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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

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7 NuSCALE SUBCOMMITTEE

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9 TUESDAY

10 DECEMBER 18, 2018

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12 ROCKVILLE, MARYLAND

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14 The Subcommittee met at the Nuclear

15 Regulatory Commission, Three White Flint North, Room

16 1C3 & 1C5, 11601 Landsdown Street, at 1:00 p.m.,

17 Harold B. Ray and Peter Riccardella, Co-Chairmen,

18 presiding.

19

20 COMMITTEE MEMBERS:

21 HAROLD B. RAY, Co-Chairman

22 PETER RICCARDELLA, Co-Chairman

23 MICHAEL L. CORRADINI, Member

24 RONALD G. BALLINGER, Member

25 DENNIS C. BLEY, Member*

1 CHARLES H. BROWN, JR., Member
2 MARGARET SZE-TAI Y. CHU, Member*
3 WALTER KIRCHNER, Member
4 JOSE MARCH-LEUBA, Member
5 JOY L. REMPE, Member
6 GORDON R. SKILLMAN, Member
7 MATTHEW W. SUNSERI, Member
8
9 DESIGNATED FEDERAL OFFICIAL:
10 MIKE SNODDERLY
11
12
13 *Present via telephone
14
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P-R-O-C-E-E-D-I-N-G-S

1:02 p.m.

CO-CHAIR RAY: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, NuScale Subcommittee. I'm Harold Ray and I'll serve as co-chairman for today's Subcommittee meeting along with Pete Riccardella.

Members in attendance are Members Rempe, Kirchner, Corradini, Riccardella, Skillman, Sunseri, March-Leuba, Ballinger, and Brown. Members Dennis Bley and Margaret Chu are participating via teleconference as we just heard. Mike Snodderly is the designated federal official for the meeting.

The Subcommittee will review the status evaluation of Chapter 2, Site Characteristics and Site Parameters, and Chapter 17, Quality Assurance and Reliability Assurance of NuScale Design Certification Application. Today we have members of the NRC staff and NuScale to brief the Subcommittee.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. That means the Committee can only speak through its published letter reports. We hold meetings to gather information to support our deliberations.

The parties who wish to provide comments

can contact our office requesting time after the meeting announcement is published in the Federal Register. That said, we set aside 10 minutes for comments from members of the public attending or listening to our meetings. Written comments are also welcomed.

The ACRS section of the U.S. NRC public website provides our charter by-laws, letter reports, and full transcripts of all full and subcommittee meetings including slides presented there. We may close the meeting after the open portion to discuss proprietary material and presenters can defer questions that should not be answered in the public session to that time.

No written statement or request for making an oral statement to the Subcommittee has been received from the public concerning this meeting. A transcript of the meeting is being kept and will be made available. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room -- actually, behind me here, I believe.

When addressing the Subcommittee participants should first identify themselves and speak with sufficient clarity and volume so that they

can be readily heard.

We have a bridge line established to the public to listen to the meeting. To minimize disturbance the public line will be kept in a listen only mode. To avoid disturbance I request that attendees in the room put their electronic devices like cell phones in the off or noise-free mode.

To accommodate the availability of interested members, we will begin with Chapter 17. And, of course, as always, any member can participate at any time, but Mike Corradini will take the lead on Reliability Assurance Program matters and I will do so on the rest of the chapter overall.

Because we have to share the half-day meeting with discussion of Chapter 2, which will be led by Pete Riccardella, as I mentioned, and we have members who need to get off to the airport this evening, I'll begin both the discussion of Chapter 2 with NuScale and with the staff by stating a couple of items that I believe deserve focused responses and I hope can receive them.

As always, our aim is to resolve questions at Subcommittee if at all possible.

Does staff management have any comments? Sometimes the staff will offer a comment at this point

but, hearing none, we'll proceed.

Okay. NuScale is at the table on the opposite here so let me do as I said I would and give you a couple of items that I hope we can address during the limited time we have.

Regarding the Quality Assurance Program Revision 3 of the NuScale Topical Report has been found acceptable as documented in the final Safety Evaluation issued September 22, 2016. This revision is referenced in Section 17.5 of the final Safety Analysis Report and it is identified there as nonproprietary.

Section 2.3.1 of the Topical Report is entitled "Design Verification" and it includes the statement that, "NuScale normally completes design verification activities before the design outputs are used by other organizations for design work and before they're used to support other activities such as procurement or testing.

Procedures are established that require identification and control of any portion of the design where verification has not been completed. When such timing cannot be achieved, the design verification is completed before relying on the item to perform its intended design or safety function."

One of the items of interest to us is the procedures referred to in this statement. In its letter dated July 24, 2017, NRC reported the results of an initial inspection which included design control.

It included substantial discussion related to the implementation of the procedure for open design item management. We will refer to open design items as ODIs. At the time of the inspection a year-and-a-half ago, there were over 1,500 ODIs.

The inspection report includes a statement that neither the design control process, nor the ODI procedure, have a requirement to establish a date or event, such as DCH submittal, to close the ODI. It indicates that NuScale stated only that they would need to be closed "prior to the affected systems, structures, or components being considered operable." And that ODIs do not need to be closed prior to DCA submittal.

Personally, I've been involved as an applicant in three separate Part 50 construction permit applications each for a new plant design. One of them was a HTGR. I completely understand the necessity to accept and track unverified design assumptions at that stage in the process.

So my first question is about how you're implementing the requirement in Section 2.3.1 of your Topical Report to ensure that design verification is completed before relying on the item to perform its intended design or safety function in this somewhat different process involving the initial stage of design certification.

I believe the second question I would like to ask up front just involves the wording that I find confusing concerning applicability of the QA program.

Section 17.5 of the NuScale FSAR states that the QA program description for the standard design is provided in the Topical Report and that "a COL applicant that references the NuScale power plant design certification will describe the Quality Assurance Program applicable to site-specific design activities and to the construction and operation phases." That's a clear and consistent statement concerning the respective responsibilities of NuScale and a COL applicant.

However, a seemingly different description appears elsewhere including on the NuScale slide 4 to be presented shortly, and in the staff SER Section 17.5.1 where it says that, "The QA program description submitted by NuScale addresses the design QA

activities in support of design certification. The NuScale QA program description does not address construction and design through activities that occur once construction begins."

I don't read this the same as in the FSAR, especially given that the design activities are expected to continue after design certification and before approval of a future COLA. I think it's just a wording problem that needs to be -- I need to be clarified on at least.

With that, those two items, Mike, is there anything you want to say about reliability assurance at this time?

MEMBER CORRADINI: No. I think we'll wait and get them when we get the 17.4.

CO-CHAIR RAY: As we go if we don't go by the numbers.

Okay. With that, I will call on Paul Infanger of NCO to begin today's presentations.

MR. INFANGER: My name is Paul Infanger. I am license and project manager at NuScale. I've been doing licensing for about 35 years, 25 years in the operating fleet. I was licensing manager at Crystal River and Turkey Point. Later I was licensing manager in Part 52 space for the EPR with UniStar.

I've been with NuScale for about three-and-a-half years. I went to Iowa State University and have a masters in nuclear engineering.

CO-CHAIR RAY: Paul your microphone is on, isn't it? You have a strong enough voice that I can't tell.

MR. INFANGER: Okay. Yeah, I'm on.

I'm going to be presenting the Quality Assurance portion of the Chapter 17 presentation. The D-RAP portion will be with my cohort here Mr. Patrick Conley.

Patrick, why don't you give a little background on yourself.

MR. CONLEY: Yes. My name is Patrick Conley. I'm the programs engineer for NuScale Power. I've been with the company about two-and-a-half years. Before NuScale I was at the Vogtle construction project on 3 and 4 where I was in quality assurance with ITAAC procedures as well. I left that to come to NuScale for an opportunity to do some design.

Prior to that I received my degree from Auburn University in --

MEMBER BLEY: Excuse me. Could you talk into the microphone a little better? I can't hear online.

MR. CONLEY: Is that better?

MEMBER BLEY: Yes.

MR. CONLEY: Prior to that I was in the Nuclear Navy as a machinist mate and that's how I got my interest in nuclear power.

MR. INFANGER: Thank you, Patrick.

Moving on to slide 2, just an overview of Chapter 17 which includes the Quality Assurance Program and Design Reliability Assurance Program, D-RAP.

The Quality Assurance Program is established in accordance with 10 CFR 50 Appendix B, and ASME NQA-1-2008 with the 2009 addenda which is endorsed by Req. Guide 1.28.

Consistent with the guidance in the NUREGs and also we use the NEI template for the QAPD, Quality Assurance Program Description. It consist of our Topical Report which is approved and has a dash A, and the Quality Management Plan which identifies requirements fully implemented in the requirements now within the scope of design phase but may be implemented in the future. We have implementing procedures as listed in the Quality Management Plan.

Chapter 17 is divided up into six subsections, the first five in the QAP. The first

three sections pretty much just point to 17.5 which has a brief description that we follow the Topical Report for the Quality Assurance Program and has the COL items for the applicants to provide information during the construction and operation phases. The QAPD for NuScale is just for the design certification phase.

CO-CHAIR RAY: Okay. You're not going to go beyond that without answering my question, are you?

MR. INFANGER: Okay.

CO-CHAIR RAY: Because that's certainly not what the Topical Report said. It says it deals with essentially everything except site-specific design activities, but it doesn't end when the design certification is issued. Anyway, I'm repeating myself. Go ahead.

MR. INFANGER: The COL item indicates that the NuScale QAPD provides in the Topical Report what we believe is needed for design certification. The template includes some portions that will be applicable later, but the applicant is responsible for everything after the design certification phase. It's not itself -- it's not a stand-alone document for the applicants.

I'm going to go back to -- can I tie in

back to the folks back at NuScale to see if I can get some additional collaboration on that?

CO-CHAIR RAY: Absolutely. I just want to be really clear as to what the heck the question is that we're talking about here. I'm trying to find the words here. Go ahead. I'll come back to this in a second.

MR. INFANGER: NuScale, come up, Carolyn or someone in the QA organization who can fill in more details.

MS. MONACO: Yeah, good afternoon. This is Carolyn Monaco, the Director of Quality here at NuScale. I'm in the Corvallis offices.

Responding to the structure of the QAPD, the activities that NuScale will do are QAPD will carry us forward into working with the applicant when we get to site-specific stages.

Our program will cover our design activities as we go forward as well. Should the applicant want to designate additional activities to us, then we'll obviously work with them as appropriate as we go forward.

CO-CHAIR RAY: Well, the way I interpret what you just said is consistent with what the FSAR states and the Topical Report states which is that the

QA program description for the standard design forget about design certification.

The QA program for the standard design is provided in the Topical Report. That's what it says plainly. It doesn't say that the standard design will transition to some other QA program at some indefinite time after the design certification is approved or issued. That's what is said elsewhere and that's what continues to be confusing.

A COL applicant it says in the FSAR, Section 17.5, "References a NuScale power plant applicable to site-specific design activities and to construction and operation." That is absolutely fine. No problem. The issue is does the QA program that we're talking about here today only apply to design certification and not thereafter?

MS. MONACO: I think the difference or the language may be that our program could be used and carried forward into site design and certain construction aspects, but the applicant could also choose to use a different program, their own program.

CO-CHAIR RAY: That's right, but I'm asking what NuScale is going to use for its design activities after certification. That's what is clear in the FSAR but not at all clear in these other

citations I've given you.

It sounds like the QA program that we're talking about today only applies to design certification and it will be something imposed by a future customer, COL applicant, on you for work on the certified design after it's issued, and there's a lot of work to be done as we all know.

Whereas, what you say in the FSAR is, "No, this QA program is for the certified design full stop." Not for site-specific activities. That's clearly the COL applicant. And also the construction and operation. That's the COL application just like the FSAR says.

Well, listen I don't want to take up more time now. I guess the question is clear but the answer is not. We can always take note of it and seek further clarification later.

MEMBER SKILLMAN: I want to weigh in on this because I've got the same comment. Let me read text from the SER, Section 17.0. This is exactly what Harold pointed to. Actually, this in the SER. "The NuScale QAPD Topical Report covers the activities associated with the certification of the NuScale power plant."

The next sentence is where I want to raise

the question. "The QAPD is based on the applicable portions of Appendix B." I'll stop there. Which portions of Appendix B are not applicable?

CO-CHAIR RAY: Okay. I think we've posed the question clearly enough and I don't want to get into a bog-down debate. We're asking for a clear answer and we'll just have to move on.

MEMBER SKILLMAN: That's good. Thanks.

CO-CHAIR RAY: Please go ahead, Paul.

MR. INFANGER: There's a number of COL items in Chapter 17. They describe the Reliability Assurance Program to be conducted during operations. The site-specific SSCs in the RAP identify QA controls for the RAP. They describe the QAP applicable to site-specific construction and operation. The last one in 17.6 is just a COL items that the application has to have a maintenance rule program in conformance with 10 CFR 50.65.

CO-CHAIR RAY: The wording, by the way, for the RAP QA is different than what we just debated here about the Appendix B and in QA 1 applicable requirements. The QA program controls for the Reliability Assurance Program are as stated here, "during site-specific design procurement instruction, but they are specified as opposed to being left at the

COL holder."

It just seems strange why the Reliability Insurance Program and the Appendix B ASME Section 3 of the program are treated differently in this regard.

MEMBER BLEY: It sounds like somebody is not muted. It's really noisy on the line.

CO-CHAIR RAY: It sounds like what, Dennis?

MEMBER CORRADINI: Somebody has to mute their line, please, because we are hearing background noise.

CO-CHAIR RAY: Thank you. I don't mean to bug you, Paul. I just want to get the record straight. Please proceed.

MR. INFANGER: Okay. We had three RAIs on Chapter 17. All of them are resolved and closed. The topics are listed there. One was on the CVCS, one on the expert panel, and one on the backup power supplies.

MEMBER CORRADINI: We are going to come back to the first for these, right? Is that correct? Is Patrick going to come back and talk about the expert panel CVCS later?

MR. INFANGER: We can talk about D-RAP and include the expert panel.

With that I'm going to introduce again Patrick for the D-RAP process.

MR. CONLEY: Thank you, Paul.

Can everyone hear me okay? Okay. So our D-RAP process was modeled after complies with NUREG 800 Section 17.4. We do have a process that documents and controls that process of D-RAP including the expert panel.

All of the SCCs, of course, were looked at for cauterization. The initial determination was declared by the subject matter expert and system engineer. Then it was confirmed through deliberation with the expert panel which makes the final decision.

Our expert panel did consist of a diverse group of personnel including design engineering, operations, PRA, and safety analysis. We also had a licensing member but they were a non-mandatory member. They could vote but it wasn't required for a quorum.

MEMBER CORRADINI: So these are internal to NuScale or these are external people?

MR. CONLEY: These are internal to NuScale.

MEMBER CORRADINI: Internal?

MR. CONLEY: Yes, sir.

MEMBER CORRADINI: Okay.

MR. CONLEY: Next slide, please.

Our PRA report is based upon the Topical Report we submitted. You can see the number there, the risk significance determination process, Rev. 0. As far as classification, we always assumed that a component was classified as risk significant unless PRA told us otherwise. We didn't start at the bottom and work out way up. We started at the top and worked our way down.

The engineering change control process determines if an expert panel is needed. We allow the engineering change control process to change the design and then, as part of that process, the expert panel will be determined if it's needed for further classification.

Next slide, please. If you look at 17.4.3.3 it states that the process for evaluating SSCs for regulatory treatment. It's described in 19.3. We had no RTNSS criterion met and, therefore, we had no RTNSS SSCs in the design.

MEMBER CORRADINI: Let me ask a question since one of our experts is on the line, but I'm sure he's going to jump in. If the PRA identifies by your risk-significant measures that something is not meeting the criterion, but later component reliability

testing of a particular component changes such that it might, does this all occur prior in the DCD portion of the analysis, or is this a COL item that the applicant has to deal with in terms of --

MR. CONLEY: As far as updates to the PRA?

MEMBER CORRADINI: Yes. In terms of if there's an update to the PRA that something's reliability estimate after testing is different. It rises. Is it up to the COL applicant to deal with the change in what's in the D-RAP and then it falls into the old RAP? That's what I didn't understand.

MR. CONLEY: We do have COL items in Chapter 17 and there are other COL items in 19 that deal with the site-specific portion. As far as the follow-up PRA prior to that, if there's information that is gained.

Sarah, can you speak, please to the process of update as needed? I know we frequently look at updates, but I'm not sure of that process entirely.

MS. BRISTOL: Yeah, this is Sarah Bristol. In a PRA update if a candidate rose to the level of potential risk significance, the candidate would be then brought to the D-RAP board for consideration either during the DCA phase or, as you mentioned,

there is a COL item to go back and look at those candidates again at the COL stage.

MEMBER CORRADINI: So is that -- so I guess I don't understand the process. Let me take an example. Let's say one of the RRV valves assume probability of failure or reliability is some value and after testing it rises. Then that changes the analysis that something falls into a RTNSS. Whose responsibility is that to identify it and track it? Is it the COL applicant? Is it NuScale as the holder of the DCD? I'm not clear.

MR. GREENWOOD: This is Dustin Greenwood at NuScale.

MEMBER CORRADINI: Can you guys speak louder? Can you guys get closer to the mic?

MR. GREENWOOD: This is Dustin Greenwood at NuScale. Sorry about that. At any phase during the COLA or the DCA this identified through testing, then it would be through our engineering change control process and gets filtered through the D-RAP.

In general, the entire process goes through the Operational Reliability Assurance Program after procurement of a specific item. So to determine the maintenance in the M rule requirements, this entire process will be done again with the site-

specific PRA and all of the actual design components.

So our process and our change control process would capture something if we identified it during this phase but, in general, to ensure that it happened, this whole program is done again during the construction phase and needs to be verified prior to going into operation.

MEMBER CORRADINI: Okay. Thank you.

CO-CHAIR RAY: Excuse me for just a second. Let me just ask one question because it's pertinent to Appendix B also.

When we say we're talking about a holder of an approved combined operating license, right, it's not just somebody who has applied for a combined license and work is ongoing. Not site work but there's other work ongoing. We're not talking about the COLA holder at that time. It's only after the COLA is approved that their status is what you just said. Is that correct?

MR. GREENWOOD: This is Dustin. I'm not sure if that question was directed at me.

CO-CHAIR RAY: To NuScale generally.

MEMBER CORRADINI: It's addressed to NuScale so whoever can answer.

MR. CONLEY: If I understand your

question, is there a transition from one process to the other?

CO-CHAIR RAY: Well, I'm more worried about the gap than the transition. In other words, having been through AP1000, as an example, a real-life thing that went into construction, the idea that on the day that the COLA is approved, suddenly things change and prior to that time they were as they were back to the beginning of time is not something we're familiar with in real experience.

What we're familiar with is the design certification holder retains responsibility under the programs described in the design certification, even though it's been approved three years ago, to do what they are doing in accordance with that program. That's the way I read your FSAR, by the way.

MR. CONLEY: Yes.

CO-CHAIR RAY: But it's all the other discussion that has got us terribly confused because it sounds like once the design certification is issued, we go into a space that isn't defined until the COLA is approved at which time then the COLA becomes effective for the things that are taking place then whether it's the D-RAP or whatever else it may be. I'm sure that's not what you intend but it's what

you can read in this is what I'm saying.

MR. CONLEY: I understand how you view it and I appreciate your comment. It is not our intent.

MEMBER CORRADINI: So help us. What is the bridge? Because my next question is going to be in the SE, the draft SE that we have in front of us, there's an open item about that there's nothing from D-RAP in ITAAC.

My thought was before I read this that the logical thing is thou shall go and do this as an ITAAC item to make sure the D-RAP is rechecked before fuel up, for example. But it's not there so that leaves me, again, a bridge.

MR. CONLEY: So the process is up to the DCA you're still responsible. Through the DCA and through the continuing design NuScale is still responsible.

The process will be once we get into certain things like you talk about testing and procurement, some of that will have to be deliberated in a contractual commercial space. Do you want to do this? Are you going to procure these proponent and take care of that testing or not?

For the things that NuScale will be responsible for, we will make sure that the D-RAP

process continues for that piece. There's a line of demarcation once you get into the COLA space that there's some deliberations with the applicants that we can continue this process for you.

We will model it for you. That's what the COL items are intended to cover is that transition and the setup of the program and making sure that the reliability of the components is still considered and updated.

CO-CHAIR RAY: Well, we just need to make that really clear. Specifically, like I say, the FSAR reads fine. It says things that are site specific are fine, or construction, or operation. That all fits the COLA. It's things that are related to the certified design completion that has got us worried.

MR. CONLEY: I understand. Because we were silent on it, you're unsure if it was going to continue.

CO-CHAIR RAY: That's right.

MR. CONLEY: Okay. I appreciate the comment.

MEMBER CORRADINI: Or who owns it. The design will be done by the DCD. Therefore --

MR. CONLEY: Correct. So it's our intent to keep the D-RAP program up through the process.

CO-CHAIR RAY: I'm was sure it was. That's why I said it was something that I thought was just a lack of clarity or some confusion. But it does need to be explicit and clear because I think you'll hear a similar discussion with our staff when they come up in which it was even less clear.

MR. CONLEY: I understand.

CO-CHAIR RAY: So we need to be -- I'm talking about an earlier discussion we had. We need to be crisp about this point that we're trying to make which is the certification is based on a program that continues on for the applicable -- for the certified design and we're going to talk, I hope, here in a little bit about open item verification and closure.

That's an activity that will go on until the plant is ready to start up as it's described here, and so we don't want it to be handed off for the certified design itself, to somebody else, and wait until the COLA is approved before we have a program that we can oversee. I think you understand.

MR. BERGMAN: Tom Bergman, Vice President, Regulatory Affairs. Just to be clear, our programs continue, but the agency's approval is of what is in the certification. The process, I mean, the ideal process is the COL fully incorporates the DCD by

reference with no changes. There would be no change if that were the case in the COLA. Only the site-specific portions would be addressed.

In reality, we know from past experience there will be departures from the certified design. To the extent those change the design, we address it at that time. And it's clear that all those design changes will have to have been done under our QA program, our D-RAP program, and the COLA will then justify the program that they're using for their application, which will be some combination of ours and theirs.

The programs don't stop, and that's clear through -- they could stop, right? I doubt ABWR, or I shouldn't use that one because that one is licensed, CE System 80+ is still maintaining a QA program and a D-RAP over their certified design, right? But we expect to move into COL space, and so those programs will continue indefinitely.

CO-CHAIRMAN RAY: Well, I just ask that you be really clear regarding what the staff can and cannot do. We'll discuss that with them and give them our best advice. But the fact is that your work will continue after the design is certified and it needs to be covered by a program that we can provide oversight

to and that has the necessary controls.

MR. BERGMAN: We agree, but that's separate from the certification in my view.

CO-CHAIRMAN RAY: Not in my view, but we can agree to disagree on that. Since you're in the position that you are, did you want to speak to the issue of the coverage of the open design item closure under the purview of this program while you're --

MR. BERGMAN: It's covered by procedures under our QA program.

CO-CHAIRMAN RAY: I've got the number. I know the procedure. What I'm not certain about is if you had anything more to say about it because what we know about it it's not clear that it's being -- it will continue to be implemented in accordance with your QA program, correct?

MR. BERGMAN: Yes.

CO-CHAIRMAN RAY: Do we need to take all of the open ODIs at the time of design certification and make an ITAAC out of each one?

MR. BERGMAN: Oh, no.

CO-CHAIRMAN RAY: No, we don't. Of course. And, therefore, afterwards, you need, there needs to be some relationship between the agency and what you're doing to close those items that allows us

to be satisfied that, yes, they're all getting closed and tracked and they're not being disregarded. Would you agree with that?

MR. BERGMAN: Yes, and that's, I think, addressed by the regulations.

CO-CHAIRMAN RAY: Well, if we're back to the regulations, then that's fine. But we're trying to get it into the program that we're looking at now, and that's what -- I agree -- pardon me -- that it's covered by the regulations, but what we want to be is covered by this. Excuse me. I ate an apple, and it's the apple that's got me.

Anyway, sorry. So thank you for responding.

MR. BERGMAN: Yes, they'll be brought to closure under a controlled process as late as construction.

