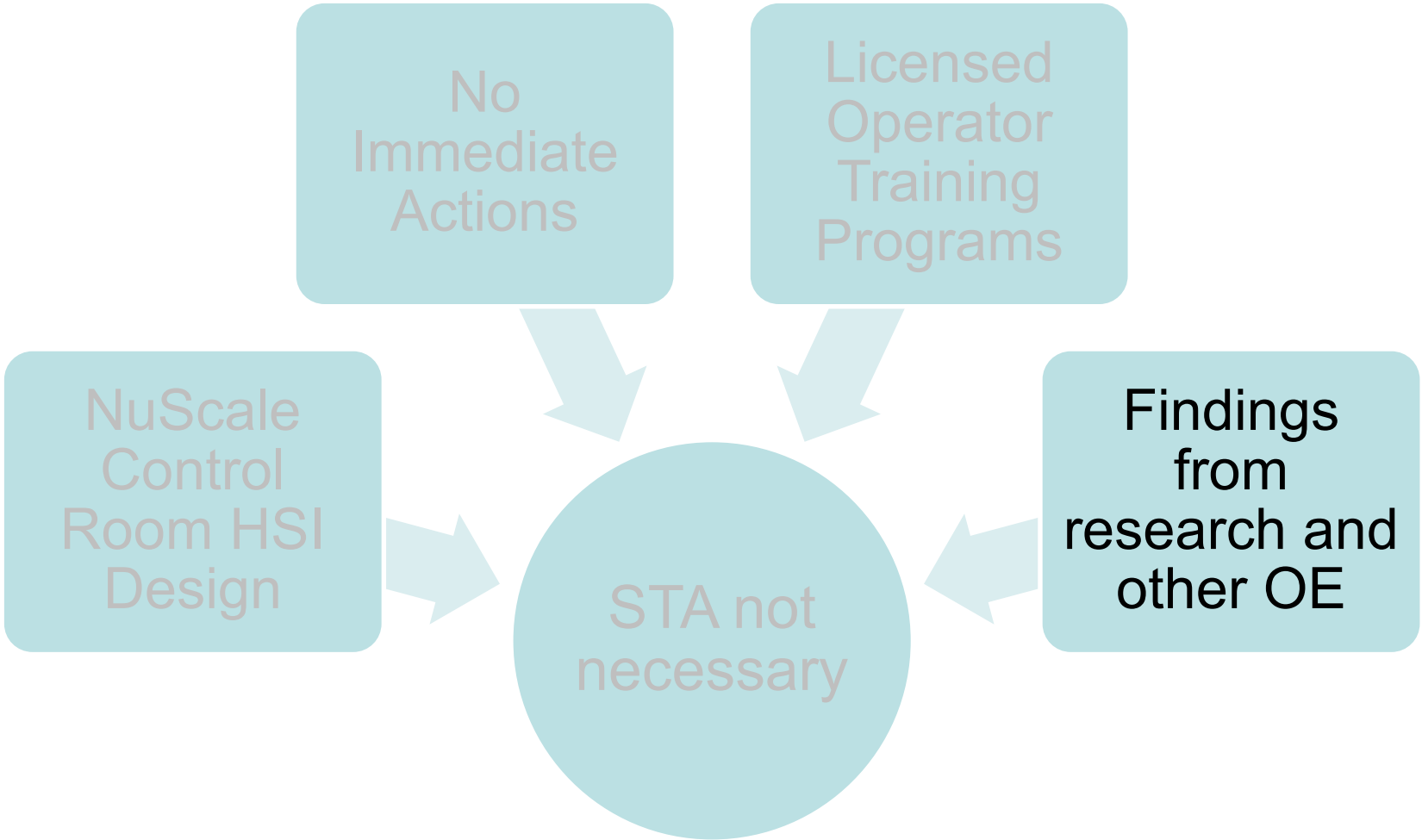

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