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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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NUSCALE DESIGN-CENTERED SUBCOMMITTEE

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TUESDAY

NOVEMBER 5, 2024

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The Subcommittee met via Teleconference, at 1:00 p.m. EDT, Walter L. Kirchner, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chair

RONALD G. BALLINGER, Member

VICKI M. BIER, Member

VESNA B. DIMITRIJEVIC, Member

GREGORY H. HALNON, Member

CRAIG D. HARRINGTON, Member

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SCOTT P. PALMTAG, Member

DAVID A. PETTI, Member

THOMAS E. ROBERTS, Member
MATTHEW W. SUNSERI, Member

ACRS CONSULTANTS:
DENNIS BLEY
CHARLES BROWN
MYRON HECHT
STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:
MICHAEL SNODDERLY

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P R O C E E D I N G S

1:00 p.m.

CHAIR KIRCHNER: The meeting will now come to order. This is a meeting of the NuScale Design-Centered Review Subcommittee of the Advisory Committee on Reactor Safeguards.

I'm Walt Kirchner, Chair of today's Subcommittee meeting. ACRS members in attendance in person are Ron Ballinger, Craig Harrington, Robert Martin, Scott Palmtag, Dave Petti, Thomas Roberts, and myself. ACRS members in attendance virtually via Teams are Vicki Bier, Vesna Dimitrijevic, and Matt Sunseri.

We have one of our consultants participating in person, Charlie Brown. I don't see him yet, but we expect him. And also, via Teams, we have Dennis Bley, Myron Hecht, and Stephen Schultz.

If I'm missing anyone, please speak up at this point. Oh, and I skipped over our esteemed Vice Chair, Greg Halnon. My apologies.

Michael Snodderly of the ACRS staff is the Designated Federal Officer for this meeting.

No member conflicts of interest were identified. And I note that we have a quorum.

During today's meeting, the Subcommittee will receive a briefing on the staff's evaluation of the NuScale Power LLC's US460 Standard Design Approval Application and will cover Chapter 3, Design of Structures, Systems, Components, and Equipment; Chapter 8, Electrical Power, and Chapter 14, Initial Test Program and Inspections, Tests, Analyses, and Acceptance Criteria, ITAAC.

We previously reviewed the Certified NuScale US600 design, as documented in our July 29, 2020, Letter Report on the Safety Aspects of the NuScale Small Modular Reactor.

Like the staff, we are performing a delta review between the two designs, including the power uprate from 50 to 77 megawatts electric per module. We are reviewing these chapters as part of our statutory obligation under Title 10 of the Code of Federal Regulations, Part 52, Subpart E, Section 141, referral to the Advisory Committee on Reactor Safeguards to report on those portions of the application which concern safety.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, or FACA. The NRC implements FACA in accordance with our regulations. Per these regulations and the Committee's Bylaws, the ACRS speaks only through its published Letter Reports. Therefore, all member comments should be regarded as only the individual opinion of that member, not a Committee position.

All relevant information related to ACRS activities, such as letters and rules for meeting participation, and transcripts are located on the NRC public website and can be easily found by typing "About US ACRS" in the Search vehicle on the NRC's home page.

The ACRS, consisting of the agency's value of public transparency and regulation of nuclear facilities, provides opportunity for public input and comment during our proceedings. We have received no written statements or requests to make a statement from the public, but we have set aside time at the end of this meeting for public comments.

Portions of this meeting may be closed to protect sensitive information, as required by FACA and the Government in Sunshine Act. Attendance during the closed portion of the meeting will be limited to NRC staff and its consultants, applicants, and those individuals and organizations who have entered into an appropriate confidentiality agreement. We will confirm that only eligible individuals are in the closed portion of the meeting.

The ACRS will gather information, analyze relevant issues and facts, and formulate proposed conclusions and recommendations, as appropriate, for deliberation by the full Committee. A transcript of the meeting is being kept and will be posted on our website.

When addressing the Subcommittee, participants should first identify themselves and speak with sufficient clarity and volume, so that they may be readily heard. If you are not speaking, please mute your computer or Teams or by pressing star-6 if you're on the phone.

Please do not use the Teams chat feature to conduct sidebar discussions related to the presentations, but, rather, use the meeting chat function to report IT problems and issues.

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In addition, please keep sidebar discussions in the room to a minimum, since the ceiling microphones are live.

Presenters, your table microphone is unidirectional and you'll need to speak into the front of the microphone to be heard.

Finally, if you have any feedback for the ACRS about today's meeting, we encourage you to fill out the public meeting feedback form on the NRC's website.

And unless there are comments from any members -- seeing none, okay, we'll proceed with the meeting. I'm going to turn to MJ from the NRC staff.

MR. JARDANEH: Hi. Good afternoon, Chair Kirchner, and good afternoon, ACRS Subcommittee Members, NuScale Participants, NRC staff, and members of the public. My name is Mahmoud "MJ" Jardaneh and I serve as the Branch Chief for the New Reactor Licensing Branch, responsible for the licensing of the NuScale US460 design, in the Division of New and Renewed Licenses, the Office of Nuclear Reactor Regulation.

Thank you for the opportunity today for the staff to present on their review of select NuScale US460 Standard Design Approval Application for SDAA chapters.

As you are aware from previous meetings, the staff is reviewing all chapters of the SDAA concurrently with staggered completion dates based on the complexity of the chapter and the extent of change from the Certified NuScale US600 design.

Today, the staff will be presenting on their review of the third group of the SDAA chapters, including Chapter 8, Chapter 14, and sections of Chapter 3. Earlier this year, the staff presented to this Subcommittee on Chapters 2, 7, 9, 10, 11, 12, portions of Chapter 17 and Chapter 18.

The remaining SDAA chapters are still being reviewed by the staff and we will inform the ACRS when the Safety Evaluations of the remaining chapters are available for their review.

In today's meeting, the staff will focus on the deltas from the Certified Designs that the NRC has approved and the Subcommittee and the Committee reviewed in the past.

Once again, thank you for the opportunity and we look forward to a good discussion.

CHAIR KIRCHNER: Thank you. And with that, I'll turn to NuScale. Welcome. Nice to see you here in person.

Peter, are you going to start for NuScale? Go ahead.

MR. SHAW: We actually have Elisa who is going to start.

MS. FAIRBANKS: Good afternoon, everyone. My name is Elisa Fairbanks. I am the NuScale

Licensing Supervisor for the Chapters 3, 8, and 14 that are being presented today, and we thank you for the opportunity to give you a summary of the Standard Design Approval Application and the review that has been performed.

And with that, I'm going to turn it over to Thomas Griffith who is online with us.

MR. GRIFFITH: Yes, thank you. Thank you, Elisa. I appreciate the opportunity here as NuScale to present Chapters 3, 8, and 14. I'd like to really start out by commending the NRC staff, as well as NuScale, for the amount of hours spent during the review in preparing for these chapters to be presented today, and I really look forward to the opportunity to present the material today. Thank you.

MR. SHAW: Good afternoon. My name is Peter Shaw. I'm a licensing engineer for NuScale Power. I've been there for three years. Prior to that, I've had 10 years of experience at the Vogtle 3 and 4 construction project. And we're here to present the chapters as stated before, 3, 8, 14, and including Part 8. Next slide, please.

Acknowledgment/disclaimer. This is based on DOE award. We are very thankful for this particular award and present here today the information on the NuScale Power Plant.

Next slide, please. We're, first, going to go over Chapter 3. Chapter 3 as a whole is going to have four presenters, and we're going to go over design of structures, systems, components, and equipment, and it excludes Sections 3.7, 3.8, and 3.9.2.

Next slide, please. A brief overview of what we're going to be covering today. Chapter 3 describes the methodologies for design of structures, systems, and components. The SDAA is a derivative of DCA design. This presentation will focus on high-level design methodology changes and also include the important audit questions and RAIs.

The SDAA structures reflect a six-module design. This has changed from the 12-module design of the DCA. This necessitates an update of the civil analysis, but the design basis is unchanged.

One of the other significant changes is the SDAA design adopted the 2017 ASME BPV code and the 2017 ASME OM code requirements.

Next slide, please. This is just a quick overview. This is a design of the SDA and the US460 reactor building and the modules within. There is a common overhead load-handling system that transports the modules. The reactor building walls protect all of the modules within. The bioshield is a radiation protection barrier. The spent fuel pool and the ultimate heat sink carry a common body of water that is used in safe shutdown.

Next slide, please. And so, this is an overview of all the sections that we're going to be going over. There's quite a few sections here. Of note again, 3.8 and 3.7 that pertain to seismic analysis and design are excluded from this presentation, as well as 3.9.2, which is mechanical equipment analysis, and also, 3A and 3B appendices are excluded.

Next slide, please. So, to start with, with Section 3.1, "Conformance with U.S. Nuclear Regulatory Commission General Design Criteria," the differences from the DCA in this particular section are generally unchanged. There are a couple of exceptions of note.

The first is that the GDC 27 compliance was simplified for the SDA with emergency core cooling systems supplemental boron. This will be further discussed in the presentations for Chapters 4, 6, and 15.

GDC 32 is a change to the lower RPV to a stainless steel material. So, no material surveillance is required. An exemption 6 requests this. This will be further discussed in Chapter 5 when it's presented.

And then, for GDC 41 and PDC 41, these have been updated with the passive autocatalytic recombiners to maintain an inert atmosphere. This will be further discussed in Chapter 6 and there are similar follow-on updates for 42 and 43. There were no audit questions and no RAI questions.

Next slide, please. Section 3.2 is the Classification of Structures, Systems, and Components. The differences from the DCA: DCA Table 3.2-1 was split to align with the guidance for Regulatory Guides 1.26 and 2.19. SDAA Table 3.2-1 lists the seismic classification of the buildings. Meanwhile, SDAA Table 3.2-2 lists the seismic Category I pressure retaining mechanical systems and components.