CO-CHAIRMAN RAY: Well, do remember that we've been through this. I chaired the AP1000 subcommittee. I've done this for years, and I realize we may be in a different circumstance now for certainly reasons, and I just want to know what the differences are.

MR. BERGMAN: The differences in what?

CO-CHAIRMAN RAY: With regard to the

application of the QA program to work that continues after the design certification.

MR. BERGMAN: So the QA program, I mean the design continues to evolve even during the certification. And all that work and work subsequent to certification continues under our own QA program, some of which will involve closure of open design items. I'm sure you've all seen that we're doing a power uprate. The power uprate isn't part of the design certification, but the power uprate, of course, would be done under the QA program. So that's standard practice.

A COL who then, that would be a good example of a departure. If a COL came in and added the power uprate, all that design would be departures from the certified design and that would all be done under the QA program. And if it impacted the D-RAP results, that would have to be reflected in the COL at that time, as well. But the program never stops. All the programs keep going.

CO-CHAIRMAN RAY: Well, that's fine. And you've made that clear enough, I think. It satisfies me, at least. We just, we'll see if everybody else agrees that that's what you're required to do following design certification.

MR. CONLEY: If I could, I'd like to add a comment about your -- maybe there's a difference in the term ODI, open design item. ODIs are unverified assumptions. So they're in the design, we just have to verify them. So I just want to make sure everybody was clear --

CO-CHAIRMAN RAY: Yes, it's not required testing. I understand that.

MR. CONLEY: Okay.

CO-CHAIRMAN RAY: But the point is you got a good system, as far as I can see, to track them, identify them, and so on. Our concern includes what visibility the agency has to the status of all of those.

MR. CONLEY: I understand.

CO-CHAIRMAN RAY: Because a certified design is different than a construction permit, as we all know. And, therefore, what we're interested in is how do we assess the status of the ODIs at the time of certification and then ensure that they're closed in time for operability requirements to be met. And that's, you referred to the fact that there are procedures in the Section 17.5, but it's the procedures used with respect to ODIs that we wanted to pursue here. And we may have some more questions on

that before you're done, but, please, I've held you up long enough now.

MR. CONLEY: Okay. That's fine. If you have specific questions, we'll do our best to answer them.

MEMBER BLEY: I think I remember that I had a question earlier. This is Dennis Bley. I wanted to ask you about the D-RAP board expert panel. The idea of expert panels in this sort of area, on the one hand they're looking to see at things pointed out in the PRA. It may not be as risk significant as the CDF. And, two, if there are things that aren't modeled in the PRA that the experts think would be important to safety at the plant, maybe because they're needed to keep the operators' understanding of the situation clear enough that what we model in the human reliability analysis still holds up.

Two questions for you. Can you give me any examples of where your D-RAP board either found something that was in the PRA that they thought wasn't really a risk issue and maybe the PRA was revised because of it? And, two, were any areas where the panel brought up issues that are not modeled in the PRA that they think could have been important?

MR. CONLEY: So if I understood, you had

two questions. The first one was is there something through operating experience that may have caused us to go back and want to revise the PRA and make something that was not risk significant become risk significant? Is that your first question?

MEMBER BLEY: That was pointed out by one of your panelists, yes.

MR. CONLEY: Okay. We will not, the PRA is the PRA. We don't update it, and I'll let Sarah speak to that. We do deliberate at the board, at the panel, and there are items, speaking to your second question, where we have brought something in and it wasn't risk significant and we deliberated whether it needed to be evaluated or elevated to risk significant.

Off the top of my head, I can't speak specifically to any one example. I'm sure we can find some for you that may fit in that or Dustin may have one.

Sarah, can you please speak to the other question about going back to revised PRA based on operating experience?

MS. BRISTOL: Yes. And this is Sarah Bristol. We did not, we looked at OE throughout developing the PRA for different aspects, but there

was no specific OE related to NuScale that was incorporated, that needed to be incorporated in the PRA update that indicated risk significance was more significant. You know, we used the generic reliability data that was, you know, based on industry OE and put that into our model.

MEMBER BLEY: That wasn't quite what I was asking. I expected that. My issue was, my question was the experts in your panel might know things beyond what's in the public operating experience that leads them to Ray's questions about things that are in the PRA and are they appropriate. I was asking did they find anything like that and, if they did, rather than just adding them to the risk or deleting them from the risk, I would think they'd want to have incorporated them in their PRA.

MR. GREENWOOD: This is Dustin Greenwood. And I think that's a great question. We took a little bit different strategy, and one of the items I think is important to point out, and I appreciate that you asked the question, the expert panel oftentimes identified items and the PRA identified items that would have screened as risk significant through the D-RAP process. But instead of adding them to the list of the D-RAP process using the risk-informed design

process, we challenged ourselves to put redundancy or add some design feature that removed it from the risk significance. So instead of identifying as risk significant, we found a design solution. Typically, it was using redundancy or other method of doing it to remove it from the risk significance.

So I hope that kind of answers your question, but we --

MEMBER BLEY: Yes, that's a more helpful answer. Thanks.

MR. GREENWOOD: Okay. Thank you.

MR. CONLEY: Okay. Any further discussion on that? If not, we'll move forward. Okay. The next slide, please.

What you see here is a figure from the DCA submittal in Chapter 17.4, and this basically outlines the D-RAP process. What I wanted to point out on this slide are a few things here, and it kind of goes back to your question about the program and process itself. We have the safety analysis. We have the results. We look at RTNSS during this process. We also look at other considerations, like Fukushima, other operating experience, what we've learned through our own experiences working with the design. And those will be inputs for the classification that the system

expert will use to make his initial or her initial determination.

Now, once that goes to the expert panel, you'll see here in the lower left, the expert panel, again, uses their own experiences, PRA results and assumptions. We also, as Dustin mentioned, we have a defense-in-depth approach and then system interactions again with RTNSS.

So all those things were considered at the expert panel. And then, through the discussion, it was either determined to be risk significant or not and then, from there, it was categorized.

And, again, going back to the process, our engineering change control process, any design change or a change to a calc has to go through that process and it gets evaluated for impacts. So ODI's updates impacts the PRA. All those things were considered through our processes.

Next slide, please. So for the risk-significance determination, this is from the, this table is in the topical. You can see the component system-level CDF and LRF values and then what we call the basic event contributor greater than 20 percent or equal to.

There were four key limitations in the

topical report. This is applicable to NuScale. And the second one is that the risk-informed applications include risk-significant SSCs with other concepts, and what that means is that we have, we consider the risk insights along with deterministic approaches and defense-in-depth concepts. And, therefore, we're implementing a risk-informed, rather than a risk-based approach.

The technically-adequate PRA addresses all hazards and all modes and the thresholds for low CDF, you can see there 10 to the minus 7 per year. NuScale meets all these conditions, as documented in the topical report.

Next slide, please. What you see before you is a list of the PRA candidates that came out through our evaluations. They're listed by system and components. ECCS, MPS, module protection system, the ultimate heat sink, those are the systems that were candidates based on their functions.

Components below, ECCS vent valves and re-circ valves, decay heat removal, actuation valves. I won't read all these for time, but you can get the gist of the idea that containment isolation valves, CVCS, CIVs, and the combustion turbine generator.

Next slide. So for other events and

initiators that were considered through the Fussel-Vesely, the reactor building crane, the LOCA inside and outside of containment, LOCA, loss of cooling accident, loss of off-site power, and internal fires and floods. We also looked at human actions with the 20-percent threshold, as well. And the chemical control volume system actuation and the containment flooding drain system were those that were analyzed for that.

MEMBER CORRADINI: Let me make sure I understand. So eventually you're going to get to the bottom line that neither of these two systems appear, but the human actions to initiate them do appear?

MR. CONLEY: The CVCS specifically was one --

MEMBER CORRADINI: And the containment flood and drain system.

MR. CONLEY: Yes. I'll speak to the CVCs one for sure, and then I'll come back to your other question.

MEMBER CORRADINI: All right. Thank you.

MR. CONLEY: So if you look at one of the previous slides, I don't know the slide number, but it was one of the three RAI questions specifically questioning the risk significance of the CVCS. We

responded to the RAI and we determined and basically specified that, from a system component function, it was not considered through the D-RAP as risk significant. It was considered through the important human actions. It's covered under that program.

MEMBER CORRADINI: So this will appear in Chapter 18 discussion? I don't think I understand that.

MR. CONLEY: I believe that's correct. Sarah, can you confirm that it's in Chapter 18?

MEMBER CORRADINI: Because I'd like Dr. Bley to pay attention to that.

MR. GREENWOOD: Yes, those actions are covered in Chapter 18 under the important human action.

MEMBER CORRADINI: So let me say it another way. I've got these systems. These systems, in some sense, are complementary. They overlap in function to provide appropriate actuation of boration or connection to the containment to the pool for an ultimate heat sink. But they're not risk significant, but the human actions to initiate them are.

MS. BRISTOL: That's correct.

MEMBER CORRADINI: Okay, all right. And that's not covered here in the D-RAP. That's covered

in Chapter 18 relative to operator actions/human reliability?

MR. GREENWOOD: That's right.

MEMBER CORRADINI: Okay, all right.

MEMBER BLEY: And we'll be doing Chapter 18 with you in about a month.

MEMBER CORRADINI: Exactly.

MEMBER BLEY: Mid-January.

MEMBER CORRADINI: So we won't forget.

MEMBER BLEY: It's close enough we'll remember that one.

MR. CONLEY: Did that answer your question for now? Okay, thank you. Okay.

Moving on to the results of the process. Again, this is a dynamic process, so there could be changes forthcoming as the design evolves. Table 17.4-1 in the FSAR shows you the systems. It also, if you look the table up itself, will show you some of the components. So the containment system, steam generator system, reactor core, reactor coolant system, CRDS, decay heat removal, ECCS, ultimate heat sink, MPS, and neutron monitoring, and then there's some non-modulate-related systems that are structures. The crane and the building and the control building were also considered risk significant.

MEMBER KIRCHNER: May I make an observation? So you screened out the two systems on the preceding, the CVCS system and the containment flooding drain system. They're risk significant because of human actions, so it strikes me, as a former designer designing advanced reactors, you don't want to be in this position. You want to design for that not to be the case, which suggests that they should be in your risk-significant list and be designed accordingly to prevent inadvertent operation because you're relying then on administrative operational controls rather than design to take them out of the risk-significant category, and that just seems counterintuitive to me for what we expect of an advanced reactor design and that needs to be caveated that's one member's opinion.

MR. CONLEY: Thank you for that. And if I understood your comment, you believe we should have designed that out using other things other than administrative controls so we weren't relying upon just the controls themselves. Okay.

MEMBER SKILLMAN: I want to join Walt and I want to re-ask Dr. Bley's question. His question was are there any systems or structures or components that operating experience suggested should be in and

that you screened out, and I'm wondering if CVCS was one of those systems. And I ask that as a guy who responded to a loss of coolant accident on a PWR whose ECCS system was disabled.

MR. CONLEY: So the question was if there were any operating experience components considered that screened out, was that your comment?

MEMBER SKILLMAN: Specifically, was CVCS screened out?

MR. CONLEY: CVCS was not risk significant; that's correct. There are multiple ways to add moderator and also to add coolant to the RCS, and, once the containment is isolated, that's where we drew the line as far as getting into the human actions. But it was screened out as not risk significant.

MEMBER SKILLMAN: I understand it was screened out. The question, I think, that Dr. Bley asked was was there any system that operating experience would have suggested should be in your list that was screened out and was CVCS among those that was screened out?

MR. CONLEY: I'll have to take that as a question and respond back, unless Dustin can speak to that specifically. I don't know the complete list.

We had, like, a hundred systems, and I can't recall each one. Dustin, can you speak to a place where we had operator experience that we screened it out?

MR. GREENWOOD: Where we screened the system out of the risk-significant discussion based on operator experience?

MR. CONLEY: I believe that was the question.

MR. GREENWOOD: We did not. We did not.

MEMBER CORRADINI: No, just the opposite. I think Member Skillman's question was it was his impression that CVCS, based on operating experience, would be screened in, not screened out. That's what I think he was trying to get at.

MEMBER SKILLMAN: That's what I was trying to get at.

MR. GREENWOOD: That's the way I understood the question also, and the answer is no. We didn't bring any in and identify them as risk significant and we did have extensive discussions about CVCS, but the idea that we had to un-isolate containment to initiate CVCS as a core makeup was the topic of the discussion. So that was discussed more clearly in the RAI when we asked why CVCS wasn't a risk significant because there are competing scenarios

that we discussed in the expert panel is all I'll talk about in this, to just quickly answer the question.

MEMBER BLEY: This is Dennis Bley. I'd go back to what Walt asked, and I'd suggest that, while I don't disagree with what he said, is these folks have broken what they're looking at in the hardware and into the human participation with the hardware. When we get to Chapter 18 and however they dealt with this, depending on how risk significant the operator action was, you know, sometimes that leads to a hardware change to make it less likely. But I would hope that's where we would see that, and I think we ought to return to this in January when we look at Chapter 18.

MEMBER CORRADINI: Okay. Why don't we move on?

MR. CONLEY: Okay. I believe that was our final slide for the presentation on Chapter 17. Thank you for your time.

CO-CHAIRMAN RAY: Okay. Well, we're now one hour in. We've got the staff to go, and we've got another whole chapter to do. I do want you, however, please speak more fully. I believe I've acknowledged that the ODI management system is a visible system. It's been checked. The inspection that was performed

so far identified some shortcomings. It identified, for example, that there's no clear restraint on a design product based on underlying ODIs. Presumably, you get at them by coming from the ODI list, not by looking at the final design document, whatever it is. But they can be tracked. I understand that.

What I'm asking you to speak to or someone, if you can, please, is how they are actually managed and if you, I'm not trying to get hung up on specific findings in the inspection because it was an initial inspection. There will be a follow-up inspection. I'm not wanting to get over dramatic about the issues that were raised.

The thing that is of concern is it wasn't clear to me that these ODIs went beyond just a list that existed, such that the products themselves identified that this is an assumption, not a verified item. And I'm trying to get you to talk a little bit about how you gained confidence that we're going to get all these things closed by the time they need to be and we're not going to have stuff manufactured that has problems with it because we didn't close an ODI in time and things like that.

None of that is in the topical report. It just says a procedure exists. I've looked at the

procedure. I understand it. But can you talk some more about how ODIs get managed so that you can give us assurance? I'll be asking the staff. They talked about in the inspection report being sufficient closure to have, enough closure to have sufficient confidence to make the reasonableness finding in the design certification issuance. I don't know how they go to do that, but I just want to know how you guys see yourselves managing this large number of ODIs that existed at least a year and a half ago.

MR. CONLEY: Okay. I'll take an attempt to answer your question. So I'll agree with you we didn't specify all that level of detail in the submittal or in the topical. Basically, we have a procedure, as we mentioned earlier, that governs open design issues or open design items. That is dovetailed with our engineering change control process, so there's many mechanisms that work together to ensure that we attach the appropriate level of identification that something needs to be changed and the way we do that is through what's called ensuring change order, an ECO.

What will happen is when a document needs to be revised or changed it goes through the engineering change control board process. It gets

analyzed for impacts through systems for the license. And as part of that, we will do an impact analysis to see where that change might be filtered through the design.

Once we identify those documents that are impacted, those ECOs are posted against those documents, so they're there attached to it so we see them visibly that there's an outstanding item here that needs to be resolved or incorporated.

Now, as far as the ODI process itself, that's part of the change process. We have an administrator who keeps the list, but when we go through to do, let's say we're going to close or resolve an open design item, that means I've got to go touch this document for revision, we'll generate an engineering change request which kicks off that process that identified, gives it the visibility. We see where it goes. The appropriate ECOs go out and get attached to the documents that won't necessarily be updated at that moment, but they are attached to show that the change is there.

Also, if we have the open design items added through a design or a calculation that's updated, if we have an unverified assumption, again, that will be identified through that process, ECOs

will be updated, and it will be part of that change control process.

So there are many things that work together through that, but it all hinges on the administration of the engineering change control process and that interacts with the ODI process itself. The number of items that you're specifically speaking about, as things get resolved those get worked off and those numbers, we do have a track on those numbers. We know what they are, what outstanding items we have, what the source documents are, what the implementing document is. So we know exactly where they are, how many we have, and the process that controls them.

So I hope that gives you a little more insight of how we handle that.

CO-CHAIRMAN RAY: Well, honestly, I inferred most of what you said from what I have seen. It just seems like a backlog that carries with it uncertainty. And from where I sit now, it's a backlog that needs visibility as one approaches. Really, it doesn't concern me about at the issuance of the design certification, provided there's an answer to the question about reasonable assurance. But the real problem is how the backlog avoids becoming a

1 significant problem.

2 You're probably aware that AP1000, before
3 construction started, went through something called
4 Amendment 6, and it had been issued previously but
5 there was an enormous amount of the same sort of
6 thing. And it was difficult, extremely difficult, to
7 identify what it was that needed to be done to get it
8 put into ITAAC and so on. Just a very big job. And,
9 yet, that was something that had at least gone through
10 the stages, almost like getting an OL after getting a
11 CP because of how it evolved.

12 I appreciate you got to have a customer
13 before you do a lot of this work. That's absolutely
14 clear. Having been a customer, I know that that's the
15 case. And so what I'm concerned about is, once that
16 happens, how these things gain the necessary
17 visibility and get done in time because we've been
18 through it before and it wasn't a very comfortable
19 process.

20 But you said all I think you can
21 reasonably say. It's something that you have given
22 visibility to. You do have a write-up in the topical
23 on design verification. It would be good if you
24 revised that thing to say a bit more on this subject
25 if you revise it for some other reason because the

implication is that it's infrequent, whereas the reality is it's going to be much more infrequent that these things exist throughout the design.

Okay. Well, with that, if there's nothing more for you folks to say, we better --

MEMBER SKILLMAN: May I please ask a question?

CO-CHAIRMAN RAY: Yes, of course.

MEMBER SKILLMAN: Patrick, what you described is, by and large, a work management program, how items are identified, how they're sifted, how they are identified for work. What, to me, is the complicated part of this riddle is you're dealing with Tier 1 and Tier 2 information. And when you're in Tier 1 information, you're into a license amendment. When you're in Tier 2 information, you can pretty much do whatever you want, do a 5059, screen it out, and say I'm going to go.

And so compounding the issue of the number of items that Harold pointed to, it seems to me that you have the added burden of how are you going to handle what might be unforeseen and emergent changes that bump into Tier 1 information? And that can stop the whole show because you've got to come back to this office for, at the minimum, discussion.

Can you briefly state how you're envisioning handling the difference between changes that might emerge on Tier 1 information?

MR. CONLEY: Yes, I can't personally speak to that. I don't know if, Dustin, if you can speak to that since it's related to ITAAC and Tier 1, I'd appreciate that. If not, we'll just have to get back to you on that.

CO-CHAIRMAN RAY: But before he responds, let me just say we've been through it, so I think I know the answer. It is what Dick said it was. I think we're more expressing a concern and a desire for visibility, something that we can hang our hat on.

MR. CONLEY: Your concern is very warranted. We understand, and it is something that bothers us, as well, and we have had lessons-learned meetings and it --

CO-CHAIRMAN RAY: If you want to have somebody speak to it further but keep it short.

MR. CONLEY: Go ahead, Dustin, if you have something to offer.

MR. GREENWOOD: Yes, this is Dustin Greenwood. Sorry. Thanks, Patrick. This is Dustin Greenwood, and I will keep it short because I know we all recognize that as a concern. In general, we tried

to ensure that we pointed to Tier 2 wherever possible in anything that was required in Tier 1 just to make sure that if a design process went through and changed it in the Tier 2 material, rather than specifically pointing it out in Tier 1 and requiring an LAR to resolve it, we just pointed back to the Tier 2 information so that that change would reflect.

But, yes, it's a long process ahead of us, and I appreciate the foresight and caution.

CO-CHAIRMAN RAY: Thank you. Anything else? All right. We will not take a break at this time. We will ask you to trade places with the staff and we'll try and wrap up Chapter 17. Again, it sounds like someone needs to mute their phone.

Do you guys got enough chairs? Okay. If I may, let me again, as I did with NuScale, express, for the purposes of all the members here, as well as the staff, stuff that I'll be looking for and hoping that you'll respond to as part of the presentation you're about to make.

2017 inspection report forwarding letter includes a statement that, "As part of the DCA review, NRC technical staff audits and additional inspections of quality activities will be performed to ensure that open design items are sufficiently closed to enable

the NRC to make its 52.54 finding." And as I said to NuScale, I've been through this several times at the CP stage under Part 50. But then we were followed by the OL stage.

Here, I don't know if the intent is to incorporate all ODIs that aren't closed into ITAAC. I'm sure it's not. But how do we deal with this open item issue? We went through it in AP1000, and it wasn't very pleasant, or it was difficult. Let's put it that way.

Last year's NRC inspection, which I referred to, included a number of findings that would seem to make visibility to incomplete design verification difficult. We've heard from NuScale about that now, but the ODIs themselves are enumerated and presumably can be tracked to closure through to when operability is required, but there were errors and omissions cited in the inspection and I'm sure those will be followed up when the subsequent inspection or inspections are done.

Also, in that inspection report, it was stated that "ODIs may exist in supporting documents' references to calculations and that the NRC inspection team did not find examples of ODI placeholders in the body of the documents reviewed," and that's what I

meant by the question in which I ask how do you find the ODIs that are outstanding? You've got a list of them, but you have to go look for where they are and what tier of design documents. They aren't reflected, according to the inspection anyway, as a placeholder in the design document.

They've committed to tracking all of the open design items properly and ensure closure before operability. However, we're interested in how the NRC will be able to verify that the management, ODI management has completed this process, most of which will take place after the design certification occurs. And I guess none of us see it as part of the COL QA program, but then you may see it differently. So please proceed.

MR. TABATABAI: Good afternoon, everyone. Thanks for giving us an opportunity to present the staff's review up to this point of Phase 2 of the review. This is a briefing of Chapter 17, which consists of two major parts: quality assurance and reliability assurance program.

With me today, and we apologize for not having name tags, but to my right Alissa --

MEMBER CORRADINI: You guys look familiar to us.

MR. TABATABAI: Yes. Alissa Neuhausen. She will be presenting reliability assurance program for the staff. Andrea Keim. She will be presenting quality assurance. And we have Ian Jung, as well, who will be helping us with the reliability assurance program.

I will go through some background information to just get the discussions started. I just wanted to recognize the staff who have reviewed this chapter. Since we presented risk significance determination topical report, Mark Caruso was our main reviewer and he has since retired. Alissa is going to talk about that if there's anything to discuss. For project management, Greg Cranston is our lead project manager for NuScale. And I'm Omid Tabatabai. I'm a senior project manager and responsible for Chapter 17.

Just an overview of the staff's review. We received Revision 0 of DCA back in December 2016, Revision 1 in March 2018, and recently we received Revision 2 of the DCA in late October. I just want to make sure that you know that the review is based on Revision 1 of the application.

We issued two RAIs containing three questions to NuScale related to Chapter 17, and they were all related to reliability assurance program.

And all of the questions have been responded to and they have been resolved.

For reliability assurance program, we conducted two regulatory audits in 2017 and 2018. And for quality assurance program, we, as you mentioned, in June of 2017, we had a quality assurance implementation inspection. And we have a follow-up inspection that we are going to plan to conduct again.

We have two open items in Chapter 17, but we don't have any confirmatory item. We will discuss in more detail what those two open items are.

With that, that concludes my portion of the presentation and I will turn the microphone to Andrea to talk about quality assurance program.

MS. KEIM: Hi, good afternoon. My name is Andrea Keim. I'm a reactor operations engineer at the NRC. I've been with the agency for more than 20 years. I have a BE and an MS in material science and engineering from Stevens Institute of Technology in Hoboken, New Jersey. I work in the Quality Assurance and Vendor Inspection Branch. The branch leads and performs routine and reactive vendor inspections, and we also conduct QA implementation inspections for new reactors. We also perform QA reviews for Part 50 and 52 applicants, and we also review the initial test

program.

Next slide. The main regulatory -- oh, back one. The regulatory requirements are Appendix A to Part 50, which gives us our general design criteria, and quality assurance is number one. So that means that licensees and applicants have to make sure their structure systems and components important to safety are designed, fabricated, erected, and tested to quality standards commiserate with the importance of the safety function they are to perform.