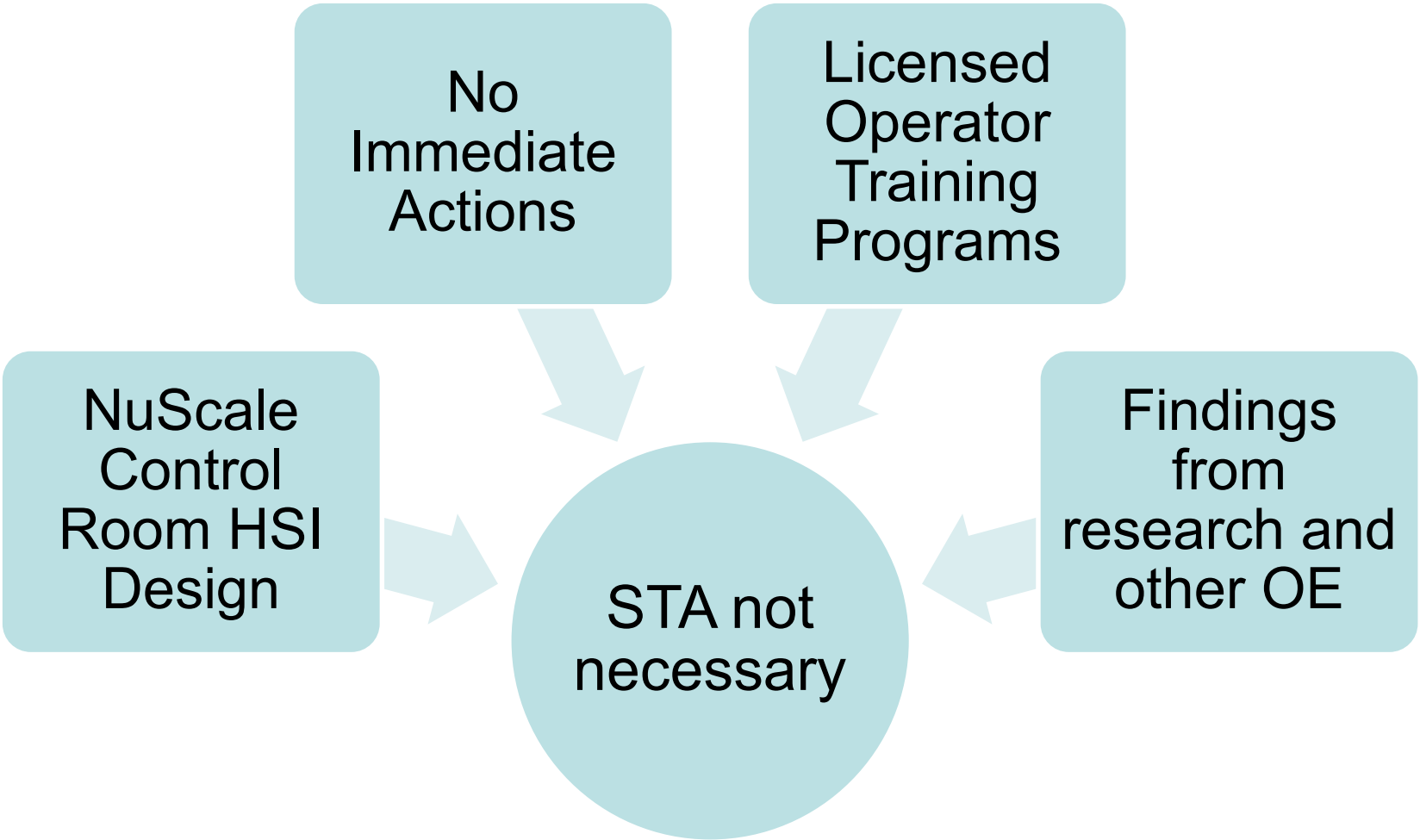

The staff concludes the proposed staffing is acceptable.