The specific component classifications for components that are not in these tables were moved to the system chapters.

COL Item 3.2-1 was removed, as no applicants are expected to add components to these tables in a COL application. There were no audit questions and no RAI questions.

I would, then, like to turn this over to Andrea Mota.

MS. MOTA: Hi. I'm Andrea Mota, licensing engineer with NuScale. I'll be presenting Sections 3.3 through 3.5. I've been with NuScale for three years, and prior to NuScale, I was a civil and mechanical engineer at the Hanford site.

3.1, "Wind and Tornado Loadings." The major difference from the DCA is that the SDAA uses more conservative wind loads than required by regulatory guidance to consolidate our analysis.

There were eight audit questions resolved. As a result of the audit, we added clarifications of the FSAR to specify which codes conform wind speeds and importance factors.

There were no RAI questions. Next slide.

CHAIR KIRCHNER: Andrea, before you go on, it's unusual that an applicant comes and presents something that's much more conservative than the regulatory guidance. So, could you just for the public record explain why you did that? Is it to allow for more site options? Or not to beat the witness, but could you explain the purpose, Andrea?

MS. MOTA: The most conservative loads from both ASCE 7-05 and ASCE 7-16 consolidate our analysis.

CHAIR KIRCHNER: Thank you.

DR. BLEY: This is Dennis Bley. To consolidate your analysis, to make it consistent everywhere, is that what you're saying? I mean, what do you mean by consolidating the analysis?

MS. MOTA: So, we can perform one analysis rather than multiple.

DR. BLEY: Okay. And then it didn't have to do with what Walt suggested, to be able to use this at more sites?

MS. MOTA: That is a positive result of using more conservative factors.

DR. BLEY: Okay.

MS. MOTA: Next slide. 3.4, "Water Level (Flood) Design." The major differences from the DCA are that the SDAA evaluates flooding zones instead of rooms.

And COL items were removed for clarification and to reflect the removal of the personnel access tunnel from the reactor building to the control building. There were 17 audit questions that were resolved.

There was one RAI question that was resolved. And as a result of the RAI, we updated the considerations and assumptions used in the flooding analyses. We added tables for flooding sources and flooding zones, and COL Item 3.4-2 was updated to clarify that the onsite flooding program will be consistent with Section 3.4.1 methodology and flood levels.

Next slide.

MEMBER HALNON: Before you go on, this is Greg. You said you know that mitigation of flooding is going to be from a combination of watertight doors, water-resistant doors, elevating equipment. Can you give me a feel for the magnitude of how many watertight doors versus water-resistance, which I'm not sure we'll hear about, too?

But, you know, I've got a lot of experience with watertight doors and it requires a lot of operator action in order to close these doors at time or even some large equipment sometimes, depending on the type of door. Could you give me just a feel for the magnitude of what you're talking about here with regard to those types of doors?

MS. MOTA: Well, we have COL items in this section to prompt the COL applicant to determine the final methodologies for mitigating flood levels and, also, to create the onsite flooding program to define those operator actions in regards to those doors.

MEMBER HALNON: Okay. When you go from rooms to zones, typically, the doors get bigger because you're not closing off a room; you're closing off an area. Do you envision having large watertight doors that have to be closed or is that all down the road a ways, depending on the configuration of the site, and whatnot?

MS. MOTA: I'm going to ask that our engineer David Benson on the line answer that question.

MR. BENSON: Good afternoon. This is David Benson. I'm a structural engineer with NuScale Power.

The intention is to define flood levels based on these zones for an applicant, and based on the SSC, if there is an SSC in that location, they would determine how they would want to mitigate those floods. If they chose to pursue doors, if they chose to pursue some other form of flood mitigation, it's up to the COLA applicant at that point.

MEMBER HALNON: Okay. Yes, I kind of get that, except you can help me with the actual configuration that you're thinking about.

If you have a safety-related pump and it needs to be elevated above, you're affecting a lot of the flow characteristics of the pump and the system. Is that beyond the level of detail of what we're talking about right now? Because that certainly could potentially change the design.

MR. BENSON: That's correct. And part of the COLA application would be that, if they change any of the assumptions or inputs, the analysis would be reperformed for flood levels.

MEMBER HALNON: Okay. Thanks.

CHAIR KIRCHNER: If I could just follow on, Andrea? Rooms versus zones, I kind of understand that, but would there be instances where you would really want the ability to isolate a room within a zone? I'm thinking of your battery, your EDAS system, in particular, and how you configure that. Is that enacted or are you treating that separately? It seems to me, if it's a safety-related system, as the example that Greg raised, that would be something you wouldn't want to leave to the COLA applicant. You would want to find that functionally and protect it accordingly.

Do you see where I'm going? We're just trying to understand the zones versus rooms when you have safety-related, or even if it's not classified as safety-related, but something, you know, where high reliability is important. It may need special treatment --

MR. BROWN: Walt, can I amplify your comment?

CHAIR KIRCHNER: Go ahead.

MR. BROWN: I'm sorry, I thought you were finished. I'm sorry.

CHAIR KIRCHNER: I am, Charlie. Go ahead.

MR. BROWN: Okay. This is Charlie. Yes, I was going to ask the question, when you talk about zones, it seems to me rooms, like the main control room, instrumentation room, a few places that you want to keep as isolated as you can, you don't want to be encompassed in some larger engulfment of water. Zones sounds all-encompassing and could result in some more critical rooms. And I'm just trying to amplify Walt's comment a little bit on the rooms versus zones.

MS. MOTA: I'm going to ask that David Benson answer this question.

MR. BENSON: Good afternoon again. The definition of zones is trying to, I guess, consolidate the analysis into specific regions. There are no rooms in specific in those areas that we would want to keep, that we would want to define the protection. It would be up to the COLA applicant to define that.

MEMBER HALNON: This is Greg. It just seems contrary to the standard design to leave some of these critical configurations up to the COLA applicant. It seems like, when they're redesigning the plant, potentially, based on flood zone, we would assume that these things are supposed to be standardized. So, your room looks like another room at a different site. Am I off-base there or is there just a difference that you're going to accept? If so, an nth-of-a-kind won't really be what we would classically think as an nth-of-a-kind off the shelf.

MR. FISCHER: Hello. This is Kevin Fischer. I am a test engineer and work on the technical aspects of the equipment qualification program here with NuScale. I'm the technical SME for Chapter 3.11. And so, I'll take an attempt to answer that.

We don't go down to the room level on that sense. We designate those zones as mild by design. So, we place all of our safety-related equipment and anything that's important to safety in those general areas to protect them from any post-accident conditions.

So, going between rooms and zones is a little bit nebulous. In the area, in general, in that zone, we define it as mild and protect that as mild, so that it's protected inherently from any post-accident conditions, as well as any anticipated operational offsets.

And so, there are a handful of rooms in those zones, but, by design, we protect those zones to remain mild post-accident, so that any of that equipment, if that's important to safety, remains protected. And how the applicant chooses to do that will be, ultimately, up to them, but that's why we design and place our equipment in those areas.

DR. BLEY: This is Dennis Bley. I'm kind of with the other people. I'm trying to see the benefit you're looking for here and why you decided to do this, and why you thought it a wise idea to put more of the onus on detection on the COL applicant. I mean, that's how that feels. Or don't you think it really needs protection? Perhaps that's going on.

CHAIR KIRCHNER: I think what we're -- if I can amplify on Dennis' point and Charlie's as well, I'll just give you a hypothetical example. So, you've got a PRA for your design. Why would you leave things up to the COLA applicant to change something in the way you treat flooding or fires, or any of these zones, such that it may alter performance of your plant with regard to safety? I think that's what we're struggling with here.

MR. FISCHER: So, another item of thought here is that we're not just protecting against flooding for all that equipment, either. There are other mitigation factors for other items that drive those rooms to harsh which would put the equipment at jeopardy post-accident, which we're protecting against as well for those areas. So, it isn't only flooding that's being mitigated in those areas, but also all the other parameters as well post-accident.

CHAIR KIRCHNER: But that's precisely my point or our points -- that why would you leave it to the COLA applicant to do something that might change the performance or characteristics of your plant with regard to safety? I can see accommodating other things that are site-specific, but it is your design; it's your plant. I'm just struggling with the comment that you're leaving this to the COLA applicant.

Okay. I know we need to go on.

DR. BLEY: This is Dennis again, just on this one. We've seen, you know, if you were around back in the '60s and early '70s, every plant by each of the vendors ended up being very different, sometimes even two units at the same plant but from the same vendor. We had a bunch of pretty smart guys who decided how they wanted their plants to be. So, we had nothing really approaching standardization. But when Part 52 came out, the hope was we would get there and we haven't.

My memory is, when we first talked with you guys quite a few years ago, you were going to make one design. Everybody would buy it as-is and that was the only way to go forward.

Then, you made a power uprate. Now you're making this change. All of a sudden, we're looking like things did in the past. And Greg mentioned the nth-of-a-kind. It seems like that's going to become ephemeral once again. At least that's what I'm worried about a little bit.

MEMBER DIMITRIJEVIC: Walt?

CHAIR KIRCHNER: Go ahead, Vesna.

MEMBER DIMITRIJEVIC: So, just because you mentioned PRA, I just want to add that the PRA, generally, it doesn't expect the internal flood or internal fires to be completed in this stage because the equipment, piping, the cables, all of these things will be laid out later, and then, you know, the position of the important equipment and also sources of, like, an internal flood will be better known. So, it is not unusual to see that these things are left to be done when the plant is actually built and there is a layout, including piping and, in the prior cases, cables.

CHAIR KIRCHNER: But to Dennis' point and mine, if it's important to safety, why allow a COLA applicant to change the design? That would require, then, redoing the PRA analyses for flooding, fire, and other threats.

MEMBER DIMITRIJEVIC: But the flooding theory would not be completed yet in that case because you don't have, like, the sources of the flooding, like pipes which can break. They're not laid out yet.