The second criteria here is Appendix B, the second regulation is Appendix B to 10 CFR Part 50, which provides our quality assurance criteria for nuclear power plants and it lays out the 18 criteria for quality assurance. 10 CFR 52.47 addresses the contents of an application and, for a DC applicant, must include a quality assurance program that satisfies the applicable portions of 10 CFR Part 50.

Next slide. That's the one. So the way we did this, the topical report was submitted and it was separate from the design certification application, and this was reviewed prior to getting the application. The approval was prior. NuScale's QR review was completed outside of the DC process. The topical report was reviewed separately to ensure

that the preliminary work on the application was done in accordance with the requirements of Appendix B to 10 CFR Part 50.

The staff used the guidance of the NUREG-800, Section 17.5, for quality assurance program description for design certifications, early site permits, and new licensee applicants as guidance for the review.

Again, the applicant's QA topical report was submitted in accordance, submittal was in accordance with Reg Guide 1.28 Rev 4, which endorses the ASME NQA-1 2008 edition through the NQA-1A 2009 addenda. The staff found this acceptable and that the submittal met the requirements of Appendix B to 10 CFR Part 50 and the staff's SER was dated September 22, 2016.

So then we go to the next one, and it talks about our review for the design certification application. And what we do with that is we verify that they referenced the approved topical report. We verified the COL application, and the staff identified an open item where we're going to do an additional QA implementation inspection.

And the last part of our review was the QA implementation inspection that has already taken

place. This occurred on June 5th through the 9th of 2017 at the NuScale office facility in Corvallis, Oregon. The inspection followed Inspection Procedure 35017. There were no significant findings identified, and the inspection report is publicly available.

Again, we plan to perform another QA implementation inspection and it's being held in the SER as an open item 17.5-1.

MR. TABATABAI: Okay. That concludes our QA presentation. Any question?

MEMBER CORRADINI: So can I ask a question?

CO-CHAIRMAN RAY: Please.

MEMBER CORRADINI: Okay. So I'm listening to Harold and I want to make sure that it's clear. So is it the staff's position that this is an issue strictly for NuScale, as Dick calls it a work management program for the ODIs, or is this something that you're watching so that, once the DCD is done and before the COL is issued, you're making sure that these things are appropriately closed? Put another way, why isn't this an ITAAC?

MS. KEIM: We've reviewed this as a process, and, during the inspections, we evaluated how they keep track of the ODIs and the process that

they're using. But we're not following each and every ODI --

MEMBER CORRADINI: No, I wasn't expecting that.

MS. KEIM: But then there's the technical staff that go and do audits for their calculations and they have some documentation in their audit program and through RAIs that also close the ODIs.

MEMBER CORRADINI: So if I've got it right, you now are, you're satisfied that their program to track and close the ODIs is appropriate, but you don't see the need to essentially assure closure of them before the COL is issued?

MS. KEIM: Not all of them, no.

MEMBER CORRADINI: Okay. Fine.

MEMBER SKILLMAN: Let me explain where I'm going with this. I've got your SER at Chapter 17.0, quality assurance. The statement is very clear. The QA PD is based on the applicable portions of Appendix B. Criterion III is design control. Criterion XVI, 16, is corrective action program.

Did you look at their Criterion III, design control program, in a context of Harold Ray's comments about the open items? Why are we asking the question? Because this is a killer. Unless these

pieces are knit together, the end product is going to be a quagmire for everybody. It's going to be a quagmire for NuScale, and it's going to be a real rat's nest for the staff. And unless it's designed properly on the front end, and it's not just work management but it's the integration of the 18 points of Appendix B, then we're probably all going to be wishing that we had done something differently a couple of years before. Now is the time to do it.

When this says applicable portions, I've got to ask, what isn't applicable?

CO-CHAIRMAN RAY: Well, the inspection report itself didn't refer to Criterion XVI, which seemed a little odd to me, but maybe it's the right thing to do in this context.

Do you know how the NRC will determine that the open design items are sufficiently closed to issue the design certification? That's what's stated in the forwarding letter for the inspection report.

MS. KEIM: Some are being closed through the audit process and through RAI --

CO-CHAIRMAN RAY: Well, they're not being closed to the audit process. They're being recognized as having been closed by NuScale through the audit process; is that correct?

MS. KEIM: Yes.

CO-CHAIRMAN RAY: Okay. But how do we, as an agency, decide that they've closed enough of them that we can issue the design certification?

MS. KEIM: Because they're following their processes through the, if their assumption comes -- they had a process which they talked about where if one of their assumptions comes out to be wrong then they have to go through the whole design control process to figure out how broad does this error --

CO-CHAIRMAN RAY: I'm asking how we decide, we, the agency, decide that they're sufficiently closed. That's what it says.

MS. KEIM: I'm not sure.

CO-CHAIRMAN RAY: I'm not either, and I've been around here perhaps as long as you have. I have never seen a statement like that before, and I'm trying to understand what it means.

MEMBER CORRADINI: Are you looking for other staff to help you? Someone was up, and they sat down.

CO-CHAIRMAN RAY: All I can do is ask who's in front of us here, but the question --

MS. KEIM: And that's in the cover letter of the inspection report.

CO-CHAIRMAN RAY: The forwarding letter of the inspection report says what I just read you, that they're sufficiently closed to -- as part of the DCA review, NRC technical staff audits, which you referred to, and additional inspections, plural, of quality activities will be performed to ensure that open design items are sufficiently closed, not that they're being managed properly. Sufficiently closed is the phrase.

MS. KEIM: Sufficiently closed is for the ones that are of high significance that they're going to be done through our RAI process and through the DCA review.

CO-CHAIRMAN RAY: Let me suggest something. Perhaps this is something which, at the full committee meeting, you'd want to get a more well-prepared answer for because I've never seen this kind of statement made. I don't know how it's done. I can imagine some things, but that's just all it is at this point. But I'd rather the staff tell us this is how we reached this conclusion that they're sufficiently closed. And as I said to NuScale, nobody in their right mind would expect them to all be closed or any given number remain outstanding, but we don't know how to ensure after the design certification is completed

that they're closed. NuScale has told us they will be closed in accordance with their program, which will remain in effect contrary to how I read what the staff has said about the applicability of the program, that it only applies to the design certification.

But be that as it may, the concern that I think is shared by Dick and others of us here is, okay, this is a necessary situation, it's not something that's a problem, so long as we understand how the heck it gets resolved. And the only mechanisms that we know about are the ones that we've used so far, you know. The one Part 52 plant under construction we went through this process, so if we're going to do it differently here tell us how we do it.

MR. LEE: Good afternoon. My name is Sam Lee. I'm the Chief of Licensing Branch 1 responsible for project managing the NuScale DCA review. I think, so I understand your point, Mr. Ray, and perhaps there will be an opportunity where we can discuss what an ODI is and what that consists of.

I think the question at hand is what constitutes the scope of the staff's review? ODI, open design item, is not an open item. I think it was earlier somebody mentioned that it was referred to as open item. Open item is really an unresolved issue or

unresolved RAI, if you will, that is found through the Phases 1 and 2 of the review, right? And at the end of the Phase 2 --

CO-CHAIRMAN RAY: No, no, let me interrupt you. I'm sorry to interrupt you, but I think it would be best if you read NuScale's definition of ODI. They call it a design assumption. It's not something that's found, it's an assumption that allows them to proceed with a design without verifying the assumption, and it's perfectly fine. There's nothing wrong with it. But it's not a finding, it is an assumption that is made that allows the design to proceed on the basis that you will later verify that assumption in some manner. We had lots of them in the Westinghouse AP1000. The ones that existed when the Amendment 6 were issued were all put into ITAAC. It was a dozen or so. This is a much bigger number. We're wondering how it's going to be managed, which we asked NuScale and we're asking you guys how it will be overseen. But it's not a finding.

MR. LEE: So within the scope of the design certification application review, the finding that the staff will make would be related to the open items coming out of Phase 2. We will not make a finding on every ODI. If it happens that, as part of

the staff's review, whether it's through the RAI process or through the audit, that there is a particular ODI that needs to be addressed within the scope of the DCA, we will, as Andrea has said. But we will, we do not plan to review and close or review of how every open design item would be closed.

CO-CHAIRMAN RAY: And, of course, you never heard me ask that. But I did ask how you would decide that they were sufficiently closed to issue the design certification. How is it done?

MR. LEE: I think that would be case specific, depending on what the question at hand would be.

CO-CHAIRMAN RAY: Will there be visibility to it, as was done when we did the final amendment on AP1000?

MR. LEE: The visibility would be through the audit process or the RAI process.

CO-CHAIRMAN RAY: But not through the process of recognizing what was outstanding, not yet closed, at the time of the issuance of the design certification?

MS. KAVANAGH: This is Kerri Kavanagh. I'm the Chief of the Quality Assurance Vendor Inspection Branch. NuScale does not supply the NRC

with their list of ODIs. That is something that the staff would come across during our inspection or through the audits of specific design documents. So the staff does not have first-hand knowledge of what that list looks like unless we're on-site doing an inspection or an audit of NuScale.

CO-CHAIRMAN RAY: How does sufficient closure get determined then?

MS. KAVANAGH: We have to determine what are reasonable assurances based on our regulatory requirements, so the staff would make that for each chapter that is reviewed.

MEMBER CORRADINI: Can I try something? I keep on listening to you guys going back and forth, and I wrote something down, but maybe this is not accurate. But my interpretation of it is, based on inspections and audits, the staff feels that they need to find reasonable assurance that the ODIs can be managed and closed. So by the audits, you look at what they've closed one by one and you gain assurance by essentially a fraction sampling of what they're doing? That's what I'm struggling with. I think that's what Harold is struggling with.

CO-CHAIRMAN RAY: Excuse me. And I'll let you speak in just a second. I'm actually, the thing

that I'm struggling with the most is a determination that open items are sufficiently closed to enable a reasonableness finding. I don't know what that means, but that's precisely what I'm trying to ask.

MS. KAVANAGH: Right. So for a QA implementation inspection, we don't do 100 percent. It's a sampling basis. So depending on what it is that we sample or who we have, which specialist we have with us on our particular team, I mean, that's the scope that we would be looking at and we'd have to make an assumption on our part that that whole process will be relayed to the rest of the program.

CO-CHAIRMAN RAY: Okay. I think we've gone around and around enough. I'm using some of Pete's time now. I appreciate you stepping up to answer. I'll just say this is not something, at least speaking for myself alone, understand sufficiently. I understand what NuScale will do. That's not a problem. And they're going to continue to do what they do before and after the design certification is issued, and before operability everything has got to get closed.

The question I'm asking is how do we decide that they've closed it enough to issue the design certification? We'll follow that as we go

forward, and that's about the best we can do right now.

If you have something more to offer us, plan to do so in February at the full committee meeting, and we'll greatly appreciate it.

MR. LEE: This is Sam Lee. I'll just restate what I've said. Staff will make a reasonable assurance finding. If that reasonable assurance finding needs a review of the ODI to reach that point, we will do so. Otherwise, we will not.

CO-CHAIRMAN RAY: I see. Well, that's fine. Glad to have it on the record. Appreciate it. Okay. Anything more for the staff?

MR. JUNG: This is Ian Jung. I'm speaking more from a Chapter 19 review. There are a set of very significant assumptions made in developing PRA, given the lack of design details or some of the limitations associated with the design stage. So those assumptions that are significant staff's review has been focusing on. And not only those assumptions are listed in FSAR and staff is also including those significant assumptions to be carried forward to a COL applicant, so there are tables, there are COL action items for verifying those assumptions. So I just want to mention that.

I was a part of the training that was offered to branch chiefs last year on ODI, and my impression coming out -- I don't want to go into detail, it was a closed meeting -- is that ODIs are, in general, so far below the design certification material that's needed for the reasonable assurance of safety finding. However, the ODIs are ongoing activity for NuScale. Any of those activities rises to a level that's going to have an impact on design certification, staff's finding on reasonable assumptions finding, they have to either come back with FSAR changes during design certification or carry forward through the COL stage. That's what my --

CO-CHAIRMAN RAY: Yes, I agree with part of what you said. But, of course, the ODIs don't have to do with PRA. That's not an Appendix B design verification issue.

MR. JUNG: There's a slight programmatic difference, but assumptions in PRAs are --

CO-CHAIRMAN RAY: I'm sure that's right. Absolutely. But I'm really just focused on the ODIs that are related to Appendix B scope or --

MR. JUNG: I understand. I just want to share my thoughts on much broader --

CO-CHAIRMAN RAY: And I appreciate the

input on a difficult thing. I did convey this issue to the staff a week ago or so, so I hope I'm hearing what you had to say after thinking about it. But I still don't understand what the mechanism is, although I think it's better now than it was.

In any event, anything more for the staff? We need to go around the members quickly and -- oh, I beg your pardon. We stopped before we did reliability assurance. I thought you hadn't asked many questions, Mike. It was my effort to beat the clock here. Please, go ahead.

MS. NEUHAUSEN: I'll be presenting on reliability -- okay. Good afternoon. My name is Alissa Neuhausen again. I'll be covering Section 17.4 on the reliability assurance program. And for the reliability assurance program, or RAP, staff's review was performed in accordance with SRP 17.4 Revision 1.

The staff reviewed the program description in implementation, programmatic controls, SSC selection, expert panel member requirements, and the list of D-RAP SSCs. The first stage of the reliability assurance program is referred to as the D-RAP, which encompasses those reliability assurance activities that occur before initial fuel load, which includes both the DC and COL phases.

The second stage comprises the reliability assurance activities conducted during the operations phase. Of course, what I'm talking about today is the DC phase.

The applicant's description includes sufficient detail of the process used to identify what is risk significant at the design phase. That way, any design changes done to those SSCs can be controlled and, as construction progresses, appropriate QA controls are applied to those SSCs.

The programmatic controls, which ensure the risk insights and key assumptions are consistent with the plant design, adjust the appropriate activities as outlined in the SRP. The selection methodology for the risk-significant SSCs considered probabilistic information that is that PRA information as approved in the risk significance determination topical report, deterministic evaluations including defense-in-depth considerations, operating experience, expert panel reviews, and severe accident analysis. The applicant met the conditions and limitations stipulated in the topical report for the described methodology to be acceptable.

The staff reviewed the expert panel membership requirements and found them consistent with

the SRP. The staff confirmed that the expert panel considered the appropriate inputs, in addition to the probabilistic information, for the selection of risk-significant SSCs. And the staff reviewed the final list of D-RAP SSCs which are those required to perform risk-significant system functions and verified the process described in FSAR Figure 17.4-1.

So based on the review of the previously-described information, the staff found that the D-RAP list was developed in accordance with its RAP methodology, that NuScale adequately implemented the expert panel in developing the D-RAP list, and that the D-RAP list is comprehensive. The three COL items respectively for integrating RAP into operational programs, QA controls during site-specific design procurement, fabrication, construction, and pre-operational testing activities, and the identification of site-specific SSCs provide an appropriate level of assurance that a COL applicant referencing the NuScale design will implement an adequate reliability assurance program.

And, lastly, the inclusion of the D-RAP ITAAC is currently the only open item in Section 17.4. SECY-18-0093 is currently with the Commission. Staff has recommended that the Commission discontinue the

use of the D-RAP ITAAC, and we're currently waiting for a response.

MEMBER CORRADINI: So can we go to that last thing, and can you explain to me -- my first conclusion was, because I didn't read Section 17.4.4.8, was there ought to be an ITAAC about doing a D-RAP before fuel load to check everything is kosher. But this says you're going to the Commission to say ITAACs aren't needed anymore. Why? Explain the logic. Can you explain the logic for me?

MS. NEUHAUSEN: I can explain a little bit of the logic. It is --

MEMBER CORRADINI: But you've got lifelines here. You can get other people to --

MS. NEUHAUSEN: So it is lined out in the SECY paper, and so the basis is that we've done it before several times. Nothing significant was really identified. And it's consistent with how the Commission has acted for additional operational programs, so the remainder of the operational programs, the Commission said we don't need ITAAC as long as it's sufficiently described in the DC. So we would consider it to be sufficiently described in the DC.

MEMBER CORRADINI: So let me try it a

different way. So as long as it's sufficiently described, so is it described somewhere in Chapter 17 that the D-RAP will be re-visited with the new PRA values prior to fuel load so that it's very clear the D-RAP will be checked? Because I couldn't find that.

MS. NEUHAUSEN: That is part of the programmatic controls.

MEMBER CORRADINI: That's part of the programmatic controls?

MS. NEUHAUSEN: Yes.

MEMBER BLEY: Did we get that SECY? I don't remember seeing it.

MEMBER CORRADINI: Dennis, you have to speak a bit louder. You're kind of fuzzy.

MEMBER BLEY: Did we get the SECY? I do not remember seeing it.

MEMBER CORRADINI: I don't either. I was going to ask for it eventually, but, no, I'm not aware of this. This was new to me when I read the paragraph.

MS. HAYES: So I'm Michelle Hayes. I'm the Branch Chief for the PRA and Severe Accidents Branch, and we wrote the SECY, as Alissa said, based on the programmatic controls that it has to be approved, it has to be submitted and described in the

COL and then approved by staff.

I think what you're talking about, having everything done before operation starts or fuel load starts, that's the second phase of the RAP program and that's part of that 17.3 COLA item, that is -- or 17.1 actually, maybe 17.4-1, where that the COLA applicant is going to put something in place during operations phase to take care of the reliability insurance activities.

MEMBER CORRADINI: Well, I guess maybe every time I get to talk about process I do it wrong, so Harold looks at me with a funny face. What I'm worried about is there's a gap. In other words, we have the D-RAP now based on a list of things, based on the PRA and expert panel, and now time marches along, they build components, the RRV, the RVV. There's assumptions about reliability of these things. The reliability changes or is estimated to be different, and some things may become risk significant and warrant or vice versa. Where does it stand that somebody is going to do another check on all of this so that before fuel load this is checked and I have another D-RAP?

MS. HAYES: So the PRA is required to be updated before fuel load, and then that would be the

part where they would go into their operational programs. That would be fed into the operational programs.

MEMBER CORRADINI: So it's only operational. The D-RAP would not change. The D-RAP is set once the DCD, once the certification is approved?

MS. HAYES: No, the programmatic controls for the D-RAP and what they're explaining with that flow chart is every time you make a design change, either the NuScale or the COLA applicant is going to be maintaining that D-RAP list.

MEMBER CORRADINI: Okay. So let me, I have to go by specific examples. So we build some first-of-a-kind RVVs and RRVs and I test them and they work well, but they don't work as well as assumed. That will go into the design process, and that will then be funneled in through the PRA and --

MS. HAYES: Yes, the PRA, a change in the PRA feeds back into the D-RAP process.

MEMBER CORRADINI: Okay, okay, all right. Thank you.

MR. JUNG: Yes, we will provide the SECY paper, although it's in public website right now.

MR. TABATABAI: Okay. This concludes our

presentation. Any other questions from the members?

CO-CHAIRMAN RAY: I'll go back to where I was some time ago and ask if there are other questions. We appreciate you being responsive, and, as I said in the beginning, we've got to move on. Yes, Pete?

CO-CHAIRMAN RICCARDELLA: This is so much different than Chapter 2. I wonder if maybe you ought to go around --

CO-CHAIRMAN RAY: I am going --

CO-CHAIRMAN RICCARDELLA: -- for individual members' comments before we move on.

CO-CHAIRMAN RAY: Appreciate it, yes. Absolutely. It is different in topic. That's what I was starting to do a bit ago when I got reminded that we still had reliability assurance to go. Thank you, staff.

Okay. With that, let me do as you say. I've got note-taking capability here. Let me ask, starting with Walt, about any comments on Chapter 17.

MEMBER KIRCHNER: Just one observation. I have been struggling with how to phrase a constructive question out of this but mindful of events to the southeast that had QA kind of issues. This sufficiently closed on ODI, to what extent have

you factored lessons, are there any lessons learned from previous certified designs that are in construction in the area of QA implementation and design control? Sufficiently closed is sufficiently vague that it leaves me pondering as to what your process is to make that determination. Do you actively engage subject matter experts from your design disciplines, like Chapter 4, the people that would review 4, 5, you know, some of the areas that really are going to be important factors in making a reasonable assurance determination? Has there been any change to the NRC processes in terms of evaluating quality assurance programs as a result of previous activities with the certified design and to what extent do you actively engage other subject matter experts in this assessment of open design issues?

CO-CHAIRMAN RAY: So this is a question you want us to take note of here, or did you, were you directing that to the staff to have them respond?

MEMBER KIRCHNER: It was to the staff. It's just something I'm pondering and perhaps --

CO-CHAIRMAN RAY: Yes, it's a tough question to answer at this moment.

MEMBER KIRCHNER: Yes. And it was a rambling question, I will admit that. But it does

make me think hard about sufficiently closed.

CO-CHAIRMAN RAY: Yes.

MEMBER KIRCHNER: Maybe they can address that --

CO-CHAIRMAN RAY: I'll take note of it.

MEMBER KIRCHNER: -- at the February meeting.

CO-CHAIRMAN RAY: We'll try to see how it fits in. Certainly, staff understood your question. You know, the other side of it for me is I don't see how we can expect the NuScale design at this point to be further along than it is. This is really an agency process issue, as I see it. I happened to be somewhat involved when Part 52 was adopted. We're now applying it in a different context, so I know that we're struggling to find out how to get things done.

I will ask the staff a question I forgot to ask. You don't object to us saying that NuScale has affirmed that their QA program will apply beyond the design certification, even though you can read some of the stuff that's been written as indicating it only applies up to design certification? You don't mind us saying that it was clarified that it applies beyond then, right?

MR. TABATABAI: I think that's what Tom

mentioned during his -- maybe he wants to clarify.

CO-CHAIRMAN RAY: I heard him say that, too. But I just want to be sure you don't mind us --

MR. BERGMAN: I want to distinguish between what we do to be practical and what is required by regulation. I'm not willing to make that regulatory commitment here. If it's not required, that doesn't mean we won't do it.

CO-CHAIRMAN RAY: Okay. Well, you won't be surprised then if we happen to advise the Commission that it should be required like anything else in the design certification is required.

MR. BERGMAN: I can't object to that. I can't object to that.

CO-CHAIRMAN RAY: Yes, okay. Mike?

MEMBER CORRADINI: I've asked enough. I pass.

CO-CHAIRMAN RAY: Okay. We're not asking more questions here. I'm trying to get note for the record of member reflections on what we've been through and --

MEMBER CORRADINI: Okay. So my reflection is, I think my confusion about the ITAAC, I guess, is resolved based on we're going to see the SECY in terms of what that implies. In terms of the QA program,

you've asked enough questions. I think I understand what the staff is, how the staff would determine reasonable assurance, so I think my questions have been answered.

MR. SNODDERLY: This is Mike Snodderly. Just to clarify, that SECY did not come before the committee and is not expected to come before the committee. Right, okay. Sorry. I thought you meant . . .

CO-CHAIRMAN RICCARDELLA: I just sense there's kind of a serious timing issue here, you know, regarding the D-RAP and the PRA. We're not going to have a final PRA until prior to fuel load, and, yet, that final PRA, as Ian said, has got a lot of, the current PRA has a lot of assumptions in it and those assumptions have fed into some key decisions that if that were to change just before fuel load, I mean, in reality, what are you going to do about it? What if the source term changes? I mean, there's assumptions from the PRA that went into choosing the size of the source term. There's assumptions in the PRA that went into picking this site boundary limits and things of that sort. If those were to change at the, you know, at the very end like that, I can't imagine we'd do anything other than some hand-waving.

CO-CHAIRMAN RAY: Well, you guys are going to talk PRA as a separate topic. This is --

CO-CHAIRMAN RICCARDELLA: We've had a meeting on that a couple of months ago, and, you know, I'm not critical of that. That seemed like it was very well done. Our PRA experts thought it was well done, but there still are a lot of inherent assumptions.

CO-CHAIRMAN RAY: Okay. Thank you. Dick?

MEMBER SKILLMAN: No further comments. Thank you.

CO-CHAIRMAN RAY: Matt?

MEMBER SUNSERI: I've been following along the QA discussions. As you know, we had several conversations out here, and I share many of the members' questions about this. So I'll just not answer because all my questions have been asked already. Thanks.