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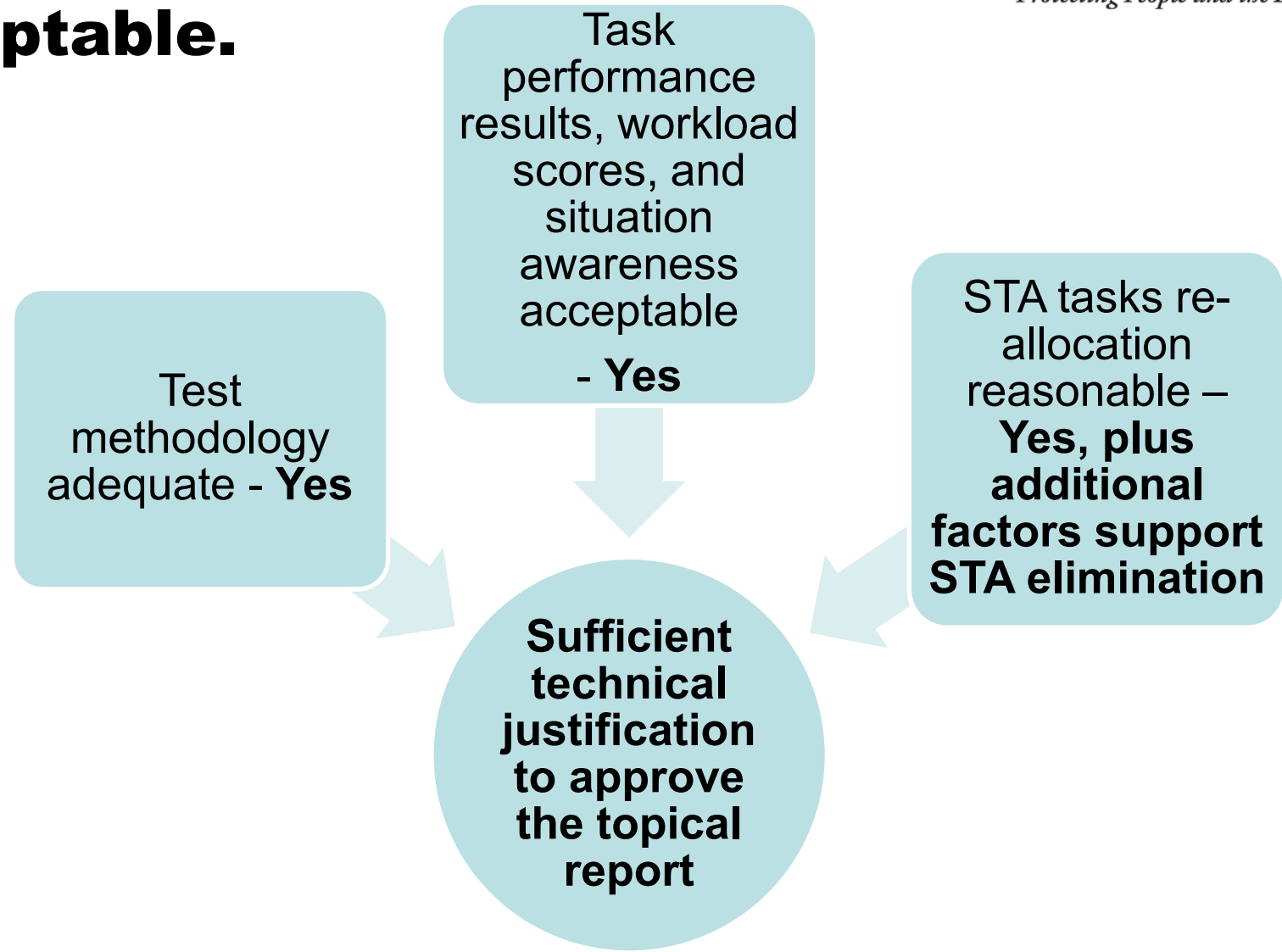

Topical Report Conditions of Applicability

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  - Human-system interface (HSI) design retaining the following features
    - Critical safety function and defense-in-depth monitoring and display, with direct links to response procedures
    - Tiered alarm scheme
    - Computer-based alarm response procedures directly linked to alarms
    - Twelve-module trend monitoring

Doug(NuScale) (Guest)

Participants

Invite someone or dial a number

Share invite

Presenters (26) Mute all

Snodderly, Michael
Organizer

"Nadja Joergensen (Guest)"

Brown, Charles

Brown, Christopher

Burkhart, Larry

Compton, Makeeka

Dave Petti (Guest)

Dennis Bley (Guest)

Doug(NuScale) (Guest)

Jose March-Leuba (ACRS) (Gu...