And also, equipment here, this is a very specific case because all their major equipment is, you know, passive and in the containment.

The thing is, if that's another case, that the equipment is important for safety may not have an exact position and a vault to protect them, and up to which level do you have to protect them? So, that's what I just want to say.

So, when they do the fire and the flood, at this stage it is very general, that these zones are designated and things like that, but they cannot be specific yet. So, that's just my input, you know, to help you in your thinking, that a lot of things happen when the equipment is actually laid out.

CHAIR KIRCHNER: Agreed, Vesna.

Okay, I think we should go on. I think we've made our point.

MR. BROWN: Walt, can I make one other observation?

CHAIR KIRCHNER: Go ahead, Charlie.

MR. BROWN: Somebody mentioned -- I think it was Dennis -- the purpose of an SDAA is a cookie-cutter design. And at least my experience in the Naval Nuclear Program, if it wasn't for total cookie cutters, we wouldn't have a fleet of submarines and aircraft carriers the way we have. We just don't change it from plant to plant, based on little nuances like that, based on the reactor plant, its controls, its arrangements.

And the idea here is to make sure we can have plants that are easily agreed-upon and built and put in service. The more COL stuff that affects it, the harder that gets, because, then, NRC has to get involved somewhere along the line to assure that that's okay, whatever the COL has decided doesn't do something that's out of the range of our considerations.

I'm just throwing that out. I just think that's an interesting thing that we need to think about or you all need to think about -- excuse me -- as a Committee.

I'll shut up now.

MR. SHAW: Before we move on, I just want to add one more thing.

CHAIR KIRCHNER: Okay, Peter, yes.

MR. SHAW: So, part of the consideration here is that we also want to limit what the risk is for a COL applicant to impact the safety basis. So, one of the important things that we've done, and part of the zone identification, as we've spoken to earlier, is that the critical rooms and the critical components are identified, per the SDAA design. Right? What we leave up to the COL applicant will not have a safety impact basis when that application goes through. And that's one of the reasons why that responsibility is deemed adequate for a COL applicant to take on, because it will not change the safety basis and the safety statements that are completed with the SDAA.

MS. MOTA: Next slide, please. Section 3.5, "Missile Protection." The major difference from the DCA is that there are no essential equipment and no turbine missile evaluation for the control building.

There are 12 audit questions that are resolved. As a result, we added FSAR clarification regarding the control building and no essential equipment. Therefore, no turbine missile evaluation required for the control building.

There are added inputs used in the turbine analysis and a table for turbine missile parameters. We added a table identifying essential structures, systems, and components and their locations. And we added missile parameters for RWA-IIa structures.

There were no RAI questions in this section.

Next slide, please. Now, I will turn the presentation over to Daniel Diefendorf.

MR. DIEFENDORF: Hello. My name is Daniel Diefendorf. I have 12 years of nuclear mechanical engineering experience. I've been at NuScale for the past 10 years and I'm the subject matter expert for the piping design and analysis. Prior to that, I had two years of experience performing pipe stress analysis in the petrochemical industry, and prior to that, two years of experience in the design, engineering, organization at San Onfre Nuclear

Generating Station.

I'll be presenting the next slide on Section 3.6, "Protection Against Dynamic Effects Associated with Postulated Rupture of Piping."

As far as differences from the DCA, our entire pipe rupture hazards analysis has been updated using the US460 design inputs.

Methodologies were largely the same, with the primary difference being that leak-before-break methodology was replaced with Branch Technical Position 3-4 B.1(ii) methodology. That's for containment penetration areas for the steam generator system, main steam and feedwater lines, and site containment.

There were three RAIs in this section, none of which resulted in technical changes to the SDA and two of which resulted in no changes at all.

The first RAI provided additional information related to removing LBB from the design, including providing stress analysis results for the affected lines.

The second provided information related to the leakage detection systems. The last provided additional information related to the break exclusion zone requirements, specifically, in the area between the containment isolation valves and the containment vessel.

For the audit, there were five question submitted, primarily dealing with clarifying the differences between the two designs for the high pressure hazards analysis, including providing sample stress analysis for the US460 design.

Only editorial changes were made as a result of the audits.

I will pass it back to Peter Shaw for the next --

MEMBER HALNON: Daniel, before you get finished, can you help me understand the decay heat removal system? You made a statement in there that it was manufactured from piping products, but it was not considered -- the piping system was considered a major component before it was excluded. Just help me understand that rationale.

MR. DIEFENDORF: Right. So, you're talking about the decay heat removal condenser --

MEMBER HALNON: Right.

MR. DIEFENDORF: -- and the application of BTP 3-4 B.1(ii) containment penetration area. For that, we apply that criteria to piping and we don't apply it to, say, the vessels or in this case the condenser.

MEMBER HALNON: Yes, I got that.

MR. DIEFENDORF: Right.

MEMBER HALNON: That's what the statement said. Why not? I didn't look at the 3-4. Is it within the bounds of what that's allowable? Or is that --

MR. DIEFENDORF: So, yes, that criteria is for piping. It's for piping which is designed to ASME piping rules. It uses conservative stress criteria for when you use the piping design rules, for example, and we apply that only to areas that are covered by the piping design specification.

MEMBER HALNON: Okay. So, you didn't postulate breaks in that because it fell in the condenser, because it fell within that criterion that you just talked about?

MR. DIEFENDORF: That's correct. So, the pipe break criterion BTP 3-4, it's applied to piping systems to prevent, to eliminate the postulation of ruptures in areas that are more likely to break, is the way it's put, which is the terminal end of piping systems, so that the condenser doesn't behave like a piping system traditionally. But the connection for the piping to the inlet of the condenser, that is within the scope.

MEMBER HALNON: Okay. Thanks.

DR. BLEY: Hey, it's Dennis again. Ron Ballinger, can I ask you a question? Did we review BTP 3-4? I don't remember.

The ideas they're talking about are very familiar, but where I'm hanging up is we're also going to see at some point a PRA that looks at events of very rare, 3 times 10 to the minus 5, minus 6, minus 7 kind of events. I don't know if this condition, B.1(ii), means they are that rare or not. And if they're not that rare, then they need to be in the PRA and not just dismissed out of hand, if you're going to do a PRA.

Can we say anything about the extent of conservatism in 3-4? I just don't know it.

MEMBER BALLINGER: I do remember the review, but you've got me on the details. I would have to go back and check. In fact, I have it. If we have a break, I'll go find out.

DR. BLEY: Okay. Then, for NuScale, I think some of us will probably want to look at that when it comes to thinking about what's in the PRA at some later point in time.

MEMBER MARTIN: I had a clarification

question. So, with the move from leak-before-break to BTP 3-4, leak-before-break requires the leak detection system. Has there been any change to the leak detection system in this move or is it still way it was approved originally?

MR. DIEFENDORF: This is Daniel Diefendorf. This was brought up in the RAI, as indicated on the slide. Essentially, the leakage detection system described in the DCA was relaxed because we were no longer using the LBB. In that RAI, we explain that the design of the leakage detection system has not changed and we still comply with Regulatory Guide 1.45 with regards to being able to detect degradation of the reactor coolant pressure boundary.

Just the sensitivity requirements have been relaxed because we are no longer utilizing a core break. But the design has not changed.

MEMBER MARTIN: Okay. Is it considered safety-related?

MR. DIEFENDORF: The leakage detection system? I would have to ask that question.

CHAIR KIRCHNER: I was going to ask it a little differently. There still would be a Tech Spec on leakage. So, could you just give us a feeling, Daniel, what the change in the leakage detection rate might be if it's, quote-unquote, "relaxed"? Is it like a gallon an hour? I'm trying to remember off the top of my head what it was for the DCA. I think it was .5 gallons per hour.

MR. DIEFENDORF: Okay, I am going to pass these questions related specifically to the leakage detection system to --

CHAIR KIRCHNER: But it would still show up in Tech Specs, and then, there it would be a question of --

MR. DIEFENDORF: Correct.

CHAIR KIRCHNER: -- what that rate is.

MR. DIEFENDORF: Right.

CHAIR KIRCHNER: I just don't remember the DCA rate.

MR. DIEFENDORF: So, I'll pass this to --

MR. GRIFFITH: This is Thomas Griffith, Licensing Manager. Yes, RCS operational leakage is in Tech Spec 345. And the limit for unidentified leakage is .5 gallons per minute. Still looking back at the DCA, I believe that remains unchanged, but it's .5 gallons per minute unidentified leakage. And obviously, there's a requirement for no pressure boundary leakage as well.

CHAIR KIRCHNER: Okay. I cut myself off. Excuse me, Tom. Just when we say something is relaxed, it begs the question, relaxed to what? It sounds like you're using the same tech spec for that particular parameter. Thank you.

MR. DIEFENDORF: I will now pass it back to Peter Shaw.

MR. SHAW: Once again, Peter Shaw. We're going over Section 3.9 now, which is 3.9.1. It is the "Special Topics for Mechanical Components."

For these, there were changes to the transients for the --

MR. BURKHART: Can I interrupt you for just one second? I'm sorry. This is Larry Burkhart from the staff.

I believe the court reporter had her hand up. I just want to make sure we're addressing concerns. Allegra?

COURT REPORTER: May I please ask people to identify themselves when speaking inasmuch as their camera is off?

MR. BURKHART: Thank you.

MR. SHAW: This is Peter Shaw speaking once again. So, for 3.9.1, for "Special Topics for Mechanical Components," there were changes to the transients from the DCA.

There were transients added, one for the density wave oscillations, for loss of feedwater, initial test program, secondary leakages tests, and control rod drive system piping failure.

Transients were removed for hydrogen detonation and hydrogen detonation with deflagration-to-detonation transition.

And there were changes with the cycle changes for the containment flooding and drain, power ascent from hot shutdown, and turbine trip without bypass.

There were three audit questions resolved. There were no RAI questions.