CO-CHAIRMAN RAY: Okay. Jose?

MEMBER MARCH-LEUBA: I want to emphasize what Pete said. I mean, he took the thought out of my head. We are making a lot of decisions about the plan based on an assumption on a PRA, and I would like from the staff to make sure that they tell NuScale that NuScale is doing that at their own risk. Don't expect

us to hand-wave anything if you're wrong at the end of the design, which is probably the most likely scenario.

So the staff should make sure that if you make an assumption and you are wrong, you are wrong. You lose your money. Okay. So that should be very clear.

CO-CHAIRMAN RAY: Thank you. Ron?

MEMBER BALLINGER: No further comment.

CO-CHAIRMAN RAY: And Charlie?

MEMBER BROWN: No further comment.

CO-CHAIRMAN RAY: Okay. So the reason we do this last part here is more setting an agenda for our discussions --

MEMBER BLEY: Dennis is still here.

CO-CHAIRMAN RAY: Yes, I know, Dennis. And I was just, I had written your name at the top of the list, and I wasn't going to forget it. But I just wanted to say I appreciate your speaking up. But, anyway, we're trying to set an agenda of items, and so we'll turn to our expert on PRA, Dennis, and ask you to finish us up.

MEMBER BLEY: I have just a couple of things to mention. One is the issue Pete brought up is important, and we've brought it up before in other

design certs. What we've been told by other vendors, designers, is that, although the PRA has to be in and the operating has to be in place before fuel load, they really expect to have all that in place two or three years before that so that there's time to deal with these issues. If that's not true, they're taking a heck of a risk.

The other thing is I did take a quick review of the SECY they brought up on the last slide. This is just my own opinion. It's a reasonable argument, I think, and it's backed up by other policy decisions. So I'm not really concerned about that. That's all.

CO-CHAIRMAN RAY: Thank you, Dennis. Margaret, are you still with us?

MEMBER CHU: No comments.

CO-CHAIRMAN RAY: Any comments from anyone else on the phone line? Or if there's anyone here in the room, is there anyone who wants to make further comment?

Okay. I'll say I've said perhaps too much here today. My intent is to try to narrow the things that are outstanding issues. One of them was clarifying the applicability of the NuScale program. I'm still mystified by the idea that we don't

recognize that it's a part of the design certification, just like everything else is; and, therefore, it remains in effect as the design certification occurs for the scope of the certified design. That's what I read in some places and not in others. So we'll perhaps want to clarify that.

We'll reflect on the issues of PRA, but I really think the best place to discuss the timing issues created by PRA is in the context of PRA, rather than QA. And that will come up shortly. We'll see where that goes.

And with that, I appreciate everyone's time. We've taken --

MEMBER CORRADINI: We'll take a break.

CO-CHAIRMAN RAY: -- two hours. It's time for a break, according to the boss.

MEMBER CORRADINI: Ten minutes.

CO-CHAIRMAN RAY: And then we'll shift gears to Chapter 2.

MEMBER CORRADINI: All right. We'll be back at 3:10 to take on Chapter 2.

(Whereupon, the above-entitled matter went off the record at 2:59 p.m. and went back on the record at 3:12 p.m.)

MEMBER CORRADINI: Okay, why don't we come

back together? And we'll begin on Chapter 2. Paul, are you going to take us through this?

MR. INFANGER: Yes, I'll start. I'm Paul Infanger. Continuing from our presentation on Chapter 17, we'd just like to introduce J. J. Arthur from Engineering.

MR. ARTHUR: Good afternoon. My name is J. J. Arthur, Manager of Structures and Design Analysis at NuScale. I've been at NuScale for just over eight years. Prior to that was non-nuclear experience working on refractory and reactive metals industry, site mechanical engineering at Oregon State.

MR. INFANGER: All right, with that we'll start with slide 2, which has the FSAR overview.

MR. ARTHUR: All right, so the purpose of our presentation this afternoon is to present a summary of Chapter 2 of the NuScale FSAR, which provides assumed site characteristics and parameters for the NuScale design. We will also summarize -- provide a summary of the RAIs received thus far in this area, along with SER and confirmatory items, which Paul will cover at the end.

Chapter 2 of the NuScale FSAR contains a description of assumed site characteristics and parameters that are intended to be representative of

a reasonable number of potential site locations in the United States. These parameters are provided in Table 2.0-1 and described in the following subsection of Chapter 2: Section 2.1, Geography and Demography; Section 2.2, Nearby Industrial, Transportation, and Military Facilities; Section 2.3, Meteorology; Section 2.4, Hydrology; and finally, Section 2.5, Geology, Seismology, and Geotechnical Engineering.

As you will note throughout the presentation, the site parameters contained within Chapter 2 are generally consistent with past applicant precedents, as well as the 2014 edition of the EPRI Utility Requirements Document.

This slide depicts the conceptual layout of the NuScale power plant. Maybe some of you have seen this. In the center is the reactor building, where the 12 reactors are located. It's flanked by two turbine buildings, six turbines in each building; the control building, where the control room resides, as well as the rad waste building.

A minimum analytical X/Q distance from the nearest release point to the exclusionary boundary and the coincident outer boundary of the low population zone boundary is also shown on this slide as 400 feet there at the bottom.

MEMBER MARCH-LEUBA: Is this a conceptual design or you are sure the LPZ will be equal to the EAB?

MR. ARTHUR: This is the assumed minimum distance, the 400.

MEMBER MARCH-LEUBA: The LPZ could be larger than this?

MR. ARTHUR: Correct.

MEMBER CORRADINI: So okay, can I say it another way? Since the major open item in this chapter is the source term that would determine this, this is a starting point which can change.

MR. ARTHUR: Correct.

MEMBER CORRADINI: Okay.

MR. ARTHUR: Just to reiterate again, the site design parameters in Chapter 2 are site-specific. Therefore, the parameters chosen are believed to be representative of a reasonable number of potential site locations in the U.S. and the COL applicant will demonstrate that their site is either bounded by the parameters provided or demonstrate the acceptability of their site-specific values.

This is a reiteration of a couple slides earlier, this 400 feet value to the EAB and LPZ. In Section 2.1, the COLA applicant will describe their

1 site-specific characteristics.
2 We do not -- sorry, was there a question?
3 Okay.
4 We do not postulate any hazards from
5 nearby industrial, transportation, or military
6 facilities. These are addressed by a COLA applicant,
7 if applicable.
8 MEMBER MARCH-LEUBA: Just for my
9 education, what if there is an airport close by, I
10 cannot site your plant?
11 MR. ARTHUR: I'm sorry. Can you repeat
12 the question?
13 MEMBER MARCH-LEUBA: What if there is an
14 airport close by? I cannot site your plant, or I have
15 to take an exception, or what?
16 MR. ARTHUR: Correct.
17 MEMBER MARCH-LEUBA: There are airports
18 near everywhere. I mean you cannot site your plant.
19 MR. ARTHUR: The applicant -- the COLA
20 applicant would be required to address that hazard.
21 MEMBER MARCH-LEUBA: Wouldn't it be more
22 wise to just assume a certain rate of flights,
23 minimum, because you are going to have? There are
24 airports every ten miles. That's my personal opinion.
25 MEMBER SKILLMAN: Let me ask this, please.

Please back a slide.

I'm looking at your application for your design cert and this is your security-related information. And your COL item 2.2-1 is as follows: A COL applicant that references the NuScale power plant design certification will describe nearby industrial, transportation, military facilities, just like you have right there. The COL applicant will demonstrate that the site is acceptable for each potential accident or provide site-specific design alternatives. I got that.

I see that over in the safety evaluation. What I think you're really referring to is Part 100.20(b). And what this text is is different than what is in your application.

Here is the text in 100.20(b): The nature and proximity of manmade hazards, and then, in paren, airports, dams, transportation routes, military and chemical facilities must be evaluated to establish site characteristics for use in determining whether a plant design can accommodate commonly occurring hazards and whether the risk of other hazards is very low.

Here's my question: Why in your application have you not included the words manmade?

MR. INFANGER: Is anyone in the NuScale office familiar with the use of the wording for manmade hazards versus just general?

MEMBER CORRADINI: Also, there is some background noise. If you are not going to make an answer, can you please mute your phone line, please? Thank you.

MR. PARKER: This is Josh Parker. I did the structural analysis. I was involved with it in the Chapter 2 work.

I don't think there was any intentional reason for leaving out manmade, necessarily.

MEMBER SKILLMAN: The skeptic in me suggests by wording this COL item the way you have, you have avoided either accidentally or on purpose a very major concern that we've dealt with on manmade hazards. And it would seem to me that the remedy is to make the wording in your COL item 2.2-1 the same as the wording in 100.20. At least that would solve the concern that I have.

MR. BERGMAN: So we'll take it -- we'll look into that prior to the full committee but -- sorry. This is Tom Bergman with NuScale.

In our view, though, a COL item that is just restating a requirement that applies regardless

of the existence of the COL item doesn't need to be a COL item but that hasn't been accepted by the staff yet, that approach. Because the COL has to comply with all regulations that comply with it, whether or not there is a COL item that reminds them of that requirement.

So we'll look into either making the language consistent with or removing the COL item.

MEMBER SKILLMAN: Thank you.

Thank you, J. J., proceed please.

MR. ARTHUR: Section 2.3 for meteorology, the maximum assumed precipitation rate, the roof snow load, and the 100-year return three-second wind gusts are shown here and all come from the 2014 edition of the URD.

The design basis tornado parameters are taken directly from Regulatory Guide 1.76 and are representative of Geographical Region I, which represent the most severe set of characteristics provided by the Reg Guide.

MEMBER SKILLMAN: Let me ask this, and this is more perhaps trivia but curiosity.

If excluded, the protectorates, Guam, the Virgin Islands, the Northern Marianas, American Samoa, and Puerto Rico. Why?

MEMBER CORRADINI: Where was that excluded, Dick? Did I miss it?

MEMBER SKILLMAN: Yes, in the text the territories are excluded. And I'm just wondering why aren't those an opportunity for NuScale.

MEMBER CORRADINI: He's going to pass.

MR. ARTHUR: I don't think those words are in our FSAR. I think they are in the SER.

MEMBER SKILLMAN: I think you're right. But why are they excluded anyways? But I would think NuScale might have something to say about that and I'll ask the staff.

MEMBER CORRADINI: But I mean just a point of information, there was a bulletin but it wasn't out of NuScale. It was out of NEI that NuScale is one of those going into Puerto Rico now considering modules there for reliable power.

MEMBER SKILLMAN: It sounds like a perfect application. I was just wondering why it's excluded. I guess it's in the SER. I figured NuScale might have something to say about that.

MR. ARTHUR: Do you have anything to say about that, Tom?

MR. BERGMAN: Okay so I'm not familiar with the details but Chapter 2 is a representative

range of sites. It doesn't preclude us from going anywhere. It's just where the site we go to doesn't meet the parameters in Chapter 2, they have to justify the difference.

Why there is an exclusion of specific portions of U.S. territories I can say but I wouldn't see that as an impediment, even if it existed. We would just have to justify why our design was acceptable for Puerto Rico, even though the staff didn't include it in their SER.

MEMBER SKILLMAN: Fair enough. Thank you.

MR. ARTHUR: The tornado missile spectra are also taken from Reg Guide 1.76 with characteristics associated with Region 1 as well.

Similarly, the design basis hurricane wind speed and missile spectra are taken from Regulatory Guide 1.221. And as with design basis tornado, the most extreme characteristics were assumed for the design.

For HVAC and cooling tower design, outdoor air temperatures are categorized into three sets of conditions: zero percent exceedance, which are shown on this slide; and one and five percent exceedance shown in the next slide.

Zero percent exceedance values were used

for the design of the control room ventilation system as recommended by the EPRI URD.

One percent exceedance values were used for the design of the reactor building and radioactive waste building HVAC systems, as well as the site cooling and circulating water designs.

We'll note the typo in the slide. That should be RXB in the first bullet.

Finally, the five percent exceedance values shown were used for the design of the turbine building HVAC systems.

Again, these temperatures were chosen by NuScale for the categories in which systems are design and in accordance with which parameters was EPRI recommendations.

As noted earlier, the distance from the nearest release point to the exclusionary boundary and the outer boundary of the low population zone boundary is 400 feet. Given this comparatively short distance, NuScale applied the ARCON96 methodology based on Regulatory Guide 1.194 in calculating atmospheric dispersion factors. This methodology is still under review in the accident source term topical report.

The top of this slide shows the accident release atmospheric dispersion factors for the EAB/LPZ

boundary and the bottom shows the accident release X/Q values at the door to the main control room and the technical support center, as well as the intake of the HVAC system for the main control room.

CO-CHAIRMAN RICCARDELLA: Are these based on that 400-foot boundary?

MR. ARTHUR: Correct.

CO-CHAIRMAN RICCARDELLA: But again, with an assumed source term.

MR. ARTHUR: Right.

MEMBER CORRADINI: So let me ask it different. Let me ask Pete's question a different way. If the source term were different, the X/Q values would not change. This is more based on distance from the point of source.

MR. ARTHUR: Distance from the point of source, assumptions about weather, release notifications, and things like that.

MEMBER CORRADINI: These are nominal assumptions.

MR. ARTHUR: Correct.

MEMBER CORRADINI: So this could change. If the source term changes and you still want to meet your limits, they could go further out, if necessary.

MR. ARTHUR: Right.

MEMBER CORRADINI: Okay, thank you.

MR. ARTHUR: Routine release atmospheric dispersion factors and the deposition factor at the exclusionary boundary are shown here. And as was just mentioned by you, the COL applicant will update these factors consistent with their site meteorology.

For hydrology, we have specified the maximum flood elevation and maximum groundwater elevation consistent with previous applicants and the EPRI URD at 1 foot and 2 feet below the baseline plan elevation respectively. COL applicant will confirm these and describe their site-specific hydrology.

For geology and seismology, the design assumes parameters that are representative of a reasonable number of plant sites in the United States. Two design basis earthquakes are assumed with a certified seismic design response spectra or CSDRS and a high frequency version of that.

These spectra bound most of the central and eastern United States and sites in less seismically active portions of the western U.S.

The balance of the parameters shown in this slide are consistent with past applicants and the recommendations of the URD.

CO-CHAIRMAN RICCARDELLA: I assume these

are based on the new updated central and eastern United States seismology -- seismic risk report? I forget the NUREG --

MR. ARTHUR: I'm going to phone a friend here.

CO-CHAIRMAN RICCARDELLA: Pardon me?

MR. ARTHUR: Josh Parker, can you answer that?

MR. PARKER: Yes, I mean our spectra was developed initially in the 2010-2012 time frame and they were consistent with the spectra available at the time. The current spectra still bounds a number of sites in the central and eastern United States --

CO-CHAIRMAN RICCARDELLA: Okay.

MR. PARKER: -- as well as the slide indicates, the less seismically active areas of the western United States.

CO-CHAIRMAN RICCARDELLA: Okay, thank you.

MR. ARTHUR: So we assume no potential for liquefaction or slope failure. And the maximum assumed settlement values are shown here: a total of four inches, half an inch per 50-foot of building length for tilt and a differential settlement of a half inch.

MEMBER CORRADINI: There seems to be

background noise in a kitchen. Could somebody please mute their phones? Thank you.

CO-CHAIRMAN RICCARDELLA: Whoever is doing your dishes, mute your phone.

MEMBER SKILLMAN: Let me ask this. On slide 16, back a slide -- excuse me -- on this slide, the tilt and total. Is there a unique discipline that will be required on this site because the reactor building is basically filled with water and there are, at least the full build, 12 modules in that building?

This building is going to have a very strong footprint, probably stronger than any we've seen. Does that obligate something different in terms of settlement and tilt?

MR. ARTHUR: I'd point that back to Josh Parker as well.

MR. PARKER: Yes, I don't think it obligates anything different. We still account for the total mass. We still evaluate that on the generic soil profile and evaluate the overall settlement. And the COL applicant wants to do a similar analysis for the site-specific conditions.

So while you are right, it is obviously different and it has a lot of water in it, the process for determining the overall settlement and tilt is

still the same as it would be for any other applicant.

MEMBER SKILLMAN: Okay, just let me ask one more question.

So you, not you personally, NuScale is going to build one of these -- let's presume they build one of these machines and they start with one module and then a second. And there are ten vacant spaces. And then they do the third and the fourth.

This is not different than loading a supertanker and unless that loading is balanced, at least in the supertanker, you can deflect and you can destroy the haul unless you do it right. There is a loading sequence, whether it is a bulk carrier or particularly something that is carrying dry cargo versus liquid cargo.

Is there a thought given to the settlement that will occur because the loading beyond the water footprint load is different because the module build may be not symmetric?

MR. ARTHUR: I know we've done some sensitivity studies in the seismic analysis for different configurations of modules in the building. I don't know if we specifically have addressed that for settlement.

MR. PARKER: Yes, I was just going to

mention that same thing.

In Chapter 3 we talk about that aspect that you are referring to. And there is a COL item for the site-specific vendor to confirm how modules are going to be loaded into the plant and then perform subsequent analyses to ensure adequacy of the design.

MEMBER SKILLMAN: Thank you.

CO-CHAIRMAN RICCARDELLA: You know I saw a number in your report in terms of the required static pounds per square foot of the capacity of the soil. Is that significantly different than say a standard PWR or BWR?

MR. PARKER: No, that's similar to other designs. It's consistent with them.

CO-CHAIRMAN RICCARDELLA: Okay, thank you.

MEMBER KIRCHNER: Just for clarification, it's consistent with what EPRI has estimated as needed or it is consistent with your fully loaded 12-module building and the resultant load that that provides?

MR. PARKER: Yes, maybe I misunderstood the initial question. I thought the initial question was on the available bearing capacity. And that bearing capacity is consistent with past applicants' assumed values. The load bearing command values is based on analyses.

CO-CHAIRMAN RICCARDELLA: And is that significantly different than the bearing demand for a standard P or BWR?

MR. PARKER: I couldn't speak to that off the top of my head. I would have to look at past applications.

CO-CHAIRMAN RICCARDELLA: Okay. I was just trying to get to Dick's point about whether the density is greater or less than a current design. But maybe you could have an answer to that by a full committee meeting.

MEMBER SKILLMAN: Yes, the requirement for the soil-bearing capacity, the gentleman is right. I agree with that.

I'm just thinking of a large building filled with water and you add 12 several hundred-ton modules to that and you do not do that symmetrically. Do you crack the building?

You can break a supertanker. You can break a bulk carrier. You can snap its backbone if you don't do it right.

MR. ARTHUR: Yes, we'll look into that.

MEMBER SKILLMAN: Okay.

MR. INFANGER: We had a number of RAIs on Chapter 2. As you can see, we've -- the majority of

them are resolved closed, or the supplements have been submitted and are under evaluation, and some of them are in the confirmatory status.

We have one unresolved closed item. It has to do with the release of radioactive of liquid effluents in groundwater and we're proposing or in the middle of discussions on how to resolve that issue.

MEMBER KIRCHNER: Just for clarification, when you say accident release, now we're talking about a single module, right, which is different from normal effluence, where it would include all 12 modules, right?

MR. INFANGER: I believe it's from the rad waste building. So it would be common.

MEMBER KIRCHNER: Oh, from the rad waste building. Okay.

MR. ARTHUR: Actually, no. It's from the pool surge control tank that's outside the reactor building.

MEMBER KIRCHNER: Oh.

MR. INFANGER: Thank you. That's a common structure?

MR. ARTHUR: Yes.

MR. INFANGER: It's still common -- it's a common structure.

MEMBER CORRADINI: This is the open item. I guess I misunderstood. This is not the same as the unresolved closed.

What's such a thing as an unresolved closed?

MR. INFANGER: That means we've had an RAI, we've sent a response, and the response the staff has said that they need additional information.

MEMBER CORRADINI: Oh, so they've come back to you another time.

MR. INFANGER: Yes. We don't have a written question yet. So we're in discussions.

MEMBER CORRADINI: Okay, thank you.

MR. INFANGER: There is one SER open item is on the X/Q values for the EAB and LPZ. And that's in the accident source term topical report which is under review.

This is just one of the confirmatory items. I believe there are 11 confirmatory items. This slide has been deleted.

That concludes our presentation.

MEMBER MARCH-LEUBA: So the open items is the method for calculating the LPZ.

MEMBER CORRADINI: The open items is the source term that would be used in the calculation.

MEMBER MARCH-LEUBA: Can you go to slide 18, acceptability of method for calculating accidents?

MR. INFANGER: Yes, it's the methodology for calculating our X/Q. And a lot of it is using the ARCON96 versus PAVAN. And it's the ARCON96 has been used in the industry for control room doses. And since our site boundary is essentially about the size of most sites for control room dose, that code was more applicable.

PAVAN is for much, much larger sites, several miles.

MEMBER MARCH-LEUBA: But the calculation keeps looking at the source term.

MEMBER CORRADINI: Yes, I guess maybe I'm misreading the open item. I apologize. That could be my mistake.

But I thought open item was to determine the subject conditions limitations NuScale methodology is acceptable for calculating accident offsite X/Qs. This review is being tracked as an open item.

So I thought the methodology is dependent upon the source term that is being used and I thought that topical report was the alternative source term you're proposing.

MR. ARTHUR: If would have Mark Shaver

jump in here, I think the answer is that this methodology is described in the accident source term topical report but it does not depend on the source term itself.

Mark, can you confirm that is true?

MR. SHAVER: This is Mark Shaver. I'm a radiological engineer at NuScale.

J. J. is correct, the accident source term topical report has the methodology to develop the accident source terms, as well as Section on our methodology to determine the EAB and LPZ X/Qs.

So the open item is that it's contingent on the source term topical for the X/Q methodology.

MEMBER CORRADINI: Oh, okay. That's my mistake then. I apologize.

MR. SHAVER: But methodologies are in it.

MEMBER CORRADINI: Okay, I misunderstood. You were referencing the topical report. I thought it was the source term itself but it's the methodology because the presumption is it's close in.

Okay, thank you.

MR. SHAVER: Correct and the X/Q is not dependent on the source term.

CO-CHAIRMAN RICCARDELLA: The source term part of that has been accepted?

MR. ARTHUR: Both are under review.

CO-CHAIRMAN RICCARDELLA: Okay.

MEMBER MARCH-LEUBA: And that's not an open item or is under review on a different chapter?

MR. INFANGER: It's not an open item for Chapter 2.

MR. SHAVER: Yes, that's Chapter 15.

MR. INFANGER: Oh, okay.

MEMBER CORRADINI: It's your favorite chapter.

MEMBER MARCH-LEUBA: That one has problems.

CO-CHAIRMAN RICCARDELLA: They're both covered in that topical report, though.

MR. ARTHUR: Yes.

CO-CHAIRMAN RICCARDELLA: All right.

MEMBER MARCH-LEUBA: One final question. We recently have been reviewing the early site permit for Clinch River where they have one review as you guys. Is the methodology similar to the one that TVA used? I mean, have you at least coordinated with them?

MR. INFANGER: I'm not familiar with what TVA has submitted.

MEMBER MARCH-LEUBA: Because it's a

completely independent operation.

MR. INFANGER: That's correct.

MEMBER CORRADINI: Just for the sake of information remember for their sizing, they took a 800 megawatt thermal source term sized by four different potential but it was at 800 megawatts thermal.

MEMBER MARCH-LEUBA: We're not talking about source term here. We're talking about how to propagate it to the boundary, which is what they did.

MEMBER CORRADINI: But that methodology is similar.

MEMBER MARCH-LEUBA: I'm pretty sure it's similar but they said they did not coordinate.

MR. INFANGER: Any other questions?

MR. SHAVER: This is Mark Shaver. That is correct, we did not coordinate with TVA on our X/Qs.

MEMBER CORRADINI: Shall we move on? It looks like the committee is silent. So, let's move on.

Shall we get the staff up here?

MR. INFANGER: You guys are ready for the staff?

MEMBER CORRADINI: There are a lot of slides. So I assume there are a lot of staff.

MR. CHOWDHURY: Good afternoon. My name

is Prosanta Chowdhury. I am with NOR, Office of New Reactors, Division of Safety and Environmental Assessment. The branch is LB1, Licensing Branch 1. I have been with the NRC for about 14 years now, 10 of which I have been working as the project manager in NRO. My background is I have a master's degree in electrical engineering and one in nuclear engineering.