Topical Report Conditions of Applicability

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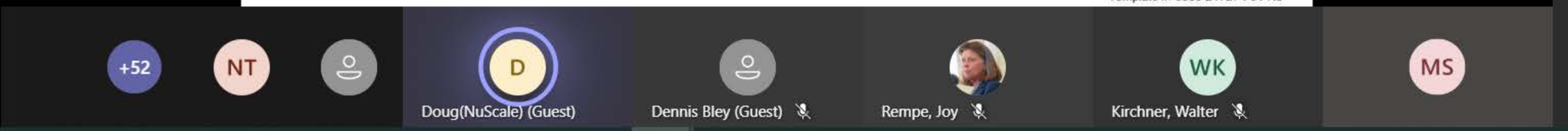
Doug(NuScale) (Guest)



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Doug(NuScale) (Guest)

Participants

Invite someone or dial a number

Share invite

Schultz, Stephen

Sunseri, Matthew

Tesfaye, Getachew

Vesna (Guest)

Widmayer, Derek

Attendees (33)

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+1 301-355-4853

+1 269-363-1941

+1 270-943-0852

+52 NT Doug(NuScale) (Guest) Dennis Bley (Guest) Rempe, Joy Kirchner, Walter MS

10:37 AM
03/16/2021

Topical Report Conditions of Applicability

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Doug(NuScale) (Guest)

Participants

Invite someone or dial a number

Share invite

"\"\\\"jing xing (Guest)\\\"\""

"\"Pat Leary - NuScale (Guest)...

Bavol, Bruce

Bellinger, Alesha

Bradford, Anna

Carrie Fosaaen - NuScale (Gu...

Court Reporter1
External

Cowdrey, Christian

D'Agostino, Amy

Deb Luchsinger (NuScale Pow...

Desaulniers, David

+52 NT

Doug(NuScale) (Guest)

Dennis Bley (Guest)

Rempe, Joy

Kirchner, Walter

MS

10:37 AM
03/16/2021

Topical Report Conditions of Applicability

- Design Features
  - No operator actions credited in design basis event (DBE)
  - Two, or less, important human actions (IHAs)
    - Easily recognizable
    - Can be completed from the main control room (MCR) by one operator
  - Human-system interface (HSI) design retaining the following features
    - Critical safety function and defense-in-depth monitoring and display, with direct links to response procedures
    - Tiered alarm scheme
    - Computer-based alarm response procedures directly linked to alarms
    - Twelve-module trend monitoring

Doug(NuScale) (Guest)

Participants

Invite someone or dial a number

Share invite

Dudek, Michael
Gamin, Kayla
Green, Brian
Hayley Keppen (NuScale) (Gu...
Jim Osborn (Guest)
Miller, Chris
Murray, Demetrius
Nourbakhsh, Hossein
Ross Snuggerud (Guest)
Ryan Flamand (Guest)
Seymour, Jesse

+52
NT
D
Doug(NuScale) (Guest)
Dennis Bley (Guest)
Rempe, Joy
WK
Kirchner, Walter
MS

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Doug(NuScale) (Guest)

Participants

Invite someone or dial a number

Share invite

Seymour, Jesse

Suber, Gregory

Tim Tovar, NuScale Power (Pla...

Tom Bergman (Guest)

Wang, Weidong

Others invited (11)

Caldwell, Bob
No response

Xing, Jing
No response

Frumkin, Dan
No response

Ballinger, Ronald
No response

Bley, Dennis
No response

+52

NT

D

Doug(NuScale) (Guest)

Dennis Bley (Guest)

Rempe, Joy

WK

Kirchner, Walter

MS