Next slide, please. As stated before, Section 3.9.2, "Dynamic Testing" --

MEMBER BALLINGER: This is Ron. Could you back up one slide? I'm going through BTP 3-4 at the same time. With regard to the deflagration-to-detonation transition, did that require any change in design and configuration?

MR. SHAW: That did. That is the inclusion of the passive autocatalytic recombiners that are now in the SDA, which is why that transient was removed. And that will be discussed more in

Chapter 6.

MEMBER BALLINGER: I got it. Okay. Thank you.

MR. SHAW: Yes. Next slide. Section 3.9.2, "Dynamic Testing Analysis." This is going to be covered at a later meeting.

Next slide, please. Section 3.9.3, "ASME Code Class 1, 2, 3 and Non-Code Components, Supports, and Core Support Structures." The most significant difference was the update to the 2017 edition of the ASME BPVC.

Audit results. There were 12 audit questions that were resolved. There was one RAI and that response has been submitted and completed. This provided additional information for the RPV flange bolted connections. There were no design changes associated with this RAI.

Next slide, please. 3.9.4, "Control Rod Drive System." Differences from the DCA, the most significant one identified was the change from a welded connection to a bolted connection.

There were seven audit questions that were resolved in this section. For the RAIs, there were two RAI questions.

The first, 3.9.4-8, provided additional

information for the steam generator set screws. As a result of this RAI, there were additional augmented inspections that were added that visually examined the set screws to verify that they don't fall out during operation.

The next RAI, 3.9.4-9, this provided additional information for the control rod drive mechanism housings and their associated connections. No changes to the bolted connection. There were no changes to the SDAA.

DR. BLEY: It's Dennis Bley again. Can you just tell us a little about why you switched from a welded to a bolted connection on the CRDMs?

MR. SHAW: It was a manufacturing change specific to the modular construction, including a bolted connection was seen as optimal for our vendors.

DR. BLEY: Okay. Thank you.

MR. SHAW: Next slide, please.

CHAIR KIRCHNER: While you're on that, Peter -- this is Walt Kirchner -- when you go from welded to bolted, does that incur additional inspection requirements and such, because we're dealing with a borated system?

MR. SHAW: So, that, actually, is covered in a later section, 3.1.3, where we did address that type of concern from the NRC. It is related to this and we can discuss that more in that particular section.

CHAIR KIRCHNER: Good. Thank you. Just hold it for then.

MR. SHAW: Yes. Next slide, please. Section 3.9.5, for the "Reactor Vessel Internals." Differences from the DCA. The upper steam generator support. This was reclassified from an internal structure to the Class 1 support.

There were no audit questions or RAI questions for this section.

Next slide, please. And then, Section 3.9.6, for the "Functional Design Qualification and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints."

Once again, this was a Code update, updated the ASME OM Code from 2012 to 2017. Updated ASME QME-1-2017. And updated requirements from a regulation change for 10 CFR 50.55a for new reactors.

There were 16 audit questions and no RAIs.

MEMBER HALNON: Peter, this is Greg Halnon. Way back when -- and I'm talking a decade or more -- when NuScale first started, they said that not all 12 or all 6 modules would be built and operating at the same time. Is that still the case?

MR. SHAW: Are you talking about during construction? Or are you talking about during --

MEMBER HALNON: Yes, we were talking about having one module built, getting that in operation to help finance the other modules, and whatever the case may be. But, nevertheless, is it possible there would be less than six modules built?

MR. SHAW: I can't really speculate on that, just because some of that information is not available. It would be up to the customer. I can say that, by and large, it would be that all -- because of ITAAC and because of the necessity for how you onboard a plant, it's going to be all operating at the same time.

MEMBER HALNON: I'm setting you up. I should have asked the question first. The frequencies, IST frequencies, and whatnot, were set as if all six modules were operating. What if they're not? Will that analysis you do with the test frequencies still be done?

MR. SHAW: But that's largely the responsibility of the COL applicant and the customer for whenever they get into the in-service tests. The frequency and outages, and what have you, that's all going to be determined by the applicant. There's only so much --

MEMBER HALNON: But throughout this thing, all of the frequencies for the HOVs, ECCS valves were all grouped plantwide to optimize the testing. If someone only puts three in, then that whole analysis has to be redone relative to the amount of data that will be coming in for the frequencies to be there. So, it seems like a pretty significant change. Is that real clear to an applicant, that that's going to be potentially a big change in the amount of testing you're going to have to do in that analysis of the frequencies?

MR. SHAW: I would like Eric Lantz to answer on the line to provide some additional context.

MR. LANTZ: This is Eric Lantz, licensing engineer at NuScale. Yes, with fewer modules, you are going to experience higher inspections of the valves per module. And in the SDA, we do specify, in fact, the IC program. The valve grouping is as required by mandatory Appendices 1, 2, and 4. So, yes, if an applicant has fewer modules, then they're going to end up with higher valve inspections per module, based on those groupings.

MEMBER HALNON: Okay, and that's real

clear. I wasn't clear when I went through it, and I can tell you I don't know it as well as you do. So, that's real clear that those testing frequencies for the Code are going to be potentially much higher, especially if you've only got one module, which would change a lot of the dynamics of personnel, maintenance personnel, programs, engineering programs, and other things. So, if that's clear, that's fine.

CHAIR KIRCHNER: Dennis, do you have your hand still up?

DR. BLEY: I do. A related question: I'm sure I know the answer, but just to confirm, if I come in and say, "I want to buy one module and I'll be going up to three, but I'm never going to go to 06," my shared systems will be the same as that that's been analyzed and built for a plant that's going to have six modules, correct? I won't be able to make changes to the shared systems because right now I don't think I'm going to use all six.

MR. SHAW: I think that would be up to a COL applicant at the time to --

DR. BLEY: Well, I can buy anything I want any way I want it? Okay. Thank you. That surprised me. And it also makes me worry more about standardization.

MR. SHAW: Well, that's not the statement. The statement is that the standard design has certain expectations for a six-module operation. If a COL applicant went to operate either in a different configuration or less than six modules, that would need to be addressed in their application as a change from the standard site.

DR. BLEY: Clearly, yes.

MEMBER BIER: Hi. This is Vicki Bier. I wanted to follow up on Dennis' question and some of the earlier discussion.

I think part of what ended up with such lack of standardization in the current fleet was kind of an incentive issue that, you know, as Dennis mentioned, yes, each site or each utility could put in their own request for changes that they wanted, but it was also kind of in the interest, especially of the AEs who were making money doing those design changes.

And I would have thought that part of the rationale for going to greater standardization in nth-of-a-kind was an entirely different business model. And that if the business model is, you know, we make our money by selling a larger number of units, and those units have to be the same, and if somebody wants something different, unless it's a really big order, or whatever, we're not going to change our manufacturing processes and our design to meet that.

And, you know, this is really more of a business question than a safety question. But do you folks have kind of a business strategy about standardization versus customization?

MR. SHAW: I would say that a business strategy for the purposes of conversation about the standard design application being pursued right now isn't necessarily subject to this presentation.

The SDA is a six-module plant. It will be approved as a six-module plant and there are business plans for how you onboard it and how you test, and eventually, reach commercial production of power.

Again, for purposes of standardization, COL applicants can't seek departures from that if there are business cases that are seen as more optimal for them. But for the purposes of this presentation, this is a six-pack design, and the six-module design is approved.

MEMBER BIER: Thank you.

MEMBER BALLINGER: This is Ron Ballinger again. There's a NUREG that's coming out, 1.220, which endorses the OM2 Code, which allows that to be used in lieu of 55a. Is that something that's on your radar? The QME-1 is still in there, but there's a newer, 2024 version.

MR. SHAW: Not for this application. We are just seeking 2017. I'm not familiar with what the differences are. If you want additional clarification --

MEMBER BALLINGER: The (audio interference) code is explicitly designed to allow for advanced reactors, non-light water reactors.

MR. SHAW: Right.

CHAIR KIRCHNER: I feel like I should make a statement here. We are examining safety-related issues. Where standardization comes in and can be a factor in the safety and performance of the plants is that customization in the balance of plant often is an initiating event, and a subsequent transient, in fact, may have safety implications.

And I just remember back to my time as a consultant to the TMI Commission, that one of the recommendations was to go in the direction of standardization, such that incidents and initiating events could be for a standardized design shared amongst many utilities, or whoever the COL applicant is. And that is beneficial fleetwide in terms of reducing incidents and transients that challenge safety systems.

So, the spirit of some of this questioning, at least where I was starting earlier with Andrea's presentation about floods versus rooms, is not to have a COLA applicant go change, for example, the waterproof integrity of your battery systems. And so, that's the spirit of our questions.

We're not testing your business case, but I think at some subsequent time there are questions about the actual installation and deployment of the modules. For example, if you bring on all six at once or do you bring them on sequentially? And how you do that does have some safety implications.

But, again, our focus here is on safety. And one of the takeaways from TMI was that the industry would benefit from standardization. That led to the development of 10 CFR 52, and here you are, under 52, making an SDA application. So, that's the interest of this Committee.

I just thought I would make that statement for the record.

MR. SHAW: Right. And that's one of the focuses of the NuScale modular design is that your safety-related components are as limited as possible to the modules. And for the purposes of the rest of the plant-shared systems, those are made as limited as possible for it, but they can be isolated, models can be isolated during operation. Certainly when we're onboarding it will be a sequential process where you will not have all six turning on at the same time. You do one, two, three as they arrive on site. So that's the intention behind a lot of this is that the COL applicant can finish a lot of his designs for some of these ancillary-type components without impacting the safety basis for it, and that's been the intention of the design.

CHAIR KIRCHNER: Okay, but just note that they could impact the performance and safety of your system if they deviate in substantial ways.

MR. SHAW: Yes. Yes. And there's evaluation processes --

CHAIR KIRCHNER: So I think what you're feeling from us is the push to have you define what's important to safety and get that configuration standardized. I can think right off the top of my head several systems that are outside your module but could have an impact, like CVCS and how that's implemented. So the expectation, at least the first order is, at part, would be part of the standard design. So I think you -- I think you get our point.