And today we are presenting the staff evaluation of NuScale design certification application Chapter 2, Site Characteristics.

So the technical branches that are represented here today are Radiation Protection and Accident Consequences Branch, Hydrology and Meteorology Branch, and Geosciences and Geotechnical Engineering Branch. So under RPAC, Radiation Protection and Accident Consequences Branch, Section 2.1, Geography and Demography, and Section 2.2, Nearby Industrial, Transportation, and Military Facilities, these two sections will be presented by that branch. Hydrology and Meteorology Branch, we present Section 2.3, Meteorology and Section 2.4, Hydrology Engineering. Geosciences and Geotechnical Engineering Branch will present 2.4 -- 2.5, Geology, Seismology, and Geothermal Engineering -- Geotechnical Engineering actually.

So the staff interactions with NuScale for Section 2.3, which is meteorology requests for additional information, ten questions were asked. Four questions closed, six confirmatory action pending EPSAR update and one open item.

So the review here that the staff completed is based on Revision 1 of the application. So we received Revision 2 of the application in October. And the SE will be updated accordingly later.

Section 2.4 has one question and that has been closed, three confirmatory actions pending EPSAR update.

Section 2.5 had three question; one closed, two confirmatory action pending EPSAR update.

So today we have with us Rao Tammara. He will be -- he is sitting next to me and he will be presenting the staff evaluation on Sections 2.1 and 2.2. Next to him is Michael Mazaika. He will be covering his evaluation of Sections 2.3.1 through 2.3.3. Jason White, next to Mike, will cover Sections 2.3.4 and 2.3.5. Yuan Cheng will cover Section 2.4. And finally, Weijun Wang will cover Section 2.5.

So branch chiefs involved in this review is Stephanie Devlin-Gill with Hydrology and

Meteorological Section and she is present in the audience.

Gerry Stirewalt is the Branch Chief of RGS, which is Geology and Seismology branch. And Mike Dudek, I don't believe he is in the audience, but he is with RPAC.

And once again, I am Prosanta Chowdhury, Project Manager.

With that, we are going to go into Section 2.1 and 2.2 and Rao Tammara will cover that.

MR. TAMMARA: Good afternoon. My name is Rao Tammara. I have 45 years of experience, out of this 22 with a consulting company doing the similar work preparing the FSAR, EA, and the EIS sections for utilities and government agencies. And for the past 18 years I am with the NRC doing FSAR and SSER Chapters 2.1, 2.2 and also aircraft hazards, covering the COLs and the ESP applications and design certifications.

Next, this application I am the lead reviewer for the Chapter 2 Site Characterizations covering the Sections 2.1 and 2.2. Next slide, please -- previous slide.

This Section 2.1 contains -- I mean addresses the geography and demography. Section 2.2

addresses the nearby industrial, transportation, and the military facilities. Next slide, please.

Section 2.1, Geography and Demography covers the areas addressing site location and the description, exclusion area authority and control, and population distribution. Since all this information is site-specific, the DC will not have the information to review; however, to see where the applicant referencing the NuScale Power design is to provide this site-specific information as a part of COL information item 2.1-1 in the COL application.

Next slide, please.

Section 2.2 covering the nearby industrial, transportation, and military facilities will address the locations and the routes of all the facilities within five miles of the site, descriptions of the products, and manufacturing products, and also evaluation of those facilities that may have a potential on the proposed facility. Manmade hazards these are all.

Since this is a design-specification or design certification application, the site-specific information is not addressed for this application. Therefore, the applicant, COL applicant referencing the NuScale Power design is to provide the site-

specific information as a part of COL Information Item 2.2-1 in the COL application.

So, all the site-specific information will be provided at the COL stage.

That is my presentation.

MEMBER SKILLMAN: I'd like to ask a question here. And it is Section 2.2.1 and among your safety evaluation at page 2-12, and here is the text. And the reference for my question is this: The ACRS is looking at the Clinch River site as a potential location for a NuScale plant.

MR. TAMMARA: That is a potential, yes.

MEMBER SKILLMAN: Yes, okay. And it has a neighbor that's called Oak Ridge National Laboratory.

MR. TAMMARA: That's correct.

MEMBER SKILLMAN: So here's the COL item: A COL applicant that refers the NuScale Power Plant certification will describe nearby industrial, transportation, and military facilities. The COL applicant's information should describe the primary function of each facility and the nature of the hazards that it presents. This information for each facility should include the facility's primary function, major products, number of employees,

materials regularly manufactured, stored, used, or transported near the site and the hazards that could result from accidents at each facility.

How is a COL applicant going to respond to this if its neighbor is Oak Ridge National Laboratory?

MR. TAMMARA: It is the COL application. If you take a look at the COL application the Clinch River it has been assessed. I mean I assess it in the sense the nearby facility has been addressed in the Clinch River application.

MEMBER SKILLMAN: Okay, thank you.

MR. TAMMARA: Because it is not a design basis but the facility is addressed. That is correct.

MR. CHOWDHURY: Anything else on 2.1 and 2.2, before we move on to 2.3?

MR. TAMMARA: I will turn it over to Mike Mazaika to cover the site meteorology.

MR. MAZAIKA: Everybody hear okay? Okay.

Good afternoon, folks. My name is Mike Mazaika. I'm one of several meteorologists in NRO and have been on staff for just over ten years. Before that, I spent 30 years in the engineering consulting and air pollution research industries.

MEMBER MARCH-LEUBA: Mike, talk into the microphone because there is people on the phone line.

MR. MAZAIKA: Okay. Better?

Okay, before that I spent 30 years in the engineering consulting and air pollution research industry, including support for nuclear and fossil projects. Next slide, please.

My presentation will cover the review of 2.3.1 through 2.3.3 of Revision 1 of the FSAR. My colleague, Jason White will present the review of FSAR Section 2.3.4 and 2.3.5

The last bullet on this slide which was brought up earlier points out potential plant site locations include all 50 states in the U.S., Alaska, and Hawaii but that the DCA is silent on U.S. Territories. That was brought up in an RAI question for clarification.

Next slide, please.

This slides indicates that the applicant postulated site parameters for various climatic extremes, and for design basis accident, and routine release atmospheric dispersion and deposition factors. The staff performed its review in accordance with applicable standard review plan sections, associated regulatory guidance, and related data resources.

Finally, we note that eventual COL applicants will need to compare their site

characteristics to the site parameter values postulated for the NuScale design. Next slide, please.

This slide covers site parameters related to extreme rainfall. The postulated site parameters, which you've seen before, are related are 19.4 inches per hour and 6.3 inches in five minutes. The values are used, in part, in determining roof loading, which is reviewed under Chapter 3.

In Section 2.3.1 we evaluate the site parameters themselves. The postulated site parameter values are consistent with most of the previously submitted DCAs and on that basis, the staff considers these site parameter values representative of a reasonable number of locations in the contiguous U.S. and for the State of Alaska.

Next slide, please.

This slide addresses winter precipitation. The applicant site parameters for normal and extreme winter precipitation events, they are 50 and 75 pounds per square foot. They represent roof loads only. Based on Interim Staff Guidance 007 and the SRP, Section 2.3.1 is looking for the basic data as ground snow loads. Conversion to roof loads is handled in Chapter 3.

The applicant did not specify the return period for its postulated values. The guidance in the ISG and the SRP calls for a return period of 100 years. Staff performed its review on that base, using the 50-year ground snow load data and conversion factors for other return periods in ASCE/SEI 7-10.

The staff focused on the snow load data and the ASCE/SEI document, although the ISG also considers rain on top of snow in the form of probable maximum winter precipitation. The reactor and control building roofs limit accumulation of liquid precipitation so that frozen winter precipitation events should be controlling.

The staff considers the site parameter values postulated as roof loads to be representative of a reasonable number of locations in the continental U.S., including some portions of Alaska. Next slide, please.

The next two slides summarize the staff's review of the site parameters for design basis winds. One hundred-year return period severe wind speed value on this slide and tornado and hurricane-related extreme winds on the next slide, which have much longer return periods.

Severe wind speeds are represented by a

three-second gust, as opposed to a sustained wind speed. Consistent with several other design submittals, this site parameter value, which is 145 miles per hour, when multiplied by a designated importance factor shown in Chapter 3, represents a 100-year return period. According to the FSAR, this value is applied to the reactor control and radioactive waste buildings.

The staff performed its review using the 50-year basic wind speed values and 50- to 100-year conversion factors presented in ASCE/SEI 7-05. The staff considers that the site parameter value and related characteristics are representative of a reasonable number of locations in the contiguous U.S., Alaska, and Hawaii.

Next slide, please.

The next wind-related slides summarizes the staff's review of design basis tornado parameters, which include a maximum three-second gust wind speed of 230 miles per hour and design-related characteristics, for example, pressure drop and rate of pressure decrease.

On the design-basis hurricane wind speed, also a three-second gust but of 290 miles per hour. Each of these design conditions is associated with an

exceedance frequency of ten to the minus seven per year.

The staff found that the tornado site parameters are based on the current version of Reg Guide 1.76 for Region 1, which is the highest tornado intensity region in the contiguous U.S.

The staff also found that the three-second gust for hurricane wind speed is based on the current version of Reg Guide 1.221. The postulated value, 290 miles per hour is the most conservative among those indicated for hurricane prone site locations in the contiguous U.S., along the Gulf of Mexico, and Atlantic coastlines. The staff confirmed that these values are consistent with the NRC regulatory guidance and, on that basis, considers that the postulated tornado and hurricane site parameters are representative of a reasonable number of locations in the contiguous U.S.

Next slide, please.

This next slide deals with the staff's review of the dry- and wet-bulb temperatures postulated for the NuScale design. For our review, there are three key takeaways on this slide.

First, like other design certification applicants, these temperatures are referenced to the

ERPI Utility Requirements Document or the URD. The applicant cites Revision 13 of the URD issued in 2014, which was updated to include small modular reactors.

Second, the staff determined that the numerical values for these design-basis temperatures have not changed since at least Revision 8 of the URD, which was issued in 1999.

Third, the coincident wet-bulb temperatures in the EPRI URD represent mean values; whereas, the coincident wet-bulb temperatures postulated for the design are said to represent maximum values and that turns out to be a somewhat important distinction.

Next slide, please.

MEMBER SKILLMAN: If you please, Mike. A picky comment. This is on your Safety Evaluation page 220. You write: Zero percent exceedance maximum/minimum amount for design dry-bulb temperatures 46.1 Celsius, 115 Fahrenheit, and 40 degrees Centigrade minus 40 degrees Fahrenheit. You actually show 40 and I think you mean minus 40 C.

MR. MAZAIKA: If that's a typo then we'll --

MEMBER SKILLMAN: It's a typo. You need a minus.

MR. MAZAIKA: Okay. Part of that was a constraint from the editors that we had to put the metric units of measure before these English units. And the site parameters are expressed in English units of measure. So we'll correct that typo.

MEMBER SKILLMAN: I'm just saying that there is a minus absent from the 40.

MR. MAZAIKA: Okay.

MEMBER SKILLMAN: Not a problem.

MR. MAZAIKA: Thank you.

CO-CHAIRMAN RICCARDELLA: Could you give a little more explanation on that last bullet? You said it was a significant difference. I'd like to understand that a little better if I could.

MR. MAZAIKA: Regarding coincident wet-bulb temperatures?

CO-CHAIRMAN RICCARDELLA: Well maximum versus mean.

MR. MAZAIKA: That was the subject of an RAI question. It is partially addressed in Revision 2 of the document and we are only reviewing through Revision 1.

The applicant cites the EPRI URD. So that's an inconsistency or an explanation that has to be resolved in a subsequent revision of the document.

Typically, ASHRAE, the air conditioning industry defines their coincident wet-bulb temperatures as mean values, which is why I confirmed it with the folks at EPRI.

The applicant can choose to do that. Statistically, it makes it more difficult to comply with both parameters, if you have a dry and a wet-bulb temperature pair or as an individual wet-bulb value. But that's the current definition that the applicant has in their document. So that's something that we have to resolve with them.

CO-CHAIRMAN RICCARDELLA: Okay.

MR. MAZAIKA: Okay? All right, next slide, please.

The staff looked at a climatological database compiled by ASHRAE, which is cited in SRP 231, which I mentioned, for the contiguous U.S. and Hawaii. We used our professional judgment for evaluating temperature conditions in Alaska. Acceptability of these site parameters from an engineering standpoint is evaluated under Chapter 9.

The maximum design dry-bulb temperatures at the zero, one, and five percent exceedance levels are 115, 100, and 95 degrees Fahrenheit. Postulated minimum dry-bulb temperatures are minus 40, minus 10,

and minus 5 degrees Fahrenheit. These maximum and minimum value are considered to be acceptable at a reasonable number of locations.

The postulated one percent exceedance non-coincident wet-bulb temperature is 80 degrees Fahrenheit. It should also be acceptable at a reasonable number of sites in the contiguous U.S., Hawaii, and, based on our judgment, in Alaska.

Next slide, please.

The last temperature-related slide deals with our observations on wet-bulb temperatures in previous COL and ESP application submittals and information in the ASHRAE database. That is that these site parameters in the NuScale DCA may be exceeded in many locations. A similar issue was discussed during the ACRS presentations for the APR1400 application review.

The applicant's wet-bulb temperature site parameter values apply to non-safety-related HVAC systems and the cooling towers. And I refer you to Tier 2, Table 3.2-1 in the DCA. Therefore, the applicant considers it a business decision not to change the proposed wet-bulb values.

Given that position and the applicant's defining coincident wet-bulb temperatures as maximum

rather than mean values, the second bulleted item indicates that the dry-bulb temperatures in those pairs appear to be acceptable at a reasonable number of locations. On the other hand, the ASHRAE database suggests that the coincident wet-bulb values are likely to be exceeded in much of the contiguous United States and Hawaii.

The last bulleted item indicates, based on the staff's review, that there is a reasonable expectation of the need for potential COL applicants to request a departure from the postulated zero percent non-coincident or the zero, one, or five percent maximum coincident wet-bulb temperatures, depending on site characteristics.

MEMBER BROWN: Question?

MR. MAZAIKA: Yes.

MEMBER BROWN: In your SER, you didn't use the word much of the contiguous. You said most of the contiguous U.S. Was there a -- I'm just reading from page 39. The ASHRAE data suggests that postulated temperature is likely to be exceeded in multiple -- in most of the contiguous United States. That's a nuance but it's a different word.

MR. MAZAIKA: True or not. So you're on page 2-39? I have a different numbering system, so I

must have it --

MEMBER BROWN: It's right above -- it's the paragraph above 2.3.1.5 that's the next to the last paragraph right above the next section.

MR. MAZAIKA: I do not know the answer to that right now. That may be a transcription error between the text of the document and the slides.

MEMBER BROWN: Okay, I just -- it's a nuance work. It's a different word. Much is different than most.

MR. MAZAIKA: Agreed. Agreed. I'll take a look at that.

MEMBER BROWN: All right, thanks.

MEMBER SKILLMAN: Michael, a question just for clarification, not challenge.

You said it was a business decision to use the zero, one, and five maximum coincident. And then you identified your third bullet with the potential need for departures for the maximum coincident wet-bulb.

It seems to me what that really is getting to is the size of your condensers for your turbines and your decay heat removal systems, heat exchanger size. Is there anything else besides turbine condenser and decay heat removal heat exchangers that

is an economic consideration?

MR. MAZAIKA: I can't answer that question directly because I'm not an engineer. I'm a meteorologist. So I would defer that to somebody under Chapter 3.

The systems that were identified were based on RAI responses and conversations back and forth with the applicant.

MEMBER SKILLMAN: Okay.

MR. MAZAIKA: So that's the best I can do right now.

MEMBER SKILLMAN: That's fair enough. Thank you.

MEMBER CORRADINI: I think we'd have to ask NuScale but my immediate guess is control room habitability issues are going to be affected by this. Otherwise, you'd have to make modifications because in APR1400, when we brought up -- the most recent one when we brought up APR1400, it was relative to that.

MR. HOUGHTON: This is Zack Houghton. I'm a mechanical design engineering manager with NuScale.

This would apply to the control room ventilation system, not the control room habitability system.

MEMBER CORRADINI: I'm sorry. I'm sorry.

MR. HOUGHTON: It would apply to the turbine condensers but it would not apply to the DHR condensers. Those are located directly in the reactor building pool, which is the ultimate heat sink which also isn't affected by ambient conditions.

So these ambient conditions don't affect any of our safety-related systems.

MEMBER SKILLMAN: So it's really the turbine condensers and the HVAC for the control room, those two.

MR. HOUGHTON: Correct, turbine condensers and your air conditioning units is what will be sized by this information.

MEMBER SKILLMAN: Yes, okay. Thank you very much.

MR. MAZAIKA: Did that answer your question?

MEMBER SKILLMAN: Yes.

MR. MAZAIKA: Okay. All right that will wrap up 2.3.1, unless there are any other questions. And then I'll go to 2.3.2 and 2.3.3 on the next slide, since they represent site-specific conditions, the COL applicant will have to address local meteorology and the on-site met monitoring program and the staff agrees with that position.

With that, if there are no more questions, I'll turn it over to my colleague, Jason White.

MR. WHITE: Thank you, Mike. Good afternoon. As Mike stated, my name is Jason White. And I am also a meteorologist in the Office of New Reactors. I've been a member of the NRC staff for just under 10 years and have served as a technical reviewer in both the Office of Nuclear Reactor Regulation and Office of New Reactors.

Today I will be discussing the review of Sections 2.3.4 and 2.3.5 of the application.

This slide addresses Section 2.3.4, which discusses the short-term atmospheric dispersion site parameters for accident releases. The exclusion area boundary, or EAB, an out of boundary of the low population zone, or LPZ, offsite atmospheric dispersion X/Q value site parameters are used in DCA Tier 2, Chapter 15, to help demonstrate that the offsite radiological consequences of accidents need to specify radiation dose guidelines as specified in 10 CFR 52.47.

The applicant stated in the application that Topical Report TR-0915-17565 describes their methodology for calculating the accident X/Q values at the EAB and LPZ.

Staff performed an independent verification of the applicant's off flight X/Q site parameter values postulated for EAB and LPZ. Staff used a portion of the NuScale methodology to calculate X/Q values based on meteorological data collected at six nuclear power plant sites.

Staff found that only one of these six sites had X/Q values that are bounded by all of the postulated NuScale site parameter values. Therefore, if a COL applicant references a NuScale design and finds that its actual site characteristic X/Q values do not fall within the corresponding site parameters postulated in the DCA, the COL applicant will need to provide sufficient justification that the proposed facility is still acceptable at the proposed site.

MEMBER CORRADINI: Let me clarify, make sure I understand you. So one out of six passed based on this. But I could move the boundary out and things would change.

MR. WHITE: Yes.

MEMBER CORRADINI: Okay, fine.

MEMBER KIRCHNER: This was nominally the -- NuScale presented a conceptual design where the EAB and the LPZ were coincident. It's the same box.

MR. WHITE: Yes.

MEMBER KIRCHNER: So what are you saying here? The 400 foot distance that they show as the minimum distance that only one out of the six sites.

MR. WHITE: Yes. According to our independent verification, yes.

MEMBER KIRCHNER: Right. Okay. So in practical terms, what does this mean? That either the LPZ is moved out or you don't site it here?

MR. WHITE: Well, the COL applicant would have to provide a justification of why it could be sited there.

MEMBER KIRCHNER: Okay.

MEMBER MARCH-LEUBA: Now, I haven't seen the numbers, but my suspicion is that NuScale is saying it can be 400 feet because it's much, much smaller than that and they have sufficient margin, meaning that if a COL applicant does not meet the parameters that they use, they may still meet the 400 feet most likely. So they have a little more wind or something than assumed. They probably still need the 400 feet.

MEMBER KIRCHNER: Well, the LPZ is based on dose not on X/Q, indirectly on the source term. So --

MEMBER MARCH-LEUBA: What I'm saying is --

MEMBER KIRCHNER: -- and EAB is a different definition.

MEMBER MARCH-LEUBA: -- I haven't seen the numbers. But the fact that NuScale is putting their money on 400 feet, it means that they believe it is 10 feet.

MEMBER KIRCHNER: Okay.

MEMBER MARCH-LEUBA: Or actually zero because they probably want to tell us the source time is zero.

MR. WHITE: Well, they're saying that their minimum distance will be 400 feet.

Next slide. The staff is currently reviewing the topical report to determine if the NuScale methodology is acceptable for calculating the design basis accident offsite X/Q values at the EAB and LPZ in relation to the NuScale design and in a COL application that references the NuScale design.

This review is going to track as Open Item 2.3.4-1. Subject to resolution of the staff's evaluation of the Topical Report, the staff concludes that the applicant has appropriately provided short-term accident release X/Q site parameter values.

Next slide. This slide discusses the onsite main control room, or MCR, and technical

supports in our TSC X/Q site parameter values. The staff performed an independent verification of the applicant's postulated onsite X/Q site parameter values of the MCR and TSC doors and at the HVAC intake.

The staff generated X/Q values using the Reg Guide 1.194 endorsed ARCON96 computer code with the source to receive the information presented in the DCA.

On the basis of this evaluation, the staff found that the applicant provided onsite X/Q site parameter values of the MCR and TSC doors and the HVAC intake that are representative of a reasonable number of locations that may be considered for a COL application.

Next slide. This slide addresses Section 2.3.5, which discusses the long-term atmospheric dispersion site parameters for routine releases. These site parameters are an offsite dose location atmospheric dispersion X/Q and atmospheric deposition D/Q values. The staff performed an independent evaluation of the applicant's postulated offsite X/Q and D/Q values.

Staff generated X/Q and D/Q values using the XOQDOQ computer code, which implements portions of

the Reg Guide at 1.111, the meteorological data from various nuclear power plant sites and the release and receptor information presented in the DCA.

On the basis of this evaluation, the staff found that the long-term routine release atmospheric dispersion and deposition site parameter values selected by the applicant are representative of a reasonable number of sites that have been or may be considered for a COL application.

Next slide. This concludes the staff's presentation on Section 2.3. If there are no questions, Yuan Cheng will now present Section 2.4

MR. CHENG: Thank you, Jason. My name is Yuan Cheng. I am an NRC technical reviewer for the NuScale DCA Part 2, Tier 2, Section 2.4, hydrologic engineering.

I hold a professional engineer's license in several states including Maryland, Pennsylvania and Ohio. I have worked for the NRC for approximately five years as a hydrologist.

Prior to joining the agency, I have worked in the private sector for approximately 35 years. Recently, I completed the technical review on hydrologic engineering for the Clinch River Early Site permit applications.

Next slide, please. Regarding applicant's site parameters, the staff reviewed and conferred to NuScale's three parameters related to Section 2.4, hydrologic engineering. They are described in the DCA Part 2, Tier 2, Section 2.0 and Table 2.0-1.

The first parameter is the maximum flood level including wind induced wave run-up to be one foot below the baseline to plant elevations.

The second is the maximum groundwater level to be 2 feet below the site grade.

The third is the maximum precipitation rate 19.4 inches in one hour and 6.3 inches in five minutes.

MEMBER CORRADINI: So can I get a clarification on the one foot below plant baseline, plant elevation? What does that mean? So if the ultimate heat sink swimming pool is so high, that's one foot below the top of the swimming pool? But I don't understand what one foot below baseline plant elevation means.

MR. CHENG: Excuse me. Here it is talking about the flood hazards. It's not talking about interior tank failures.

MEMBER CORRADINI: So I'm looking for a way to identify what that location is. Is that --

MR. CHENG: External flood.

MEMBER CORRADINI: But I mean, is it one foot below -- what's the baseline elevation? Is it a piece of equipment or is the control room at baseline elevation? What is baseline elevation?

MR. CHENG: Okay. The base plant elevation is the finished floor elevations, finished floor.

MEMBER CORRADINI: Okay. Thank you.

MR. CHENG: The concrete, the top of the concrete.

MEMBER CORRADINI: Okay.

MEMBER MARCH-LEUBA: On a related question, we recently reviewed the Turkey Point application. And they actually considered climate change for the sea level change, for really for 60 years. If NuScale was to be located close to a body of water, would they need to consider climate change, sea level changes?

MR. CHENG: Based on the standard review plan and the current skylines and regulations, the climate change is not included in the design.

MEMBER MARCH-LEUBA: But it was in this particular application that we're reviewing.

MR. CHENG: Yes. But the ongoing change,

like climate change, have sometimes impact on the sea level rise, which deals with monitors and that kind of documents and research.

If they truly have some negative impact or adverse impact, we will re-evaluate the flood.

MEMBER MARCH-LEUBA: Is that going to be part of your Chapter 2 contributions?

MR. CHENG: No, no. That is not part of the NuScale's review. Climate change is not.

MEMBER MARCH-LEUBA: You're saying that whatever the flood level is, you'd better be one foot above it, right? And then we'll determine what the flood level is on your site?

MR. CHENG: Yes. Based on this, it's one foot below.

MEMBER MARCH-LEUBA: I mean, that's an iffy way out.

MR. CHENG: Yes.

MEMBER MARCH-LEUBA: But okay.

MR. CHENG: The next slide. Reviewing the applicant's Section 2.4, hydrology engineering, the staff confirmed the hydrological conditions are site specific and they will be evaluated in the COL stage.

The staff confirmed that in the COL stage, the Section 2.4.1 through 2.4.14 with the exceptions

of Sections 2.4.8 and 2.4.10 will be evaluated as they are related to site specific hydrologic conditions.

The applicant provides the COL information items 2.4.1 to defer the site specific analysis on those sections.

Next slide. The staff confirmed that cooling water canals and the reservoirs, Section 2.4.8, are not required as a safety-related made out water sources for the other heat sink for the NuScale design. The other heat sink design does not rely on external water supply for at least 30 days.

Staff confirmed that flood protection requirements, Section 2.4.10, are not applicable since the baseline plant elevation is one foot above the maximum flood level. Therefore, the staff confirmed the COL stage, Section 2.4.8 and 2.4.10 are excluded from the COL information, 2.4-1.

Next slide. The applicant provides the COL information items, 2.4-1, and states as follows. It combined licensed COL applicants that reference the NuScale power plant design certification. We'll investigate and describe the site specific hydrological characteristics for the Section 2.4.1 through 2.4.14, except Section 2.4 and 2.4.10.

Next slide. Conclusions. The staff

confirmed that the NuScale DCA site parameters meet the requirements of 10 CFR Part 100.

The staff concludes that all regulatory requirements have been satisfied with no open items. Three confirmatory items remain in the staff's safety evaluation report and will be confirmed with the applicant's Revision 2 of NuScale's DCA Part 2, Tier 2, Section 2.4, hydrologic engineering.

This concludes my presentation, and I will now pass the presentation to Dr. Weijun Wang for Section 2.5.

MR. WANG: Okay. If there is no question regarding 2.4, I will present the summary of the staff review on the Section 2.5.

I'm Weijun Wang. I'm a senior geotechnical engineer with the NRO. I have a PhD degree in geotechnical engineering and am a licensed professional engineer in Virginia.

I have been working in geotechnical engineering and the related field for over 38 years, including 12 years in accounting at the NRC and 13 years at the Federal Highway Administration.

I am one of the technical reviewers of the Section 2.5, geologist, seismology and geotechnical engineering.

So this section includes the topics, like, basics geological and the seismic information vibratory ground motion surface faulting and basically we are talking about seismic information here so the stability of the subsurface materials and the foundations on the slope stability.

Next slide please. This section, the Section 2.5, the application established the site parameters for the NuScale design and for the site suitability determination. So this slide, just the list related to site parameters because the applicant already presents the details and values. So I just, okay, with the list here.

Next slide please. The Section 2.5 and 2.5.3 defined geology related site parameters such as no fault displacement potential under the plant structures at the site. And they also specified in COL information item that the site specific basic regional and site geologic information to be addressed by COL applicant.

By the way, because of the site parameters, especially in 2.5, it's not site specific. Therefore for the any site parameters here, it has to be addressed by the COL applicant.

Next slide, please. The Section 2.5.2

defined the certified seismic design by spectra. And in this design it also defined another CSDRS at a high frequency is best specified for the hot rock site which is chute for the most central east U.S.

This tool, CSDRS, seismic loading design bases and it in turn covers most of the south in the U.S.

This section also defines as the COL for main items to specify the site specific basic regional and the seismic information with local vibratory ground motion and site safe shutdown earthquake to be addressed by the COL applicant.

Next slide, please. This slide shows the example of the certified seismic design response spectra to include the basic one and another one for the high frequency.

Next slide, please. Sections 2.5.4 and 2.5.5 did not reveal the stuff usual, the RAIs.

CO-CHAIRMAN RICCARDELLA: Can I ask you a question?

MR. WANG: Yes.

CO-CHAIRMAN RICCARDELLA: Go back to the previous slide.

MR. WANG: Okay.

CO-CHAIRMAN RICCARDELLA: You have the

design specification spectra and you have two other spectras. Are those just shown there for reference? The lower ones.

MR. WANG: Okay. The first one on the chart on the left side one is also showed the reference. That's the spectra response. That response spectra it came in the Regulatory Guide at 1.60. It just gives the comparison, which we show that for the NuScale design the certified -- the seismic design of one spectra actually is envelope the Regulatory Guide, the spectra.

CO-CHAIRMAN RICCARDELLA: Okay.

MR. WANG: I will continue. Okay. So in the RAI for Section 2.5.4, the issues involved the site subsurface material uniformity. And also about some of the static and the dynamic parameters of the subsurface material whether those parameters apply to all the subsurface material, including the backfill material and also related to the limits of the total and the differential settlement for safety related structures and the lateral earth pressure evaluation.

The applicant adequately addressed all of the RAI issues and the specified pertinent items to be addressed by COL applicants.

Next slide, please.

MEMBER SKILLMAN: No, would you stay there, please, on that slide.

MR. WANG: Okay.

MEMBER SKILLMAN: I'm looking at your safety evaluation and unfortunately the portion of the safety evaluation is protected information. Would you speak a little bit about differential settlement?

You state on your third bullet limits of total and differential settlements for safety related structures. And it appears as though you have some settlement details in the safety evaluation that are unlimited. Would you speak to that please?

MR. WANG: Okay. The initial application of the NuScale design for the set of parameters regarding the total settlement initially it's a state. There's no limit on the total settlement.

But our concern was it's normally for any structures. If you have large the total settlement, normally it's associated with larger differential settlement.

Think about that. If a structure that's uniformed, that settled and there's no connection to other structures, it normally won't affect its normal operation although it may cause some problems. For example, if a building settled too much and your door

probably will settle into the ground, you probably will have hard time to get in and out.

So if you see anything like that, there's no limit on the total settlement, then it will raise a question. It's really you don't have any limit on the total settlement. So that's one question we ask in our RAI.

And finally the applicant responded to us and said, yes, there is a limit. It's a limit of total settlement of four inches. So that's a reasonable value here.

MEMBER KIRCHNER: This is a good time to ask a question. Since most of these site parameters that you evaluated, I think NuScale used suggested every industry kind of nominal values. I know we're going to hear about actual evaluation against these site characteristics when we get to Chapter 3 and 15 and other places, 15 like the meteorology factors being used for accident analysis.

But is there anything that you collectively, all of you found that was unique about this design that would place more demands on the siting characteristics than nominal values that they have taken from EPRI. See what I'm saying?

I think settlement might be one because of

the overall weight, mass and hence bearing pressure of a very large building filled with water with 12 modules. Anything else like that unique that would say that nominal values taken from an industry recommended standard needs further investigation.

It seems like this RAI, for example, focused on something that would be rather unique for a NuScale module for the plant.

MR. WANG: Okay. I can only speak from the geologist site module and the geotechnical engineering area and regarding, like, the climate and hydraulic. Probably my colleague can answer that.

And based on our review, I did not find like anything really out of the normal run-off the actual standard. Like, for example, if there's a differential settlement, like the tool, it's like a 1 over the 600 to 1,200 and the half inch of differential settlement, that's all the normal run-off of the industry standard for the larger structures and so forth.

Yes, if you are talking about the unit, the loading for this design, this unit loading actually is greater than, like, 81,000.

MEMBER KIRCHNER: Right.

MR. WANG: Yes. However, because the

requirement for the bin capacity and the settlement limit is always in the normal standard requirement. So, therefore, at least in our section, we did not identify anything abnormal.

MEMBER KIRCHNER: Thank you.

MEMBER SKILLMAN: Is the four inches that you just mentioned a change to the safety evaluation? Is there a new safety evaluation that identifies that four inches and its acceptability?

MR. WANG: Yes. You know, it's for the four inch in total settlement is not -- if you think of four inches, probably this much, and you probably sort of maybe too much actually for this type of structure. Four inches of total settlement won't cause any problem.

The only concern is the total settlement is for -- was building. It doesn't matter. You know, you also need to consider another issue is the so-called another type of differential settlement which is the settlement between two buildings because --

MEMBER SKILLMAN: We fully understand that. We are, in your safety evaluation, we are looking at the words of the document that we were asked to review. And we are seeing text that would suggest to us that there is no limit. And you are now

saying there is a limit. It's four. The four is acceptable. It's been evaluated. And it's a differential settlement.

And you're also saying it's acceptable because, I guess, you're thinking that the buildings will settle at the same rate and at the same displacement. We understand, at least I understand, that's what you're saying.

MR. WANG: Okay.

MEMBER SKILLMAN: Thank you.

MR. WANG: You're welcome. Next one. Okay. The conclusion --

MEMBER SKILLMAN: Is the FSR going to be revised? How is that four inches going to be codified in your safety evaluation? Will there be a revision one?

MR. WANG: Okay. That's a number we will be presenting in the, I believe, Revision 2 of the FSR. We'll specify all the change. And by the way, that's two confirmatory items we're tracking here.

MEMBER SKILLMAN: Okay. Thank you. Thank you, sir. Thank you.

MR. WANG: So the conclusion is there is no open items. And the applicant adequately specified the site parameters related to geology and the

seismology on the geotechnical engineering.

And also if the applicant probably identified the site specific information to be addressed in the COL application and it describes such information in the COL open items. So, again, there are two confirmatory items we are currently tracking. I believe that will be my presentation. Any other questions?

MEMBER CORRADINI: Other questions by the committee? Should we go around -- why don't we first hear comments from the -- can we open the line to the outside world? The phone line -- she's working on it. Is there any comments from members in the audience? Is the phone line open?

MEMBER BLEY: You mean, like, members?

MEMBER CORRADINI: Well, Dennis, you're more than welcome to -- but we have a separate public line that's open that I'm also looking for members of the public. We'll come back to the ACRS members after we get the public.

PARTICIPANT: It's open.

MEMBER CORRADINI: Is any member of the public going to make a comment? Okay. Going once. All right. Why don't we close the line?

Okay. Dennis, why don't we start with

you. Any comments you'd like to make about Chapter 2?

MEMBER BLEY: I have no extra comments about Chapter 2. Thanks, Mike.

MEMBER CORRADINI: Let me ask another question since we're not going to be coming back into session until full committee when this is presented. Do you have anything relative to an interim letter that you want to emphasize, assuming the committee wants to write it in a letter?

MEMBER BLEY: Hmm.

MEMBER CORRADINI: Is that a hmm or a yes?

MEMBER BLEY: That was a hmm. Personally, I don't have anything. There was a lot of discussion, not on Chapter 2 earlier, but you might want something in there. But personally I don't have anything I would feel obliged to call to your attention at this point.

MEMBER CORRADINI: Okay. Thank you, Dennis. So let me go around. We'll start with Walt and go around the room.

MEMBER KIRCHNER: No further comments. Thank you.

MEMBER CORRADINI: Let me make you, though, talk about the opportunity for an interim letter and if so, what things would be in it?

MEMBER KIRCHNER: In my opinion, it's some of the issues we debated with regard to Chapter 17.

MEMBER CORRADINI: Deserves to be mentioned in an interim letter.

MEMBER KIRCHNER: In some manner this expression, clarification on -- pardon me, sufficiently closed on the ODIs to make a reasonable assurance determination.

MEMBER CORRADINI: Okay. Thank you. I actually forgot. Margaret, I assume, is still out there. Margaret, are you still out there? No, different line. Okay. She must have left us. Pete?

CO-CHAIRMAN RICCARDELLA: No. We have some comments from our consultant, Steve Shultz, that I think we'll have to take into account in our letter writing.

MEMBER CORRADINI: Okay. But nothing from you?

CO-CHAIRMAN RICCARDELLA: Nothing from me.

MEMBER CORRADINI: Okay.

MEMBER SKILLMAN: Yes. I would like to ask the staff -- this is on Section 2.3 and this has to do with identification of missiles more energetic than design basis missiles defining FSR Tier 2, Section 3.5.14. This is a coal item.

And the question I wanted to ask when we were going through this portion is what are these missiles and what are their sources? And I'm wondering if someone from the staff can respond to that.

And I'll cite the SER location here in just a second. I'm going through this as quickly as my computer will allow. Please come back to me. Keep on going and come back to me so I can be accurate when I identify the issue. Matt, go ahead.

MEMBER SUNSERI: I don't have anything else to add.

MEMBER CORRADINI: Jose?

MEMBER MARCH-LEUBA: Yes. I am a little slow today because I have to confess I have not prepared for these two chapters because I have been occupied with other topical reports.

But during -- and this is not the worst thing, but a favor I want to ask during the full committee. I would like for, especially NuScale to talk a little bit more about the low population some, the LPZ methodology. Because I buy the Bellefonte site and build a reactor there, I will be required to have a 10 mile radius.

So obviously for some reason you are

asking for an exception from the rule. All I hear is that your LPZ must be larger than 400 feet. But I have no idea how you plan to calculate it.

So if you could shed some light on what you plan to do with LPZ, I mean, obviously, there's going to be some cut of frequencies that you will not --

MR. BERGMAN: I think those were probably addressed better when you look at the EPZ methodology report, which is separate from the DCA. It's not part of our DCA application.

MEMBER MARCH-LEUBA: So this is not this topic even though you included many --

MR. BERGMAN: We'll look to see if there's a related question. But if it's specific about the EPZ methodology, that is not part of the DCA.

MEMBER MARCH-LEUBA: We'll see that later?

MEMBER CORRADINI: We'll see that not as part of the DCA. Not as part of the DCA. It's separate from the DCA.

MEMBER MARCH-LEUBA: Will we see that before summer?

MR. BERGMAN: I'll have to ask the staff on their schedule.

MEMBER CORRADINI: I think, Jose, if I

might, it's going to be part of the source term discussion. The source term will be one of the inputs. But the EPZ determination is a separate entity than from the DCD.

MEMBER MARCH-LEUBA: Okay. If we don't have it under CPI on the records, you are excluding them out.

MR. CHOWDHURY: We do not have a schedule for the EPZ Topical Report yet.

MR. SHAVER: So right now it's tentative but we're going to --

MEMBER CORRADINI: Is it on?

MR. SHAVER: Thank you. So right now we made the decision that we were going to focus on the SER with open items. And that should be wrapping up in July.

So right now we've tentatively scheduled the emergency planning zone topical to have a subcommittee meeting on October 22. And that means we would need the staff's evaluation by September 22. That's the current plan.

MEMBER MARCH-LEUBA: All I'm telling the staff, until NTR is reviewed and approved, this crucial zone is certainly larger than 400 feet because it is 10 miles.

MEMBER CORRADINI: Now you're getting confused about emergency planning zone and LPZ.

MEMBER MARCH-LEUBA: LPZ.

MEMBER CORRADINI: The emergency planning zone is 10 and 50 by rule.

MEMBER MARCH-LEUBA: Yes.

MEMBER CORRADINI: But that's not the EAB and the LPZ. It's a different calculation.

MEMBER MARCH-LEUBA: Mm-hmm.

MEMBER CORRADINI: One is a siting calculation and one is an emergency planning zone calculation. Different --

MEMBER KIRCHNER: EAB, that's a different definition. These are different terms, Jose. So EAB is the terminology where the owner of the site controls that boundary.

MEMBER MARCH-LEUBA: That's my fence.

MEMBER KIRCHNER: LPZ is a dose-based designation for distance.

MEMBER MARCH-LEUBA: Which we just went through the methodology for calculating for Clinch River.

MEMBER KIRCHNER: And the EPZs are currently 10 and 50. But these are different. They're all different. They're all defined

differently. And so just be careful. I think you were confusing --

MEMBER CORRADINI: But I think, Jose's point is when are we going to get to it? The answer is probably not until late '19.

MEMBER MARCH-LEUBA: Okay. Until such time as the staff gets it, the EPZ, and I think the LPZ, too, is too much. I mean all around the LPZ --

MEMBER CORRADINI: I think you're incorrect about the LPZ. You are correct about the EPZ.

MEMBER MARCH-LEUBA: Okay. For sure the EPZ.

CO-CHAIRMAN RICCARDELLA: Except for Clinch River TVA requests an exemption to the ten mile.

MEMBER KIRCHNER: Because the rule-making is in process, what TVA chose to do was to, in their early site permit, ask for two exemptions, which the staff reviewed. And so it's through exemptions that they're looking for a different definition of the EPZ for the plume exposure pathway.

MEMBER BLEY: But that's irrelevant for the devices. It's true. But it's irrelevant for the devices.

MEMBER CORRADINI: You have to get closer, Dennis. We can't hear you. You're a bit muffled.

MEMBER BLEY: I'm screaming into my phone at the top of my voice. Never mind.

MEMBER MARCH-LEUBA: Okay. Given the extent of the discussion, during the full committee if we can have a slide on it, on the concept, so I can understand what we're talking about. I will not proceed. Next.

MEMBER BALLINGER: No further comment.

MEMBER CORRADINI: Charlie?

MEMBER BROWN: No further comment.

CO-CHAIRMAN RAY: I don't have a comment on two. Were you asking about 17 also? That's what I thought. I don't know. Were you responding, Matt, for example, on 17?

MEMBER SUNSERI: I was deferring to you actually.

CO-CHAIRMAN RAY: Okay. I don't expect I would recommend, but I need to think about it some more so everything is tentative here.

On recommended comments, Mike, directed toward NuScale, I think that comments may be appropriate in terms of how we look at the process ourselves. And I just need to discuss that among the

members a little further. I've sent an email to you.

MEMBER CORRADINI: I'm not following you, I'm sorry.

CO-CHAIRMAN RAY: I don't see anything in what NuScale has presented that tells me we need to comment about what they're doing or their program or whatnot.

MEMBER CORRADINI: In terms of an interim letter?

CO-CHAIRMAN RAY: Correct.

MEMBER CORRADINI: Okay. I missed that.

CO-CHAIRMAN RAY: But what I am saying is that with regard to how we, the agency, are dealing with it, there may be a comment that we should make.

MEMBER CORRADINI: Okay.

CO-CHAIRMAN RAY: Because it's related to our process not their process.

MEMBER CORRADINI: But let me just get to it though. I mean, my sense of it is though that from your original comments on 17, if we do an interim letter, there are going to be some comments to the staff about the SER that we might want to make relative to, we'll call it, finding reasonable assurance for closure of these ODIs.

CO-CHAIRMAN RAY: Well, that's one aspect

of it. There are others as well --

MEMBER CORRADINI: Okay.

CO-CHAIRMAN RAY: -- having to do with how the status is monitored post-design certification for example.

MEMBER CORRADINI: Okay.

CO-CHAIRMAN RAY: But it needs some more discussion because we're into a process space here where we need to make sure we understand what the intent is of the design certification relative to what happens before, what happens afterward and so on.

But in terms of the program that NuScale presented, I don't --

MEMBER CORRADINI: You don't see a need.

CO-CHAIRMAN RAY: Personally, right now, I don't see a need. It may evolve --

MEMBER CORRADINI: Okay.

CO-CHAIRMAN RAY: -- out of further discussion. But that's the way I see it.

MEMBER CORRADINI: Okay. Let me go back to Dick. We skipped over Dick.

MEMBER SKILLMAN: Thank you. This is a 2.2.4 in the safety evaluation. It is on Page 217. And here's the text. NuScale is saying the applicant stated -- or the NRC is communicating what NuScale

communicated. The applicant stated the following principal types of hazards will be considered with respect to each of the above areas of review if they have a probability of occurrence greater than ten to the core minus seven per year. I got it.

This is more energetic than tornado missile spectra. I understand that this becomes the, if you will, the applicant's accountability. But I'm just wondering what the NRC was thinking when they wrote missiles more energetic than tornado missile spectra or if that was just, if you will, a statement to establish an envelope for which the safety evaluation is applicable. It's Section 2.2.2.

MR. TAMMARA: I think hurricane missiles might be a little bit higher than that one, but that will be looked at by the COL applicant. That's what the intent was.

MEMBER KIRCHNER: Dick, I remember --

MR. TAMMARA: Because we went through, and the question arose at the PSEG application or whatever. And we discussed it, too, and we discussed this aspect a little bit at that time.

And the new regulatory aspect of whatever it is it was proposed it is higher than the --

MEMBER SKILLMAN: I think it was the

hurricane straight line winds and the potential for the higher wind field to lift a vehicle or a fairly large component.

MEMBER KIRCHNER: Normally the tornado missile dominates. But there were certain sites where it appears. And we saw one that was at the Turkey Point, right, in Florida, where the hurricane generated missile actually was dominant. And so I suspected, the way I interpreted it, is normally it's going to be -- I forget the reg guys. You all live and die --

(Simultaneous speaking.)

MEMBER KIRCHNER: There was a more recent reg guy for hurricanes.

MEMBER SKILLMAN: It's 1.22.1.

MR. TAMMARA: The COL applicant will calculate that probability and show that it might be less than ten to the core minus seven.

MEMBER SKILLMAN: Thank you. That was the item that was tugging at me. And, Mike, the other item is I think, you know, one man's opinion. This plant is a heavyweight. It's a dense plant. It is a large footprint with a large volume and mass of water in 12 modules.

And I understand soil bearing requirement.