MR. SHAW: Understood. Yes.

CHAIR KIRCHNER: Okay. Thank you. Go on.

MR. SHAW: That concludes 3.9.6. I want to pass it over to Gene Eckholt.

MR. ECKHOLT: Good afternoon. My name is Gene Eckholt, licensing engineer with NuScale Power. I've been with them almost three years. I've got 45 years' experience in the industry. Started at Consumers Power at Palisades, Midland and spent the rest of my career at NSP, Xcel Energy, mainly supporting Prairie Island but also Monticello to a limited extent. Also obtained a senior reactor operating license at Prairie Island as well.

I'll be presenting Sections 3.10, 3.11, 3.12, 3.13, and Appendix 3C. We'll start with Section 3.10, seismic and dynamic qualifications of mechanical and electrical equipment. There weren't any real significant changes between DCA and SDA. The adopted newer versions of regulatory guidance and industry standards, there were 3 COL items related to administration of the qualification program that were removed. COL application will incorporate the seismic and dynamic qualification program as described in the SDA design by reference. There's no need for separate COL items. The information that would be needed is contained in the SCA.

There were -- there was only one audit question, it was resolved, and there were no RAI questions.

Next slide.

Section 3.11 describes the environmental qualification of mechanical and electrical equipment. The most significant change between DCA and SDAA is the NuScale environmental qualified equipment was updated to reflect the U.S. post-60 design. That's a significant portion of that section, and that was most significantly impacted. There was 11 audit questions resolved. Three items here, noted, that resulted from those audits. We created new equipment qualification zones for the control building and for the harsh environments that only contain electronic equipment. We clarified the application of some of the industry standards, and we evaluated design-basis accident dose contributions for the limiting collapsed liquid level event. And there were no RAI questions.

Next slide.

Appendix 3C is related to 3.11. It describes a methodology for environmental qualification of electrical and mechanical equipment. The significant differences from the DCA were the tables. The back of Appendix 3C were updated to reflect environmental qualification zones, harsh/mild environment zones, post-accident operating times, normal operating conditions, design-basis event environment conditions, and limiting design basis accident environmental qualification radiation dose.

There was one audit question that was resolved, and there were no RAI questions.

Next slide.

MEMBER ROBERTS: Hey, this is Tom Roberts. If you go back to the previous slide, what's the difference between those last two bullets? It was limiting -- here, design-basis event of environment conditions and then limiting design-basis accident environmental qualification radiation dose. How do those differ?

MR. ECKHOLT: I'm going to ask Kevin Fischer from NuScale Engineering to respond to that.

MR. FISCHER: Hi. This is Kevin Fischer. When I introduced myself earlier, I did fail to bring up my background. I did four years here at NuScale in DQ and testing and then before that I was at Bechtel at the Hanford Site for six years in nuclear safety and radiological engineering, as well as a start-up for the last two years. And so on the note with design basis event environmental conditions, that has to do with just throughout the facility the changes in the -- all the parameters that had to do post-accident for the limiting design basis environmental qualification dose rates. Those are specifically for areas of concern in the highest experienced dose rate in that area. And so, in certain cases, we only had a single radiological dose that was provided. And we expanded that out to provide additional dose rates over time to reduce the eventual dose rate as those conditions changed.

MEMBER ROBERTS: Okay, thank you. So neither of those assumes a core damaging accident? Is that correct? Because if you look at the history of your -- DCA had kind of a novel approach where the environmental conditions for design basis event didn't include a core damage assumption and kind of relegated that assessment to Chapter 19. But I was just trying to understand that last bullet is not intending to cover core damage scenarios. It's just different aspects of the design basis, the environment, in different places. And that's where I'm finished with my question. Thank you.

MR. FISCHER: That's correct.

MR. ECKHOLT: Next slide. Section 3.12 discusses the design of ASME Class 1, 2, and 3 piping systems, piping components, and associated supports. The most noteworthy difference of DCA and SDAA was we removed the reference to NUREG 1367, functional capability of piping systems. There were 12 audit questions resolved, and one of those clarified how the functional capability guidance of that NUREG is addressed by NuScale. There were no RAI questions.

Next slide.

CHAIR KIRCHNER: This is Walt Kirchner. Could you just elaborate what the impact, if any, of removing the reference to 13.67 means? In terms of approaches or any substantive change in -- to any of the safety-related --

(Simultaneous speaking.)

MR. DIEFENDORF: This is Daniel Diefendorf. It didn't have any impact on the design of any piping system. The reason we removed the reference and instead explained how we addressed the NUREG 13.67 concerns, separately, in that audit response. Specifically, it only provides guidance -- or the very first criteria in there that is that it's only for reversing dynamic loads. So right off the bat, essentially you're excluded from having any functional capability criteria for loading combinations that include a non-reversing dynamic load. We weren't the first applicant to run into that issue.

So instead of referencing NUREG 13.67, we went through the criteria and showed how they were addressed in other ways already either by -- they had been addressed by the ASME code and since the original report in 1992 or they were addressed by separate regulatory guides that we conform to or -- essentially that, yes. Or by our design inherently.

CHAIR KIRCHNER: Okay. That's what I thought. I thought you had all backed down the ASME codes as appropriate. Thank you.

MR. ECKHOLT: Okay, next slide. Section 3.13 discusses Class 1, 2 and 3, threaded fasteners. The most noteworthy change is containment pressure vessel retaining threaded fasteners are now examined in accordance with the ASME Section 11, subsection IWE. There were three audit questions resolved. And there was one RAI that resulted in the addition of augmented visual inspection or examination requirements for ASME Class 1 threaded inserts and seal welds.

CHAIR KIRCHNER: Gene, would you elaborate and just share with us what that impacts? It's mainly containment vessel, right? What about the RPV?

MR. ECKHOLT: I'll ask Pete Shaw to speak to that. This is your question from earlier about the --

CHAIR KIRCHNER: Yes.

MR. SHAW: This is Peter Shaw speaking. So for the purposes of the threaded inserts on this account, if the insert is inside of a carbon steel, stainless steel laminate construction, the threaded insert, itself, is stainless steel, and then there's a seal weld applied around it to maintain continuity of the corrosion barrier.

What was identified during the RAI and the questions asked that, you know, what if there is a corrosion of that seal weld, if for some reason there was a degradation. There are certain access ways and man-ways during operations that are regularly opened for inspection and access. And those are being used as representative of the condition of those seal welds. if there is a degradation noted in those particular welds, there is then an expansion criteria that's applied to look at other threaded inserts in other portions of the reactive vessel. Does that answer your question?

CHAIR KIRCHNER: Yes. Thank you.

MR. ECKHOLT: That concludes NuScale's presentation for Chapter 3.

CHAIR KIRCHNER: Greg, do you have any further questions?

MEMBER HALNON: No. No further questions.

CHAIR KIRCHNER: Members? Vesna, Vicki, have you any further questions on Chapter 3?

MEMBER DIMITRIJEVIC: No.

MEMBER BIER: No, I don't.

CHAIR KIRCHNER: Okay, and also I extend that to our consultants. Dennis?

DR. BLEY: No, thank you.

CHAIR KIRCHNER: All right. Well, thank you very much. We'll turn to the staff now, right? Yes, so, there will be, for those online, a pause here, where you're going to change out our NuScale presenters with our NRR staff. Thank you.

(Whereupon, the above-entitled matter went off the record at 2:14 p.m. and resumed at 2:17 p.m.)

CHAIR KIRCHNER: Whenever you're ready,

go ahead.

MR. CHOWDHURY: Good afternoon. My name is Prosanta Chowdhury. I am the NRR --

CHAIR KIRCHNER: Hold that closer, please.

MR. CHOWDHURY: NRR project manager. I have been with NRC for 19 years and 7 months, and out of those, I've been a project manager for 16 years.

This will be the NRC staff's presentation on Chapter 3, Sections -- subsections 3.7, 3.8, and 3.9.2 of the NuScale SDAA, standard design approval application, that the staff has reviewed.

So I'll go over the slides, and if there are technical questions, then staff, some staff are present in this room and some are online.

As for my educational background, I have a master's degree in nuclear engineering and a master's degree in electrical engineering. I also worked for the State of Louisiana for 18 years in the radiation protection area dealing with (audio interference).

So with that, if we can go to the next slide, please.

So this slide shows the staff who actually performed the review, and I have here only four of them, but others have presented to the audience and online. So for the record I'll read the names, please. So Michael Breach, George Wang, Gordon Curran, John Honcharik, Kaihwa (Robert) Hsu, Chakrapani Basavaraju, Nicholas Hansing, Raul Hernandez, Cory Parker, Thomas Scarbrough, Edward Stutzcage, Jorge Cintron-Rivera, and Sheila Ray.

Next slide, please.

I'm the project manager, as I mentioned already, and Getachew Tesfaye is also present. He's the lead project manager for this project.

Next slide, please.

So this is an overview of the staff's view of Chapter 3, NuScale SDAA Chapter 3, except Sections 3.7, 3.8, and 3.92. From this point forward I will not say except 3.7, 3.8, and 3.9.2 because I've already established that. That part the staff already reviewed.

So NuScale submitted revision 1 of the FSAR Chapter 3 on October 31st, 2023. NuScale performed a regulatory audit as part of the review of Chapter 3 from March 2023 to December 2023 when you closed the audit.

Questions raised during the audit were resolved within the audit. Seven RAIs were issued.

Staff completed the review of Chapter 3 and issued an advanced safety evaluation to support the ACRS Subcommittee.

Next slide, please.

Staff evaluated the following sections. I don't see 10, 11, 12, 13 -- okay, they're coming. Yes.

So as part of 3.11, Appendix 3C was also reviewed. So these are the sections NuScale already went through. They're in exact same sequence, so I'm not going to read those.

Next slide, please.