1 But I'm thinking, as large and strong as this building
2 is, it's still an eggshell. And there are some
3 demands on the structure of the reactor building that
4 are different from any, at least that I've seen, in my
5 career. And I'm not sure that that's highlighted as
6 prominently as it needs to be. And that's all I want
7 to say. Thanks.
8 MEMBER CORRADINI: Anything else from any
9 of the members? Okay. With that, we'll adjourn.
10 Happy holidays.
11 (Whereupon, the above-entitled matter went
12 off the record at 4:59 p.m.)
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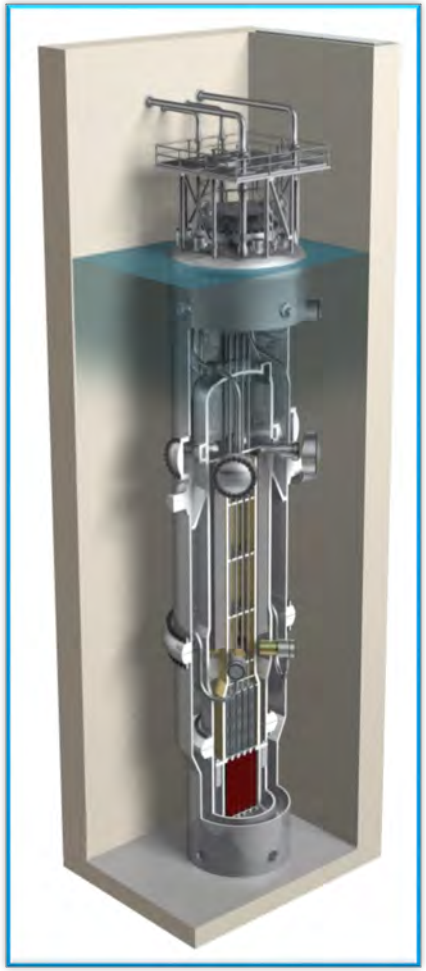
ACRS Presentation

Chapter 17 - Quality Assurance and Reliability Assurance



Patrick Conley
Engineering Programs

Paul Infanger
Licensing Project Manager

December 18, 2018

PM-1218-63732
Revision: 0

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Template #: 0000-21727-F01 R4

Purpose

- Provide FSAR Chapter 17 overview
  - Quality Assurance Program (QAP)
  - Design Reliability Assurance Program (D-RAP)

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Quality Assurance Program

- Established in accordance with 10 CFR 50 App B and ASME NQA-1-2008 with NQA-1a-2009 addenda as endorsed by RG 1.28, Rev. 4
  - Consistent with guidance in NUREG-0800 and NEI 11-04A Rev. 0 QAPD template

- Consists of
  - Approved TR-1010-859-NP-A, “Quality Assurance Program Description for the NuScale Power Plant,” Rev. 3
  - Quality Management Plan (QMP) - identifies requirements fully implemented and requirements not within scope of design phase, but may be implemented in future
  - Implementing procedures listed in QMP

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QAP (cont'd)

Section No.	Description	Remarks
17.1	Quality Assurance during the Design Phase	Described in 17.5
17.2	Quality Assurance during the Construction and Operation Phase	Not applicable to design certification Item COL 17.5-1
17.3	Quality Assurance Program Description	Section 17.5
17.5	Quality Assurance Program Description – Design Certification, Early Site Permits, and New License Applicants	Does not address construction and design QA activities that begin once construction begins

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COL Items

- 17.4-1 Describe RAP to be conducted during operations
- 17.4-2 Identify site-specific SSC in RAP
- 17.4-3 Identify QA controls for RAP SSC during site-specific design, procurement, fabrication, construction, and preoperational testing
- 17.5-1 Describe QAP applicable to site-specific design, construction, and operation
- 17.6-1 Describe 10 CFR 50.65 maintenance effectiveness monitoring program

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RAIs

- Only three RAIs on Ch 17
  - RAI 8879 17.04-1 (chemical and volume control system)
  - RAI 8879 17.04-2 (expert panel)
  - RAI 8909 17.04-3 (backup power)

- All three are Resolved-Closed

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D-RAP Process

- Complies with NUREG-0800, Section 17.4
- Process controlled by procedure
- SSC risk categorization determined by SME and confirmed by expert panel, which makes final decision
  - Expert panel consists of Design Engineering, Operations, PRA, and Safety Analysis
  - Licensing is a non-mandatory member

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D-RAP Process (cont'd)

- PRA input based on approved TR-0515-13952-NP-A "Risk Significance Determination," Rev. 0
- Default classification is "risk-significant" for safety-related functions, unless PRA specifically determines SSC functionality is not risk-significant
- Engineering Change Control process determines if expert panel review is required

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RTNSS

- FSAR 17.4.3.3 states the process for evaluating SSC for the regulatory treatment of non-safety systems (RTNSS) program is described in FSAR 19.3
  - No RTNSS criterion met
  - No RTNSS SSCs in design

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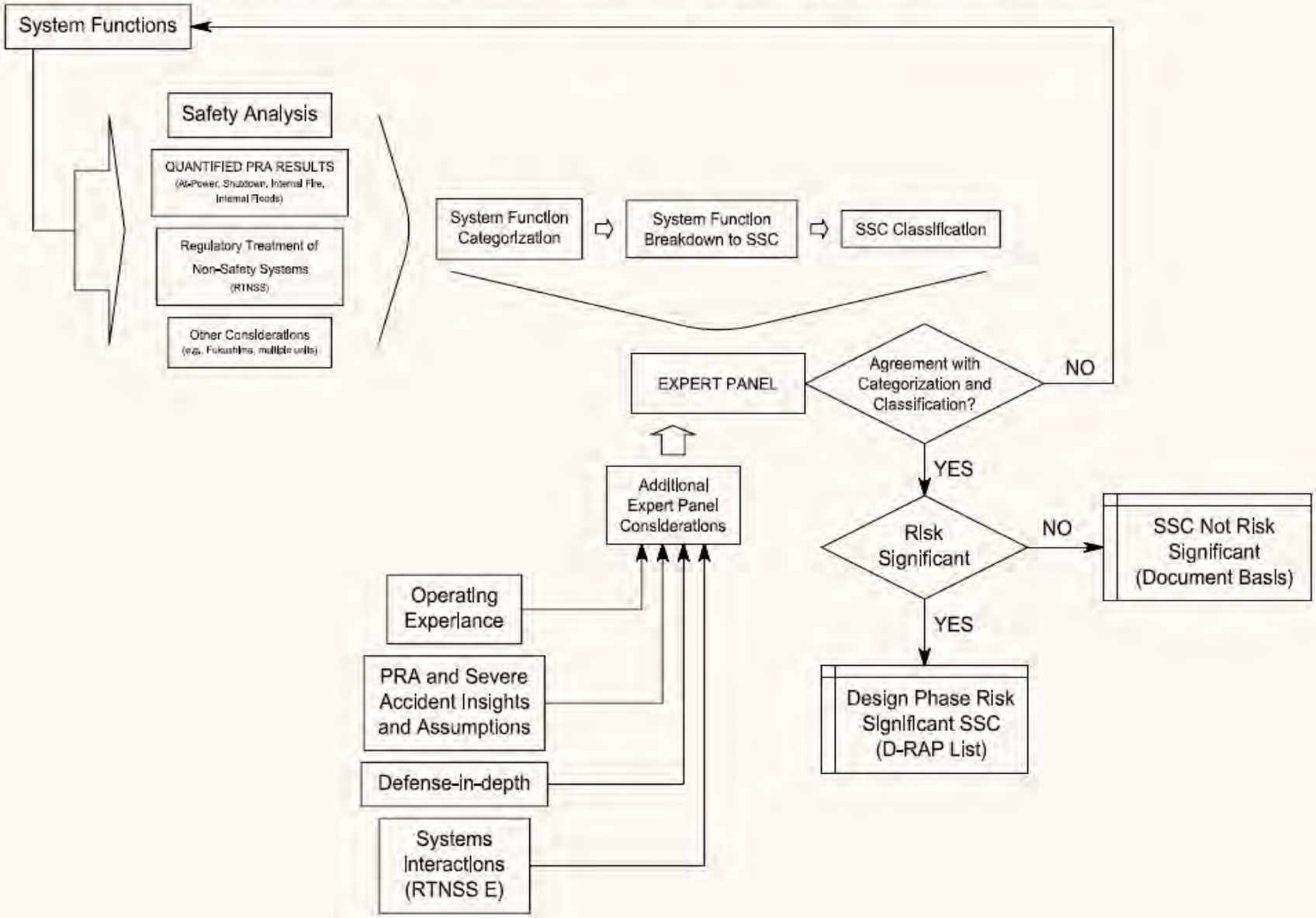
Figure 17.4-1: NuScale D-RAP Process for SSC Risk Significance Determination



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Risk Significance Determination (RSD)

Table 1. NuScale criteria for risk significance

Parameter	Criteria for Risk Significance
Component-level basic event	Conditional CDF $\geq 3 \times 10^{-6}$/yr
System-level basic event	Conditional CDF $\geq 1 \times 10^{-5}$/yr
Component-level basic event	Conditional LRF $\geq 3 \times 10^{-7}$/yr
System-level basic event	Conditional LRF $\geq 1 \times 10^{-6}$/yr
Basic event/contributor	Total FV ≥ 0.20

- Key conditions and limitations in RSD topical report SER
  - Only applicable to NuScale
  - Risk-informed applications include consideration of risk-significant SSCs with other concepts (e.g., defense in depth)
  - Technically adequate PRA that addresses all hazards and all modes
  - Thresholds based on very low CDF (< 1×10^{-7} per year)
- NuScale met all conditions and limitations

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D-RAP PRA Candidates

- Candidate risk-significant SSCs from PRA
  - Systems
    - emergency core cooling system (ECCS)
    - module protection system
    - ultimate heat sink
  - Components
    - ECCS reactor vent valves and reactor recirculation valves
    - decay heat removal system actuation valves
    - reactor safety valves
    - containment system containment isolation valves (CIVs)
    - chemical and volume control system CIVs
    - containment evacuation system CIVs
    - combustion turbine generator

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D-RAP PRA Candidates (cont'd)

- Other events and initiators (Fussel-Vesely FV>20%)
  - Reactor Building crane
  - LOCA inside containment
  - LOCA outside containment
  - loss of offsite power
  - internal fires
  - internal floods
- Human actions (FV>20%)
  - chemical and volume control system actuation
  - containment flooding and drain system actuation

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Final D-RAP Results

- Table 17.4-1: Risk-significant D-RAP SSC
  - containment system
  - steam generator system
  - reactor core system
  - control rod drive system
  - reactor coolant system
  - emergency core cooling system
  - decay heat removal system
  - ultimate heat sink
  - module protection system
  - neutron monitoring system
  - Reactor Building, Reactor Building crane, Control Building

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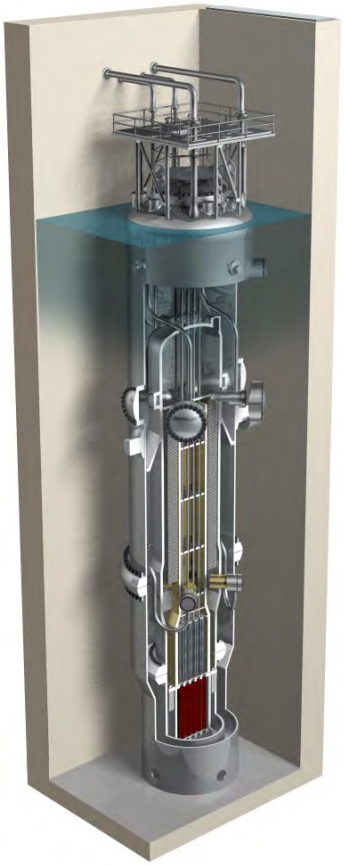

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U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Safety Evaluation with Open Items: Chapter 17, "Quality Assurance and Reliability Assurance"

NuScale Design Certification Application

ACRS Subcommittee Meeting
December 18, 2018

Agenda

- NRC Staff Review Team
- Summary of the NRC Staff's Review
- Quality Assurance
  - FSAR Sections: 17.1, 17.2, 17.3, and 17.5
- Reliability Assurance
  - FSAR Section: 17.4
- Abbreviations

NRC Staff Review Team

- Technical Staff
  - Odunayo Ayegbusi, NRO
  - Andrea Keim, NRO
  - Mark Caruso, NRO (Retired)
  - Alissa Neuhausen, NRO
- Project Management
  - Omid Tabatabai, Senior Project Manager
  - Greg Cranston, Lead Project Manager

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Protecting People and the Environment

Overview and Summary of Staff's Review

- DCA Rev. 0 submitted in Dec. 2016; Rev. 1 in Mar. 2018; and Rev. 2 in Oct. 2018. The Staff's SER is based on DCA, Rev 1
- Issued 2 RAIs (containing 3 questions) related to Section 17.4. All RAI Questions are resolved-closed
- Conducted two regulatory audits related to Section 17.4 during April-August 2017 and March-April 2018
- Conducted one Quality Assurance Implementation Inspection in June 2017. A follow-up inspection is being planned
- The Staff's Chapter 17 SER contains two open items – details will be discussed in the subsequent slides
- There are no Confirmatory Items in the SER

Section 17.5
Quality Assurance

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Protecting People and the Environment

Regulatory Basis

- 10 CFR Part 50, Appendix A, GDC 1 requires that QA program be established and implemented
- 10 CFR Part 50, Appendix B specifies 18 quality criteria that the QA program description must address
- 10 CFR 52.47(a)(19) requires that a standard DC applicant include a QAPD that satisfies applicable portions of Appendix B to 10 CFR Part 50

Topical Report Review

- NuScale submitted Topical Report NP-TR-1010-859-NP, "Quality Assurance Program Description for the NuScale Power Plant," Revision 3 on March 24, 2016
- NuScale commits to NQA-1-2008 and NQA-1a-2009 addenda as endorsed by RG 1.28, Revision 4
- The NRC staff reviewed the QAPD using NUREG-0800 Section 17.5
- The NRC staff SER dated September 22, 2016

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Staff's Review of DCA, Section 17.5

- References "Quality Assurance Program Description for the NuScale Power Plant," NP-TR-1010-859-NP-A, Revision 3
- COL Item 17.5-1: A COL applicant that references the NuScale Power Plant design certification will describe the quality assurance program applicable to the site-specific design activities and to the construction and operations phases.
- Open Item 17.5-1: Additional QA implementation inspection

QA Implementation Inspection

- June 5 - 9th, 2017
- NuScale Office Facility in Corvallis, Oregon
- Inspection Procedure 35017, “Quality Assurance Implementation Inspection”
- No findings of significance were identified
- QA Inspection Report is publicly available at (ML1720J382).
- Additional QA inspection is being scheduled and is listed in SER Open Item 17.5-1

Section 17.4
Reliability Assurance Program (RAP)

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Reliability Assurance Program

- Staff evaluated NuScale's reliability assurance program, including the design RAP (D-RAP) list in accordance with SRP Section 17.4, Rev. 1

- Staff found the RAP program sufficient in:
  - Program description and implementation
  - Programmatic controls
  - SSC selection methodology
  - Expert panel member requirements
  - Determination of risk significant SSCs

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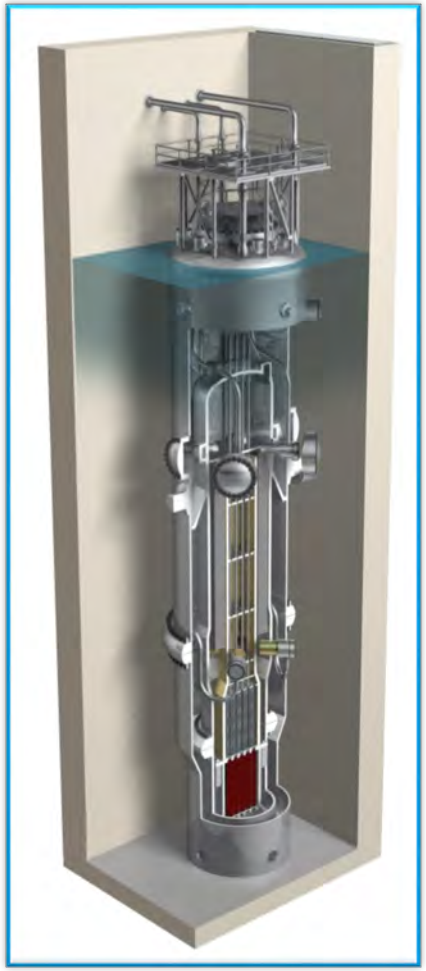
Reliability Assurance Program

- Staff found:
  - the D-RAP list was developed in accordance with its RAP methodology and the D-RAP list is comprehensive.
  - NuScale adequately implemented the expert panel in developing the D-RAP list.
  - COL items provide reasonable assurance that the RAP for a COL applicant which references the NuScale design will be adequate.
- Open Item: D-RAP ITAAC (SECY-18-0093)

Abbreviations

ACRS	*Advisory Committee on Reactor Safeguards*
COL	*Combined License*
DC	*Design Certification*
DCA	*Design Certification Application*
D-RAP	*Design Reliability Assurance Program*
FSAR	*Final Safety Analysis Report*
ITAAC	*Inspections, Tests, Analyses, and Acceptance Criteria*
NRO	*NRC Office of New Reactors*
QA	*Quality Assurance*
RAP	*Reliability Assurance Program*
SER	*Safety Evaluation Report*
SSC	*Structures, Systems, and Components*

ACRS Presentation Chapter 2 - Site Characteristics and Site Parameters



J. J. Arthur, P.E.
Manager, Structures and Design Analysis

Paul Infanger
Licensing Project Manager

December 18, 2018

PM-1218-63753
Revision: 0

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Template #: 0000-21727-F01 R4

Purpose

- Provide FSAR Chapter 2 overview
  - Site characteristics and parameters
  - RAIs
  - SER open item

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Chapter 2 Overview

- Site parameters are generally consistent with past applicant precedents and 2014 EPRI Advanced LWR Utility Requirements Document

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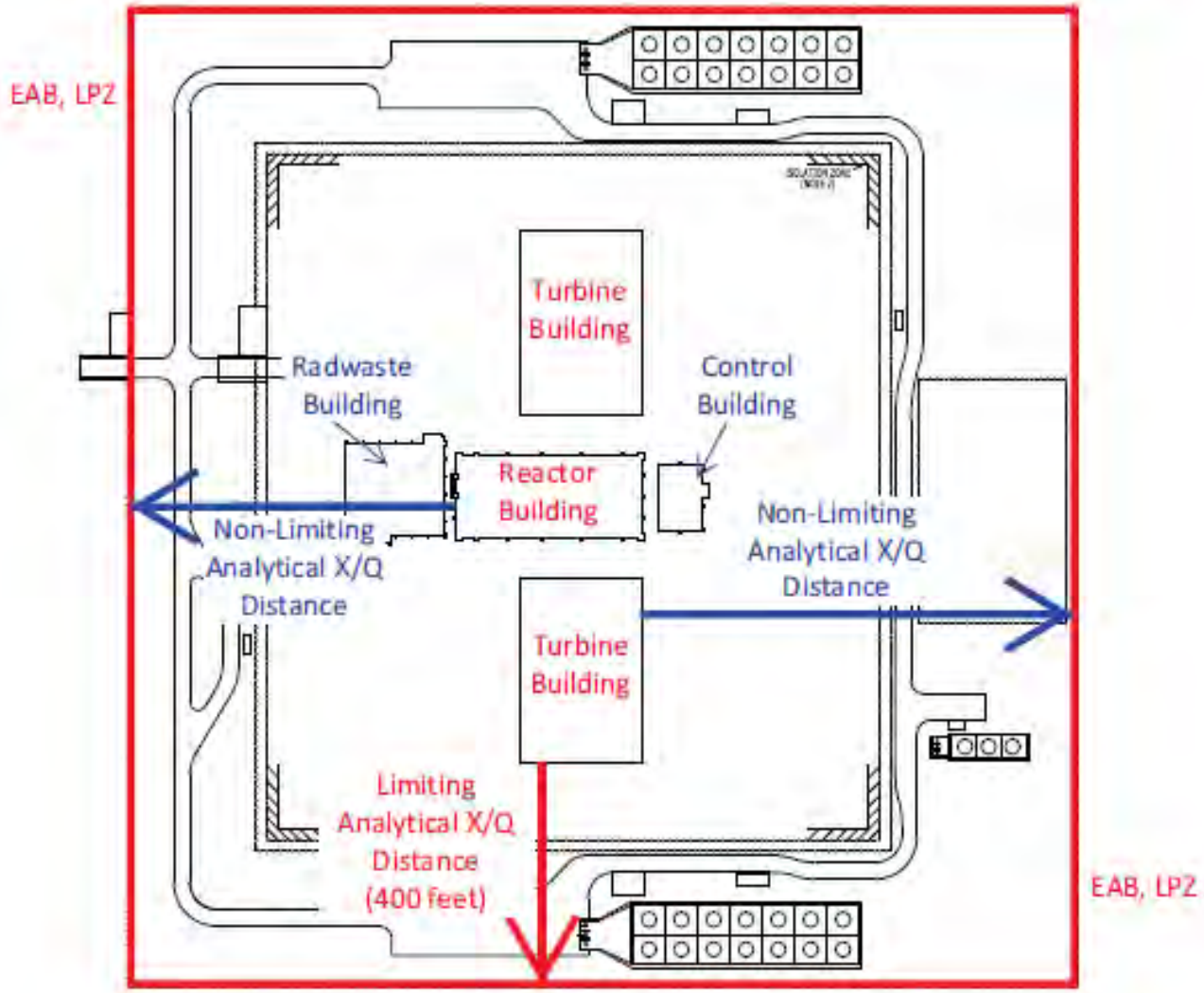
Conceptual Site Layout



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Site Design Parameters

- Design assumes site parameters representative of a reasonable number of potential plant site locations in the U.S. A summary of the parameters is in FSAR Table 2.0-1 and provided in following slides.

- COL Item 2.0-1: demonstrate site-specific characteristics are bounded by design parameters specified in Table 2.0-1. If not bounded, demonstrate acceptability of site-specific values.

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2.1 Geography, Demography

- Minimum distance from EAB to nearest release point – 400 ft
- Minimum distance from LPZ outer boundary to nearest release point – 400 ft
- COL Item 2.1-1: describe site geographic and demographic characteristics

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2.2 Nearby Facilities

- No hazards from nearby industrial, transportation, or military facilities postulated
- No aircraft hazards postulated
- COL Item 2.2-1: describe nearby industrial, transportation, and military facilities; demonstrate design acceptability for each potential accident or provide site-specific design alternatives

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2.3 Meteorology

- Max precipitation rate [HMR (NOAA), EPRI URD]
  - 19.4 inches/hr (6.3 inches for 5 min period)
- Roof snow load [HMR (NOAA), EPRI URD]
  - normal / extreme 50 psf / 75 psf
- 100-yr return 3-sec wind gust (EPRI URD)
  - 145 mph with importance factor of 1.15 for RXB, CRB, RWB
- Design basis tornado (RG 1.76)
  - max wind speed 230 mph
  - translational speed 46 mph
  - max rotational speed 184 mph (radius 150 ft)
  - pressure drop / rate 1.2 psi / 0.5 psi/sec

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2.3 Meteorology (cont'd)

- Tornado missile spectra (RG 1.76 R1, Table 2, Region 1)
- Design basis hurricane (RG 1.221)
  - missile spectra (RG 1.221 R0, Tables 1 & 2)
  - max wind speed 290 mph
- 0% exceedance values (historical limit excluding peaks < 2 hr) used for CRVS design
  - max outdoor design dry bulb temp 115°F
  - min outdoor design dry bulb temp -40°F
  - max coincident wet bulb temp 80°F
  - max non-coincident wet bulb temp 81°F

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2.3 Meteorology (cont'd)

- 1% exceedance values used for RXB and RWB HVAC design, and SCWS and CWS design
  - max outdoor design dry bulb temp 100°F
  - min outdoor design dry bulb temp -10°F
  - max coincident wet bulb temp 77°F
  - max non-coincident wet bulb temp 80°F
- 5% exceedance values used for TGB HVAC design
  - max outdoor design dry bulb temp 95°F
  - min outdoor design dry bulb temp -5°F
  - max coincident wet bulb temp 77°F

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2.3 Meteorology (cont'd)

- Atmospheric dispersion X/Q methodology based on ARCON96
  - NuScale site boundary (400 ft) vs traditional LWR (~ 2,600 ft – 19,700 ft)
  - NuScale applies ARCON96 methodology based on RG 1.194 for improved accuracy in predicting atmospheric dispersion for a short EAB/LPZ distance, as opposed to a PAVAN methodology based on RG 1.145, which was developed for longer distances
  - Methodology described in Accident Source Term topical report Rev. 2

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2.3 Meteorology (cont'd)

- Accident release X/Q at EAB/LPZ boundary
  - 0-2 hr 6.22E-04 s/m^3
  - 2-8 hr 5.27E-04 s/m^3
  - 8-24 hr 2.41E-04 s/m^3
  - 24-96 hr 2.51E-04 s/m^3
  - 96-720 hr 2.46E-04 s/m^3
- Accident release X/Q at MCR/TSC door and HVAC intake
  - 0-2 hr 6.50E-03 s/m^3
  - 2-8 hr 5.34E-03 s/m^3
  - 8-24 hr 2.32E-03 s/m^3
  - 1-4 days 2.37E-03 s/m^3
  - 4-30 days 2.14E-03 s/m^3

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2.3 Meteorology (cont'd)

- Routine release X/Q and D/Q (bounding offsite dose)
  - undepleted/no decay 1.44E-05 s/m^3
  - undepleted/2.26-day decay 1.44E-05 s/m^3
  - depleted/8.00-day decay 1.44E-05 s/m^3
  - D/Q 1.44E-07 l/m^2

- COL Item 2.3-1: describe site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5

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2.4 Hydrology

- Max flood elevation (EPRI URD)
  - 1 ft below baseline plant elevation
- Max groundwater elevation (EPRI URD)
  - 2 ft below baseline plant elevation
- COL Item 2.4-1: investigate and describe site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14

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2.5 Geology, Seismology

- Design uses geologic, seismologic, and geotechnical engineering parameters representative of a reasonable number of potential plant site locations in the U. S.
- Two DBEs: CSDRS and CSDRS-HF
- Spectra bound most of central and eastern U.S., and sites in less seismically active portions of western U.S.
- Fault displacement potential none
- Min soil bearing capacity 75 ksf
- Lateral soil variability uniform (< 20° dip)
- Min internal friction soil angle 30°
- Min shear wave velocity $\geq$ 1000 fps

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2.5 Geology, Seismology (cont'd)

- Liquefaction potential none
- Max settlement for RXB, CRB, RWB
  - Total 4 inches
  - Tilt 0.5 inch per 50 ft of building length or 1 inch total in any direction
  - Differential (RXB-CRB, RXB-RWB) 0.5 inch
- Slope failure potential none

- COL Item 2.5-1: describe the site-specific geology, seismology, and geotechnical characteristics for Section 2.5.1 through Section 2.5.5

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RAIs

FSAR Section	# RAIs	Resolved Closed	Unresolved Closed	Confirmatory	Suppl Resp In Eval
2.3	13	5		5	3
2.4	1		1		
2.5	5	1		2	2

- Unresolved Closed issue involves analysis of accidental release of radioactive liquid effluents in groundwater and surface water using BTP 11-6 methodology and guidance (RAI 8750 Question 02.04.13-1)

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SER Open Item 02.03.04-1

- Acceptability of method for calculating accident offsite X/Q values for EAB and LPZ, which is the outer boundary from the AST topical report TR-0915-17565

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Abbreviations

AST – accident source term

COL – combined license

CRB – Control Building

CRVS – normal control room HVAC system

CSDRS – certified seismic design response spectra

CSDRS-HF – CSDRS - high frequency

CWS – circulating water system

DCD – Design Control Document

EAB – exclusion area boundary

EPRI – Electric Power Research Institute

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Abbreviations (cont'd)

FSAR – Final Safety Analysis Report

HMR – Hydrometeorological Report

HVAC – heating ventilation and air conditioning

LPZ – low population zone

LWR – light water reactor

MCR – main control room

NOAA – National Oceanic and Atmospheric Administration

RAI – request for additional information

RG – Regulatory Guide

RWB – Radioactive Waste Building

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Abbreviations (cont'd)

RXB – Reactor Building

SER – Safety Evaluation Report

SCWS – site cooling water system

TGB – Turbine Generator Building

TSC – technical support center

URD – Utility Requirements Document

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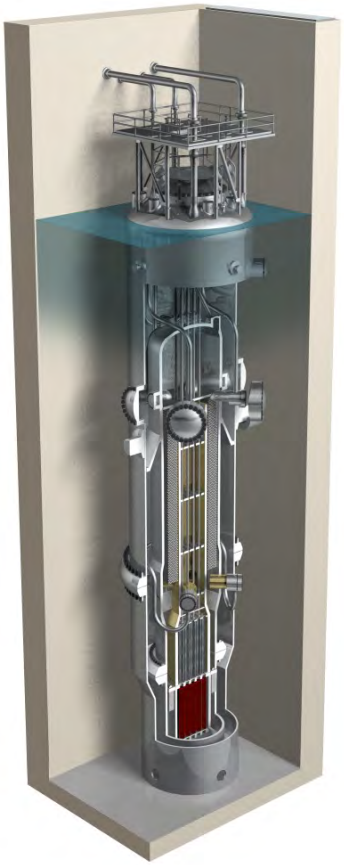

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Chapter 2: SITE CHARACTERISTICS

Project Manager: Prosanta Chowdhury

December 18, 2018

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Technical Branch Presentations

Radiation Protection and Accident Consequences Branch

- **Section 2.1 Geography and Demography**
- **Section 2.2 Nearby Industrial, Transportation, and Military Facilities**

Hydrology & Meteorology Branch

- **Section 2.3 Meteorology**
- **Section 2.4 Hydrologic Engineering**

Geoscience & Geotechnical Engineering Branch

- **Section 2.5 Geology, Seismology, & Geothermal**

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NRC Staff Interactions with NuScale

Requests for Additional Information

Section 2.3 – 10 questions; 4 Closed; 6 Confirmatory Action pending FSAR update; 1 Open Item

Section 2.4 – 1 question; 1 Closed; 3 Confirmatory Action pending FSAR update

Section 2.5 – 3 questions; 1 Closed; 2 Confirmatory Action pending FSAR update

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NRC Presenters

Rao Tammara: NRO/DLSE/RPAC – Sections 2.1 & 2.2
Michael Mazaika: NRO/DLSE/RHM/RMET – Section 2.3.1 – 2.3.3
Jason White: NRO/DLSE/RHM/RMET – Sections 2.3.4 – 2.3.5
Yuan Cheng: NRO/DLSE/RHMB – Section 2.4
Weijun Wang: NRO/DLSE/RGS – Section 2.5

Stephanie Devlin-Gill: Branch Chief - NRO/DLSE/RHM
Gerry Stirewalt: Branch Chief - NRO/DLSE/RGS
Michael Dudek: Branch Chief - NRO/DLSE/RPAC

Prosanta Chowdhury: Project Manager - NRO/DLSE/LB1

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Section 2.1: GEOGRAPHY AND DEMOGRAPHY

Section 2.2: NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

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Section 2.1 - Geography and Demography

- The review involves the following sections of the NuScale Power DCD:
  - 2.1.1 - Site Location and Description
  - 2.1.2 - Exclusion Area Authority and Control
  - 2.1.3 - Population Distribution

The COL applicant that references the NuScale Power design certification will describe and address the site geographic and demographic characteristics as described above. The COL applicant is to provide this site specific information as part of COL information Item 2.1-1 in the COL application.

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Section 2.2 - Nearby Industrial, Transportation, and Military Facilities

- The review involves the following sections of the NuScale Power DCD:
  - 2.2.1 - Locations and Routes
  - 2.2.2 - Descriptions
  - 2.2.3 - Evaluation of Potential Accidents

The COL applicant that references the NuScale Power design certification will describe and address the nearby industrial, transportation, and military facilities. The COL applicant is to demonstrate that the design is acceptable for each potential accident or provide site-specific design alternatives. The COL applicant is to provide this site specific information as part of COL information Item 2.2-1 in the COL application.

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Section 2.3: METEOROLOGY

December 18, 2018

Overview of DCA FSAR

Section 2.3 - Meteorology

- Review involves the following sections through Revision 1 of the NuScale DCA FSAR:
  - 2.3.1 – Regional Climatology
  - 2.3.2 – Local Meteorology
  - 2.3.3 – Onsite Meteorological Measurements Programs
  - 2.3.4 – Short-Term Atmospheric Dispersion Estimates for Accident Releases
  - 2.3.5 – Long-term Atmospheric Dispersion Estimates for Routine Releases
- Potential plant site locations in U.S. including contiguous (lower 48) states, Alaska, and Hawaii. DCA is silent on potential deployment in U.S. Territories

Overview of DCA FSAR **(Cont'd)**

Section 2.3 - Meteorology

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Postulated Site Parameters

- Applicant postulated site parameters related to:
  - Climatic Extremes (i.e., precipitation, winds, ambient temperatures)
  - Atmospheric Dispersion and Deposition Factors (design-basis accident & routine (normal) releases)
- Staff reviewed Section 2.3 of the NuScale DCA FSAR in accordance with SRP Sections 2.3.1 through 2.3.5, associated regulatory guidance, and related data resources
- A COL applicant is required to compare its site characteristics to the site parameters postulated for the NuScale design

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Climate-related Site Parameters

- Maximum Precipitation (Rainfall) Rates for Roof Design
  - Consistent with most of previously-submitted DCAs
  - PMP values from HMR No. 52 (based on selected storms east of 105th Meridian in contiguous U.S.)
  - Postulated site parameters representative of a reasonable number of locations in contiguous U.S.

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Climate-related Site Parameters (Contd)

- Winter Precipitation Loads (for Roof Design)
  - Site parameters only provided as normal and extreme roof snow loads. Consistent with intent of DC/COL-ISG-007, Applicant revised Chapter 3 to allow back-calculation of ground loads (reported in Section 2.3.1)
  - Design of RXB and CRB roofs limits accumulation of liquid precipitation such that frozen winter precipitation events should be controlling
  - Staff evaluated 100-year return ground snow loads based on ASCE/SEI 7-10 for contiguous U.S. and Alaska
  - Postulated site parameters are representative of a reasonable number of locations in continental U.S. (including some portions of Alaska)

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Climate-related Site Parameters (Contd)

- Design-Basis Severe Wind Speed (100-Year 3-Second Gust)
  - Also referred to as straight-line winds. Postulated design-basis severe wind speed (3-sec gust) based on ASCE/SEI 7-05 and is applicable to RXB, CRB, and RWB
  - Staff evaluated 100-year return straight-line wind speed (3-sec gust) using ASCE/SEI 7-05 for contiguous U.S. and Alaska consistent with SRP Section 2.3.1
  - Site parameter value and related characteristics representative of a reasonable number of locations in the contiguous U.S., Hawaii, and much of Alaska

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Climate-related Site Parameters (Contd)

- Design-Basis Tornado
  - Postulated DBT wind speed (3-sec gust) and pressure parameters (with exceedance frequency of 1E-07 per year) based on RG 1.76 (Rev. 1) for Region 1 (highest tornado intensity region)
  - Site parameters representative of a reasonable number of locations in contiguous U.S. DBT parameters not specified in RG 1.76 for Alaska or Hawaii. DCA does not address these locations
- Design-Basis Hurricane
  - Postulated DBH wind speed (3-sec gust) with exceedance frequency of 1E-07 per year based on RG 1.221 represents highest 3-sec gust depicted in RG 1.221
  - Site parameter representative of a reasonable number of locations, including hurricane-prone areas, of contiguous U.S. DBH wind speeds not specified in RG 1.221 for Pacific Coast of contiguous U.S. or Hawaii. DCA does not address these locations

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Climate-related Site Parameters (Contd)

- Ambient Design Dry- and Wet-Bulb Temperatures
  - Postulated site parameters for 0%, 1%, and 5% exceedance maximum and minimum dry-bulb temperatures, wet-bulb temperatures coincident with indicated maximum dry-bulb values, and 0% and 1% exceedance non-coincident wet-bulb temperatures
  - Applicant referenced numerical values to Rev. 13 of EPRI URD (2014) and indicated (via RAI response) that values represent annual, rather than seasonal, exceedance probabilities. Staff determined that numerical values are same as in Rev. 8 of URD (1999)
  - Coincident wet-bulb temperatures in EPRI URD represent mean values whereas coincident wet-bulb temperatures postulated in DCA represent (via RAI response) maximum values

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Climate-related Site Parameters (Contd)

- Ambient Design Dry- and Wet-Bulb Temperatures
  - Staff evaluated postulated dry- and wet-bulb temperatures based on data summarized by ASHRAE for contiguous U.S. and Hawaii, and used professional judgement for temperature conditions in Alaska
  - Maximum and minimum dry-bulb values for all exceedance levels acceptable at a reasonable number of locations in most of continental U.S. and Hawaii
  - Postulated 1% non-coincident wet-bulb temperature acceptable at a reasonable number of locations in contiguous U.S., Hawaii, and, based on professional judgement, Alaska

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Climate-related Site Parameters (Contd)

- Ambient Design Dry- and Wet-Bulb Temperatures
  - Applicant took position (via RAI response) that chosen wet-bulb temperature site parameters are for non-safety related HVAC systems and cooling towers (see Tier 2, Table 3.2-1). Therefore, it is a business decision not to change these values
  - Postulated 0%, 1%, and 5% dry-bulb temperatures appear to be acceptable at a reasonable number of locations (except in desert southwest and drier portions of California). However, ASHRAE database suggests **maximum coincident wet-bulb temperatures** in those pairs likely to be exceeded in much of contiguous U.S. and Hawaii
  - Based on Applicant's position, it is reasonable to expect a need for potential COL applicants to request a departure from postulated **0% non-coincident, or the 0%, 1% or 5% maximum coincident wet-bulb temperature(s)** depending on site characteristics

Topics of Interest

- **Section 2.3.2 – Local Meteorology**
  - FSAR states that "[l]ocal meteorology is site-specific and is addressed by the COL applicant." Staff agrees
- **Section 2.3.3 – Onsite Meteorological Measurements Programs**
  - FSAR states that "[o]nsite meteorological measurements programs are site-specific and addressed by COL applicant." Staff agrees

Topics of Interest

Section 2.3.4 - Short-Term Atmospheric Dispersion Site Parameters for Accident Releases

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Offsite EAB and LPZ X/Q Site Parameter Values

- Applicant stated that topical report, TR-0915-17565, describes the methodology for calculating accident X/Q values at EAB and LPZ
- Staff performed an independent verification of Applicant's offsite X/Q site parameter values postulated for EAB and LPZ
- Staff used a portion of the NuScale methodology to calculate X/Q values based on meteorological data collected at six nuclear power plant sites
- Staff found that only one of these six sites had X/Q values that are bounded by all of the postulated NuScale site parameter values
- If a COL applicant references the NuScale design and finds its actual site characteristic X/Q values do not fall within corresponding site parameters postulated in the DCA, the COL applicant will need to provide sufficient justification that the proposed facility is still acceptable at the proposed site

Topics of Interest

Section 2.3.4 - Short-Term Atmospheric Dispersion Site Parameters for Accident Releases (Contd)

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Offsite EAB and LPZ X/Q Site Parameter Values

- **Open Item 2.3.4-1**. Staff is currently evaluating TR-0915-17565 to determine if the NuScale methodology is acceptable for calculating DBA offsite X/Q values at EAB and LPZ in relation to NuScale design and in a COL application that references NuScale design
- Subject to resolution of the Staff's evaluation of TR-0915-17565, the Staff concludes that the Applicant has appropriately provided the short-term (accident release) X/Q site parameters

Topics of Interest

Section 2.3.4 - Short-Term Atmospheric Dispersion Site Parameters for Accident Releases (Contd)

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Onsite MCR and TSC X/Q Site Parameter Values

- Staff performed an independent verification of Applicant's postulated onsite X/Q site parameter values at the MCR and TSC doors and HVAC intake
- Staff generated X/Q values using the ARCON96 computer code with the source and receptor information presented in the DCA
- Staff found that the Applicant has provided onsite X/Q site parameter values at the MCR and TSC doors and HVAC intake that are representative of a reasonable number of locations that may be considered for a COL application

Topics of Interest

Section 2.3.5 - Long-Term Atmospheric Dispersion Site Parameters for Routine Releases

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Offsite Dose Location X/Q and D/Q Values

- Staff performed an independent evaluation of Applicant's postulated offsite X/Q and D/Q site parameter values using the XOQDOQ computer code
- Staff found that the long-term (routine release) site parameter values selected by the Applicant are representative of a reasonable number of sites that have been or may be considered for a COL application

Acronyms & Abbreviations

Section 2.3 - Meteorology

- ACRS – Advisory Committee on Reactor Safeguards
- ASCE/SEI – American Society of Civil Engineers/Structural Engineering Institute
- ASHRAE – American Society of Heating, Refrigeration & Air Conditioning Engineers
- COL – Combined License
- CRB – Control Building
- DBA – Design-Basis Accident
- DBH – Design-Basis Hurricane
- DBT – Design-Basis Tornado
- DC – Design Certification
- DCA – Design Certification Application
- D/Q - Relative Deposition Factor ($1/m^2$)
- EAB – Exclusion Area Boundary
- EPRI – Electric Power Research Institute
- FSAR – Final Safety Analysis Report
- HMR – Hydrometeorological Report
- HVAC – Heating, Ventilation, and Air Conditioning System

Acronyms & Abbreviations

Section 2.3 – Meteorology (Contd)

- ISG – Interim Staff Guidance
- LPZ – Outer Boundary of the Low Population Zone
- MCR - Main Control Room
- PMP – Probable Maximum Precipitation
- RAI – Request for Additional Information
- RG – Regulatory Guide
- RWB – Radioactive Waste Building
- RXB – Reactor Building
- SRP – Standard Review Plan
- TR – Topical Report
- TSC – Technical Support Center
- URD – Utility Requirements Document
- X/Q – Atmospheric Dispersion Factor (sec/m^3)

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Section 2.4: HYDROLOGIC ENGINEERING

December 18, 2018

Site Parameters For Hydrologic Engineering

- The applicant identified three site parameters related to hydrologic engineering: (Reference to DCA PART 2, Tier 2, Table 2.0-1)
    - Maximum flood level, including wind-induced wave run-up, one foot below baseline plant elevation
    - Groundwater level is a minimum of two feet below the site grade
    - Maximum precipitation rates: 19.4 inches in one hour and 6.3 inches in 5 minutes

Site-Specific Characteristics and COL Information Item 2.4-1

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- DCA PART 2, Tier 2, Sections 2.4.1 through 2.4.14, except 2.4.8 and 2.4.10, should be evaluated in COL stage:
  - Staff confirmed that DCA PART 2 Tier 2, Sections 2.4.1 through 2.4.14, except 2.4.8 and 2.4.10, are related to site-specific characteristics
  - Characteristics include: local hydrology, local intense precipitation, probable maximum flood on stream and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami hazards, ice effects, channel diversions, low water considerations, ground water, and a liquid effluent release to groundwater
  - Those sections related to site-specific characteristics will be evaluated in COL stage by future applicant

Site-Specific Characteristics and COL Information Item 2.4-1 (Continued)

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- DCA PART 2 Tier 2, Sections 2.4.8 and 2.4.10 are not evaluated in COL stage:
  - Staff confirmed that cooling water canals and reservoirs (Section 2.4.8) would not be designated as safety-related make-up water sources for NuScale design
  - Staff confirmed that the NuScale ultimate heat sink design does not rely on an external water supply for at least 30 days (Section 9.2.5.4)
  - Staff also confirmed that flood protection requirements (Section 2.4.10) are not applicable since the baseline plant elevation is one foot above the maximum flood level elevation

Site-Specific Characteristics and COL Information Item 2.4-1 (Continued)

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- COL Information Item 2.4-1:

  A combined license (COL) applicant that references the NuScale Power Plant design certification (DC) will investigate and describe the site-specific hydrologic characteristics for Sections 2.4.1 through 2.4.14, except Sections 2.4.8 and 2.4.10

- COL Information Item 2.4-1 addresses the three site parameters.

Staff Conclusions

- NuScale DCA site parameters meets the requirements of 10 CFR Part 100, “Reactor Site Criteria”
- All regulatory requirements have been satisfied
- No open items
- Three confirmatory items

Acronyms & Abbreviations
Section 2.4 – Hydrologic Engineering

CFR – *Code of Federal Regulations*

COL – Combined License

DC – Design Certification

DCA – Design Certification Application

NRC – U.S. Nuclear Regulatory Commission

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Section 2.5: GEOLOGY, SEISMOLOGY, AND GEOTECHNICAL ENGINEERING

December 18, 2018

Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

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The review involved the following sections of the NuScale FSAR:

- 2.5.1 Basic Geologic and Seismic Information
- 2.5.2 Vibratory Ground Motion
- 2.5.3 Surface Faulting
- 2.5.4 Stability of Subsurface Materials and Foundations
- 2.5.5 Stability of Slopes

Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

Establishes site parameters as NuScale design basis or for a site suitable for the design, which include:

- no fault displacement potential under the plant structures
- certified seismic design response spectra (CSDRS)
- certified seismic design response spectra - high frequency (CSDRS-HF)
- minimum shear wave velocity of the subsurface material
- minimum ultimate bearing capacity
- uniformity of soil layers
- no potential for soil liquefaction
- minimum coefficient of static friction
- minimum soil angle of internal friction
- limits of foundation settlement

Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

Sections 2.5.1 and 2.5.3 findings:

- DCA defined geology related site parameters such as no fault displacement potential under the plant structures at a site
- DCA specified in COL Information item that site specific basic regional and site geologic information to be addressed by COL applicants

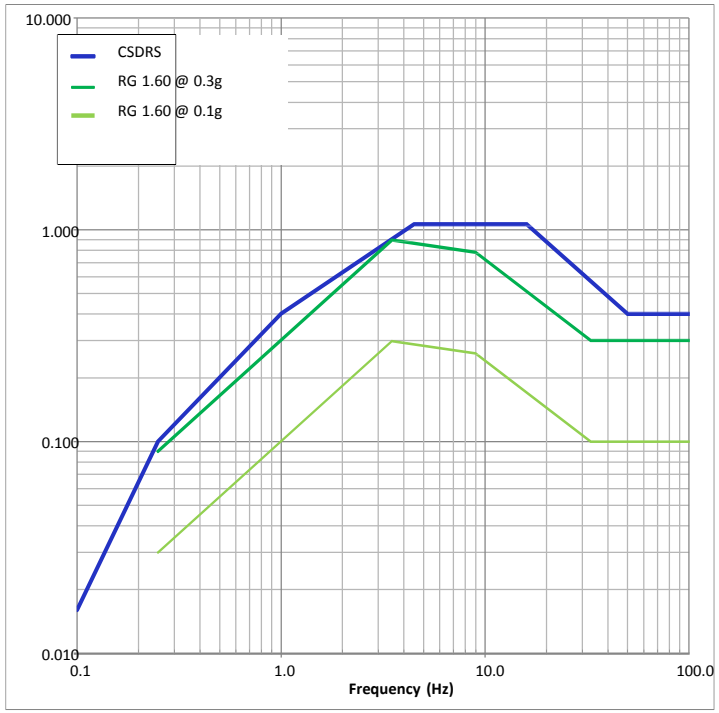
Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

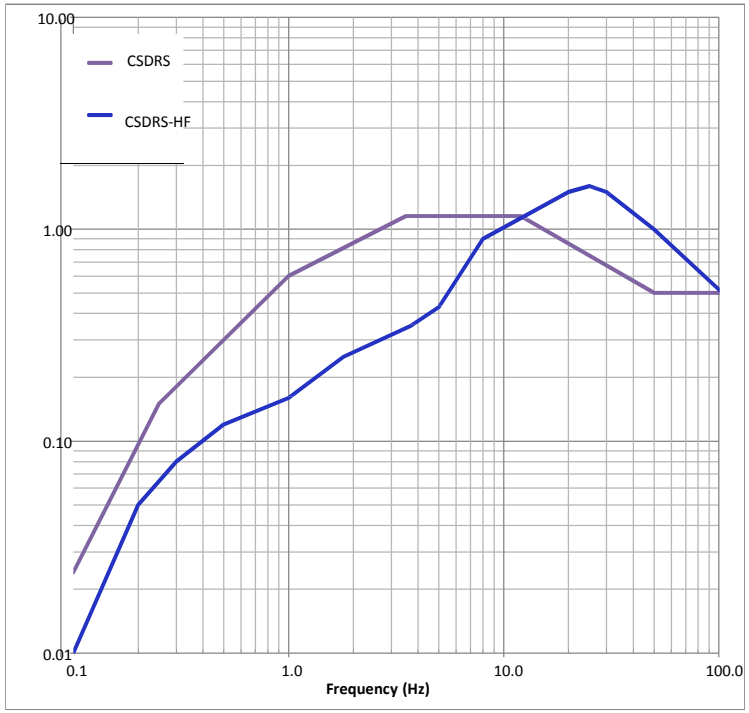
Sections 2.5.2 findings:

- The DCA defined CSDRS and CSDRS-HF as its seismic loading design basis, and intended to cover sites at most of the central and eastern U.S., as well as sites in the western U.S.
- DCA specified in COL Information item that site specific basic regional and site seismic information, with local vibratory ground motion and site safe shutdown earthquake to be addressed by COL applicants

NuScale Horizontal Certified Seismic Design Response Spectra at 5% Damping



CSDRS vs RG 1.60



CSDRS and CSDRS-HF

Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

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Sections 2.5.4 and 2.5.5 findings:

- The staff RAIs focused on:
  - site subsurface material uniformity requirements
  - applicability of static and dynamic parameters of the subsurface materials, including the backfill materials
  - limits of total and differential settlements for safety related structures
  - lateral earth pressure evaluation
- The applicant adequately addressed all RAI issues, and specified pertinent items to be addressed by COL applicants

Technical Topics of Interest

Section 2.5 – Geology, Seismology, and Geotechnical Engineering

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Staff Conclusions

- No Open Items in Chapter 2.5
- The applicant adequately specified geologic, seismic and geotechnical engineering related site parameters for NuScale design and for site suitability determination
- The applicant properly identified site specific information to be addressed in a COL application, and adequately described such information in COL Information Items
- Two Confirmatory Items are currently being tracked by the staff to ensure that proposed changes presented in the RAI responses to be incorporated in future revised DCA document