So Section --

Previous slide. Reverse one. Yes.

Section 3.1 is conformance with NRC GDC, General Design Criteria, and these are discussed in our sections of the safety evaluation.

Next slide, please.

3.2, the classification of structures, systems, and components. There are no significant differences between the NuScale DCA, FSAR, and SDAA FSAR, and NuScale provided SSC seismic classification of Category I, II, and III and there are some tables, 3.2-1 and 3.2-2, consistent with regulations and guidance, and the SDAA's safety evaluation conclusion is the same as the Design Certification Application SE conclusion.

Next slide, please.

Section 3.3, wind and tornado loading. Significant differences are highlighted here. High wind speed, 190 miles per hour, and maximum tornado wind speed, 270 miles per hour. Using our American Society of Civil Engineering/Structural Engineering Institute 7-16 to establish the wind load pressure for RW-IIa structures. NuScale provided adequate justification for applying the wind load pressure on the RW-IIa structures by using ASCE/SEI 7-16. The SDAA conclusion is the same as the DCA conclusion.

Next slide. Section 3.4.1, the technical staff is online if there are any questions for this specific section. Significant differences listed here, flood analysis methodology defined bounding flood levels for building zones. Individual rooms not discussed, such as battery rooms or instrument rooms. Maximum SDA of flood heights are significantly greater than DCA, and location of SSC subject to flood protection not identified.

However, NuScale provided flood analysis results table of zone, limiting flood source, and maximum flood height. There are three COL items, 3.5-1, 3.5-2, 3.5-3, confirm the final location and mitigation of SSC subject to flood. So that will be the responsibility of the COL applicant.

The SDAA safety evaluation conclusion is the same as the DCA with additional COL applicant to further evaluate the SSC protection from flood levels.

MEMBER HALNON: This is Greg. Can you elaborate, what was the DCA conclusion? If you can't -- if you don't see the data on the specific rooms like battery rooms, for instance, and you don't know the final location of the mitigation equipment. How can we make the same conclusion that it's okay?

MR. CHOWDHURY: So thank you for the question.

Gordon Curran, are you online?

MR. CURRAN: Yes, I am. This is Gordon Curran from NRR. I'm from the Containment Plant System Branch. I've been at the NRC for 16 years and in the industry for 24 years.

The same conclusion in the DCA is with the conditions of the COL applicant because as you have heard from NuScale, the COL applicant will define later where the components are listed. So that's why I indicated here with the addition of the

COL applicant's scope.

MEMBER HALNON: Okay. I think it's easy to say that it's going to be okay because they're going to figure it out later. I guess it goes back to our earlier discussion. The level of standardization is in its (audio interference) platform and safety case for the whole plant. It sounds like this is a big different, I mean this could be a potential effect, not just in flood levels. I mean, you can make the flood levels okay, the full protection okay, but you could be affecting another piece of design. How are you connecting us those dots to make sure that they're not protecting the significant equipment at the expense of some other conclusion that you're making somewhere else?

MR. CURRAN: Yes, this is Gordon Curran. We tried numerous times to get the information from NuScale, but NuScale decided that their design is to push the details off to the COL applicant.

One thing that I had noted in this slide that was of particular interest is the significant difference of the flood heights in the DCA as opposed to the SCA. The DCA itself showed the rooms, and it had it listed out in a table, the rooms with batteries and there was a flood height of -- I think it was around 24 inches for most rooms. However, for the NuScale, the SDA design, the flood heights in many of -- well, a lot of the rooms are anywhere from 4 feet to 15 feet, not inches. They are feet. So many of the rooms with lower elevations could be essentially submerged.

Now there's no discussion as to what components are in these rooms and that was a concern that the staff had had.

MEMBER HALNON: I understand your -- saying the conclusion is the same based on the promise that the COL applicant will make it all okay. I guess from a reviewer perspective, how are you ensuring that flood protection is maintained, but it's not at the expense of some other critical design, like I mentioned earlier, potentially the (audio interference) and pump or the instrumentation, the batteries, or something else that you could make okay from a flood level, but you may be changing some other critical design characteristics. How -- from a reviewing perspective, how are you making sure all those dots are connected?

MR. CURRAN: As a former reviewer perspective, this can't be done at the SDA level based on the extent of information that is provided.

MEMBER HALNON: I understand that. You can't do it now because you don't have the promise. But how are you going to do that when an applicant comes in for a COL? They're going to come in and say this is -- the flood protection is fine because I raised this above the 15-foot level. It used to be at 2-foot plus 1 inch level. Now it's at 15 feet plus 1 inch. How are you going to ensure that Chapter 3.4.1 is satisfied, but some other chapter is not, you know, because it's changed. You've changed the standard -- something else in the standard design.

MR. CURRAN: The NRC's review of the COL design, we'll have to review it at that point, and the COL will have to provide an additional flooding analysis based on the --

MEMBER HALNON: Okay, I realize I'm asking you a hypothetical, I just -- it's concerning to me that so many things can be changed at the COL level that will make this one parameter just fine, but will change other things. So it comes back to the, I guess, the customization aspect of it again.

MR. SHAW: This is Peter Shaw speaking. I'd like to maybe provide a little bit more context to this discussion. When we talk about the 3.4, it's the civil features associated with the design. When you're asking about the equipment, you need to be looking at 3 Charlie which is the environmental qualification for it. So a change in flood height of water level and that type of an impact would have to impact Section 3 Charlie, and it would need to be evaluated as such. So this equipment isn't just going to be changed in absence of any sort of context with the safety evaluation. It has to be changed with considerations of the environmental qualifications of the equipment. Does that provide some assistance?

MEMBER HALNON: It provides a level of -- I understand that. Maybe it's just an overly simplistic example of thermal hydraulics of raising an instrumentation above a water level, maybe level instrumentation or potentially a pump or some other thermal hydraulic calculations and other seismic designs two over one, all kinds of different things. How is that all going to be connected up if you're making just the change to make it a flood?

MR. SHAW: So there's a table in 3.4 that describes the flood height as was described earlier. Is my mic coming in okay?

CHAIR KIRCHNER: Actually, you stand a

little --

MR. SHAW: Stand over here? Okay. So when we're talking about Section 3.4 and if there's change in the flood level heights based on a requested sign change from COL applicant, that would have impacts across the license. You're never going to change just one section without also considering other impacts to the license basis, as part of your license basis consideration process and your subsequent 50.59.

So for -- if you change a flood height, in a particular room, based on a design change sought by an applicant, you would also have to look at those impacts in 3 Charlie and make sure that the equipment that you have in those particular flood zones or rooms is going to be still qualified for that location. If it needs to be changed because the flood height impacts that particular component, that would then be assessed at a change in the table and a change in the equipment.

MEMBER HALNON: Thanks, Peter. It just feels like it's going be a string that has to be pulled through most of the chapters.

MR. SHAW: It does, yes.

MEMBER HALNON: And then that comes back

to my concern about have you changed the overall safety case based on the standardization of design? I get it, that's going to be a lot of work, but you have to.

MR. SHAW: Yes, and those are departures that are reviewed as part of a COL application process. There will be a review on that.

MEMBER HALNON: Potentially it seems like you can almost -- you may not even recognize the design at some point other than the big pieces of it. Some of these things maybe even could flow into the accident analysis as well. So I get it. It will be a lot of work by the COL applicant. Thanks.

DR. SCHULTZ: Peter, this is Steve Schultz. I thought in your earlier discussion you had mentioned at the outset that moving from rooms to zones was going to provide some simplification in the design and regulatory review of the design at the COL stage. Is that not right?

MR. SHAW: So is your question pertaining to the -- so the change from the DCA to the SDA in the flood zone analysis process --

DR. SCHULTZ: Yes. Yes.

(Simultaneous speaking.)

MR. SHAW: -- associated to the rooms.

When it comes to discussing the process for the standard design application, yes, that is seen as a optimization for the analysis for the flood design. When it comes to COL applicant changes, they will need to evaluate those and its impacts to flood zones.

DR. SCHULTZ: In essentially the same way?

MR. SHAW: Yes.

DR. SCHULTZ: Thank you.

CHAIR KIRCHNER: It seems to me that we're skirting an issue that's out there. I hope I have the right acronym, the EDAS, whatever the battery system is called, does have some functions important to safety. Where those battery systems are located in the reactor building is pretty important when you're looking at things like flooding, fire, and other hazards. So I find this, one member, a little unsettling.

If I read these lines literally, SDAA flood heights are significantly greater than DCA. We're talking about internal flooding. We're talking about a system that's important to safety. I have a concern that this is kind of -- we're reviewing an SDA, and we're leaving this to the COL even though this has concerns that may impact safety. Seems to me, going back to this issue of standardization, that this is going to have an impact. This would require, depending on the layout, subsequent reanalysis by the staff of whatever a COLA applicant submits. I think, unless I'm missing something here, aren't we going away from the whole objective of 10 CFR 52 and an SDA application?

So, Getachew, maybe you can -- you've got the perspective as the PM here.

MR. TESFAYE: Yes.

CHAIR KIRCHNER: Can you help us here?

MR. TESFAYE: Yes, thank you. This is Getachew Tesfaye. So as opposed to the DCA, which is required for the -- essentially complete design, SDA Part 52 SDA regulation doesn't require that. So when we defer something to the COL state that means we're not making any regulatory finding on that item.

CHAIR KIRCHNER: Move your microphone closer.

MR. TESFAYE: Oh, I'm sorry. Can you hear me now?

CHAIR KIRCHNER: Yes, better.

MR. TESFAYE: So just to repeat what I just said, as opposed to the DCA, which essentially requires a complete design of this -- when you approve this by design, SDA regulation doesn't require that.

So the applicant chose to defer this to the COL applicant, or any other applicant that references the SDA design, could be a construction permit applicant. They have to do that. So we're not making any safety finding on this particular issue.

MEMBER HALNON: Yeah --

(Simultaneous speaking.)

MEMBER BIER: This is Vicki Bier.

MEMBER HALNON: Hold on, Vicki.

MEMBER BIER: Yes.

MEMBER HALNON: That last bullet says that you made the same conclusion as the DCA, which is a safety decision. I assume that you accepted the design. So I'm just kind of reading the last bullet there. The conclusion is the same. So and you're telling me the conclusion was not the same.

MR. TESFAYE: With the addition of a COL line. So that's the key piece.

MEMBER HALNON: It seems to be the entire argument you're making is that it's not at all standard. I got it. Okay. Never mind. Go back again. COL applicant has a lot of work to do and the staff will have a lot of work to do to receive it.

MEMBER BIER: Yeah, if I can follow up now. This is Vicki. It sounds like one of the issues that's going to be affected is just regulatory certainty, not that I think a lot of applicants are going to submit inappropriate designs or whatever, but just that the SDAA approval is more along the level of it is possible to build this design safely rather than this design is safe. And so then it's incumbent on the COL applicant to say that their particular implementation of the design is going to be safe. And again, I would hope that it's straightforward, but it does I think affect regulatory certainty.

DR. SCHULTZ: This is Steve Schultz again. Vicki, just to follow up on your comment, anything that is pushed out like this to the applicant later on, where there will be, we hope, many applicants, is going to increase the burden on both the design process as well as the regulatory review. And any time you take -- any time you assign regulatory resources to this project versus another project, you're reducing overall safety of the system. It doesn't seem like the right thing to do. The more we can identify and standardize the safety of a facility and not have to do it time after time after time, the better off we are. Just a general comment really.

MEMBER DIMITRIJEVIC: This is Vesna Dimitrijevic. I just want to point something and then

I'm -- because I'm now really, you know, a little -- start getting confused about the standardization. We know that PRA in COLA for as-built, as-to-be-operated plant is totally -- it could be totally different PRA than what was submitted in DCA or SD. So there is expectations that PRA will have to be redone when all of those things are finished, the equipment is lay out, the plant is built, and non-safety -- the systems, the procedures, all of these things, and written PRA will have to be redone. So the -- if the PRA is a measure of the safety it should show this. So I am not sure why are we now concern so much here and we were not so concern in the -- when we were doing DCA.

DR. BLEY: This is Dennis. I think the issue people are tied up with here, Vesna, is not what you say. What you say is true; it's going to have to be redone in time to support this review, but what at least I hoped was that it wouldn't have to be redone as you went COL to COL, that there -- it would be a standard plant and except for the site you wouldn't have to do any update even -- and that's what seems not to be true.

MEMBER DIMITRIJEVIC: But this is also site issue, building, the layout, the flood risk for extent of floods.

DR. BLEY: But building layout should be the same, but it is a site issue for sure.

MEMBER DIMITRIJEVIC: Well, that's the standard design guarantees the plant will look exactly the same when it's completed and everything be lay out the same. I'm not sure about that. The whole procedures will be the same and the -- so I'm just trying to see what's a difference between DCA and SDAA.

MEMBER HALNON: I get the external flooding. This is internal flooding. And so to me it should be the same.

MEMBER DIMITRIJEVIC: Well, internal flood also depending on the pipe layout, doesn't that -- I mean, you know?

MEMBER HALNON: Why would the pipe layout be any different?

MEMBER PALMTAG: This is Scott Palmtag. I'm a little confused too on -- it seems like you're asking for things -- the final design isn't done yet, but you're asking for things that aren't -- we don't know yet. So these things aren't -- the pipe layout is not known yet so we're not going to be able to ask these questions until the final design is done.

That's the way NuScale approached this, is they just said well, they'd just push this off to the COL. I mean, I don't see any other way you could do it because the final design isn't done yet. So I don't even know the pipe layout should (audio interference). I don't see an issue with what they've done. Financially it may not be the best way, but --

(Simultaneous speaking.)

MEMBER HALNON: No, it's -- I agree, Scott. This is Greg again. It goes beyond just the pipe design. It is different instrumentation and other things. And if it goes from 2 feet to 15 foot in a room, and the room is 16 feet high, that's a problem.

MEMBER PALMTAG: Well, yeah, but it goes back to the design requirements, the equipment design requirements. So they're going to have to show that it's safe in the end. They just --

MEMBER HALNON: Yeah.

MEMBER PALMTAG: -- don't have enough information.

MEMBER HALNON: Yeah. No, I agree. And I don't want to push this to a more detailed standard design, if you will, but what I was trying to get a handle on is that the standardization of design in itself just to me is a safety platform for the plant since the beginning of -- my plant is safe because here's my standard design. And now what I'm seeing, at least here -- I'm trying to get a clear definition of what that is and what it isn't. And when you get internal flooding -- I didn't see where things would be changing from plant to plant. So my sense is that when we walk into the NuScale 1, 2, 3, 4, 5, and 6, they're going to be the same because they're all on the same site. When it goes somewhere else, it's going to be way different because of different -- something else.

So my point is does that affect the safety case --

MEMBER PALMTAG: Yeah.

MEMBER HALNON: -- in some other system or some other conclusion being made? I'm trying to get a clear definition of what the standard is.

MEMBER PALMTAG: Maybe I see it a little differently because I don't -- this is me; I'm speculating, but I don't see this -- the different designs are going to be different. I just see it as the final design is not finished yet so they don't know these things.

(Simultaneous speaking.)

MEMBER HALNON: -- first part is that you don't -- we can't say that.

MEMBER PALMTAG: Yeah, that's true.

MEMBER HALNON: So I'm trying to find out what they approved, what's been offered, and what is the safety platform for the plant. And internal flooding is just the one that to me seemed it shouldn't be all that different. I will say, I mean, I understand the work will get done. It will be a safe design. It just may not be the same as X, Y, and Z's plants.

MEMBER BIER: One other comment following up on Walt's reflections back to Three Mile Island. Again, this is Vicki Bier. I think one issue that we have found in the U.S. compared to, say, France is that in the long run the lack of standardization kind of affects fleet safety because if there are unexpected problems, you find it once and correct the problem everywhere. And if you have insufficient standardization, then every plant may have its own unique problem, or many plants may have their own unique problems, and they all have to be found and fixed one at a time kind of.

And it's -- I think it can be an issue, but it's not one that's easy to address in our regulatory system because the system is really looking at the safety of the plant at the moment. But it's licensed, and in the U.S. all of those plants were judged to be safe enough. And the subsequent backfits and reanalysis and whatever were a hardship to the industry, but it didn't really disprove the original licensing approval in any way.

So it's just kind of some perspective that, yes, this could have fleet-level implications if the differences between plants end up being significant, but I think it's going to be difficult to address that at the level of the SDAA or even the individual COL applications.

MEMBER HALNON: Vicki, this is Greg. Thank you. And, Scott, appreciate your perspective. I think it's -- I'll make a promise. I won't bring it up again. Because now I'm just really trying to get an understanding where the standard is and where it isn't and what we're approving for a standard design for both the fleet and in preparation for a final design, like Scott said. I have no problem. I think the plant will be safe. I think it's just going to be some extra work down the road that I didn't expect to have to do, so I was -- so I'm done questioning it. I think the point's been made. I think we can move on.

CHAIR KIRCHNER: Prosanta, why don't you carry on, if you would, please?

MR. CHOWDHURY: All right. Thank you.

CHAIR KIRCHNER: And then I'm looking at the clock. If there's a juncture here where we should take a break, we'll take a break.

MR. CHOWDHURY: Sure.

CHAIR KIRCHNER: But go ahead, please.

MR. CHOWDHURY: Thank you. Next slide, please? So this is our prediction from external sources.

CHAIR KIRCHNER: Pull that microphone closer again, please?

MR. CHOWDHURY: Once again, Prosanta Chowdhury, PM. This is Section 3.4.2, Flood Protection from External Sources. So there are no significant differences between the NuScale DCA FSAR and SDA FSAR. Information NuScale provided is bulleted here. The analysis procedures to transform the static and dynamic effects of the highest flood and groundwater levels into effective loads. There are two COL items, 3.4-4 and 3.4-5. The conclusion has not changed from the DCA. There are 11 audit questions, and all were resolved during the audit.

Next slide? Section 3.5.1.1, Internally-Generated Missiles Outside Containment. No significant differences. NuScale provided evaluation of internally-generated missile from plant equipment and credibility of missiles. And conclusion in SDAA did not change from DCA.

3.5.1.2, Internally-Generated Missiles Inside Containment. No significant differences. No credibility of missiles inside containment based on plant design. And SDA conclusion didn't change from DCA.

3.5.1.3, Turbine Missiles. There are differences between NuScale DCA FSAR and SDAA FSAR that include increased bounding turbine missile parameters, mass and velocity. So the SDAA has for Module 77 megawatt electric versus 50 megawatt electric turbine in DCA.

Orientation of control building is more favorable with regard to turbine missile trajectory, however the CRB is not considered essential to be protected from turbine missiles, high trajectory.

NuScale provided bounding missile parameters and barriers analysis of reactor building. This is discussed in Section 3.5.3 of the SER.

S -- should that be SSC? They are

required to be protected. There are two COL items that demonstrate site-specific turbine missile parameters bounded by analysis and evaluate other nearby facilities turbine parameters.

The conclusion is essentially the same that the essential SSCs are protected from turbine missiles using barriers.

There are two audit questions and all resolved in audit. And for any technical questions I have John Honcharik who will answer technical questions.

CHAIR KIRCHNER: Does that conclude your presentation for Chapter 3?

MR. CHOWDHURY: No, I have --

CHAIR KIRCHNER: You have more, right?

(Simultaneous speaking.)

CHAIR KIRCHNER: Okay. So let's go on.

MR. CHOWDHURY: Okay. 3.5.1.4, Missiles Generated by Tornadoes and Extreme Winds. Basically NuScale described the missile types and parameters for extreme wind missiles evaluated in design. COL item 3.5-2 exists to confirm automobile missile velocity and altitude of impact parameters will bound extreme wind conditions at site. And the SDAA conclusion is essentially the same as DCA conclusion.

Next is 3.5.1.5, Site Proximity. And this is COL item 3.5-3 to evaluate the site-specific hazards from nearby or co-located facilities for more energetic missiles than defined in SDAA. The conclusion has not changed from DCA. Now this does not include aircraft impact.

3.5.2, Structures, Systems, and Components to be Protected from External Missiles. NuScale provided safety-related and risk significant SSC that must be protected from external missiles are located inside Seismic Category I reactor building and Seismic Category I portion of control room building. CRB as mentioned in slide for 3.5.1.3 is not considered essential to be protected from turbine missiles. The conclusion in SDAA did not change from DCA.

Next, please? 3.5.3, Barrier Design Procedures. There are some differences. For example, steel-plate composite walls were not available for the DCA; neither were steel barriers. NuScale provided three-step design approach based on Bruhl equations to prevent perforation of SC walls from missile impacts, Ballistic Research Laboratory, BRL, formula to determine the minimum steel missile barriers with 25 percent thickness increase. The conclusion did not change from DCA except for steel-plate composite walls and steel barriers.

George Wang is here, who is the technical reviewer for this section, if you have any questions for him. All -- eight audit questions were issued, and all were resoled during the audit.

Next? 3.6, Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping. There are differences. As you have heard, LBB methodology no longer -- leak-before-break methodology no longer used for main steam system and feedwater system inside containment vessel. Break exclusion zone to use BTP 3-4. Leak detection sensitivity changed from 0.005 gallons per minute to 0.01 gallons per minute. No LBB. Containment isolation test fixture added between CNV nozzle safe end and containment isolation valve for lines outside CNV in the break exclusion zone under bioshield.

NuScale provided preliminary analysis results for MSS and peak FWS show acceptability for change to BTP 3-4. Leakage detection sensitivity change, stated above, meets Reg. Guide 1.45 limit of 0.5 gpm. Preliminary analysis results for welds in break exclusion zone outside CNV under bioshield justifies break exclusion with CITF. Preliminary stress analysis for ECCS RRV and RVV bolted connections with threaded inserts, unchanged from DCA, and is representative for other bolted connections with threaded inserts.

There were five audit questions and three RAIs for this section. All were resolved. And the conclusion in SDAA remained the same as DCA. I have Chakrapani Basavaraju at the end, who is the technical expert, if you have any questions.

CHAIR KIRCHNER: Would you -- his is Walt Kirchner. Prosanta, would you elaborate on the third sub-bullet about the safe ends and the CIV? So has this resolved to the staff's satisfaction your concerns about a potential large break in those areas outside containment, particularly lines like the chemical volume control system, the CVCS lines?

MR. BASAVARAJU: Yes, we had --

MR. CHOWDHURY: Introduce yourself, please.

MR. BASAVARAJU: Yes, we had an RAI request on this particular --

MR. CHOWDHURY: Introduce yourself, please.

MR. BASAVARAJU: This is Pani Basavaraju, mechanical engineer in the Testing Branch. I am the technical reviewer with 18 years in RC. And prior to that I was in Bechtel for around 18 years and for some time in --

CHAIR KIRCHNER: You'll need to speak up.

MR. BASAVARAJU: For some time in (audio interference). So for this particular one -- and this is in the break exclusion zone in the containment penetration area outside containment. And there are essential lines, pressurizer spray, CVCS in that, and discharge. And high-pressure and degasification line. So and there are welded connections in that area. So we asked if -- in what area they applied BTP 3-4 criteria, which is extremely limiting. The stress is limited to 80 percent of the ASME Code. And then the usage factor for fatigue is limited to 1.1, which is very conservative. So all these values in these lines are -- were shown to be meeting, based on the preliminary design analysis, they meet these extremely limiting stress criteria in those -- for all of those --

(Simultaneous speaking.)

CHAIR KIRCHNER: So the cycling of the CVCS system pressurizer spray, you're still confident that there's significant margin there --

MR. BASAVARAJU: Yes.

CHAIR KIRCHNER: -- in that analysis of

the piping stresses?

MR. BASAVARAJU: Yes.

CHAIR KIRCHNER: Okay. Thank you.

MR. CHOWDHURY: 3.9.1, Special Topics for Mechanical Components. Significant differences, the heatup rate for reactor heatup to hot shutdown transient changed. NuScale provided final component stress analysis will use the latest transients' input for ITAAC. The SDAA conclusion is the same as DCA. This does not include density wave oscillation.

MEMBER MARTIN: I've got a question. Bob Martin. In NuScale's presentation they made a note about the removal of an event -- this is the detonation. Now, I don't think it was so much removal, because I think in the previous approval they didn't have say a recombiner and they had made arguments that it was from a source term in terms of hydrogen and oxygen, that there were -- it was insufficient to cause a detonation.

But now we have a recombiner that has appeared in the design, and I'm kind of wondering how that came about. And I can imagine through deliberations with you guys that maybe to address uncertainties associated with scenarios, just the hydrogen and oxygen generation, that this design change came about.

Can you provide some insight on where that recombiner came from? Because now all of a sudden it seems to be more of a concern because it's there, whereas before it wasn't there. And it's not completely fair because I didn't ask the same question to NuScale.

MR. CHOWDHURY: NuScale may be able to answer that.

MEMBER MARTIN: That didn't necessarily come out of questions that came from you all. Maybe in Chapter 19 --

(Simultaneous speaking.)

CHAIR KIRCHNER: Well, I can provide some insight. When we reviewed the DCA, one of the concerns that the Committee identified was the post-TMI requirement to do sampling of the containment atmosphere. And what was considered or proposed was to open the containment -- I'm not going to get the acronym right -- the containment fill and drain system line, which is a substantial line, four inches if I remember correctly, and that line then would have a loop attached to it for actually sampling.

And there is lots of questions about the risk of opening up a line of that size to bypass containment effectively just to do a sample of the containment atmosphere. And also there was considerations of how representative that sample would be from a stagnant line. You would have to have a recirculating smaller line that would make the sample measurement.

But that was flagged as a concern. I don't know cause and effect that -- based on the recommendation of the ACRS that the applicant NuScale put the recombiners in as a means to not only take down the pressure loading if you were to have a detonation event, but also as a substitute to doing that sampling, which had the risk of breaching -- bypassing containment. And so by having the recombiners there in the containment, then I think the applicant can make a convincing argument to the staff that they don't need to have the provision or the post-TMI requirement of a sampling of the containment atmosphere.

MEMBER MARTIN: There wasn't a conversation about sources of oxygen. I mean, it seems a little hard to believe there's no way that, you know, from some event that ultimately leads to a severe accident, you can't get oxygen if you had a breach of interfacing systems, what have you, that are sort of in an oxygen environment. But that didn't come up. I mean, they've otherwise argued that oxygen from all sources has -- is excluded.

CHAIR KIRCHNER: I can't speak for the applicant. I would say that I think they did in the DCA design an actual evaluation of the detonation threshold.

MEMBER MARTIN: Right. I saw that.

CHAIR KIRCHNER: And they --

MEMBER MARTIN: So I'm -- and it's almost like, well, they did the work.

(Simultaneous speaking.)

CHAIR KIRCHNER: -- it was designed to withstand that.

MEMBER MARTIN: Right. So then why don't just include it instead of making of point that they don't need it, which was kind of in the presentation? Either you did it or you didn't. If you did it, go ahead and take credit for it and just let it go.

CHAIR KIRCHNER: At this point we should let the applicant correct the record.

MEMBER MARTIN: I think that --

CHAIR KIRCHNER: Okay. Go ahead.

MR. BECK: This is Tyler Beck with NuScale. So we added the PAR (phonetic) to remove that load and remove the previous carve-outs from the DCA, which the detonation loads -- you have to include those in the design specs for all the components. And it certainly leads to more expensive things of that sort. And we just took -- there's no load anymore. With the FAR there's no possible combustion event, taking that out of the design.

MEMBER MARTIN: But there was before? No, right? In your earlier design, I mean you made the same argument.

(Simultaneous speaking.)

MR. BECK: -- design there was the evaluation of detonation loads.

MEMBER MARTIN: But you would have had, what, a relatively small amount of oxygen? And that was what you were claiming all along. So, but that load was still something that we're concerned about in the first go-around or --

MR. BECK: Well, that was a load in the DCA, but now it is not with the FAR.

MEMBER MARTIN: Yeah. Okay. One thing about, you know, PARs, of course they work on a -- at a pretty slow rate, right? Then oftentimes you'll see the severe accident management or the combustion gas control system having both igniters. And PARs deal with the uncertainties of the rate of hydrogen releases. You'll feel like there's -- again, getting back to the question of where does the oxygen come from, you exclude that, you don't really have a big -- I'll call it the big problem. But there was no issue or question regarding the rates at which these processes could happen and the uncertainties associated with a severe accident, which we all know are very large.

MR. BECK: When we present Chapter 6 you'll -- we'll certainly cover combustions -- combustible gas. I'll just say that our design is very different with the blowdown to containment and the percent oxygen compared to a traditional design. It's different in that respect. But we'll get to that in Chapter 6.

MEMBER MARTIN: Thank you.

CHAIR KIRCHNER: No, their starting point is a vacuum, right, in the containment, which is completely different than a large LWR, which is an oxygen environment unless you inert, which we don't.

MEMBER MARTIN: Right.

DR. SCHULTZ: This is Steve Schultz. While we're still on this slide, the last statement -- last two statements indicate the conclusions are the same, but does not include the evaluation of the density wave oscillation. Some of the evaluations in the -- some of the discussions in the safety evaluation do include open items associated with Section 9.2 and just presuming that those are going to be resolved by our review of 9.2 in the end of next spring, or the beginning of next spring. Is that true?

MR. CHOWDHURY: This is Prosanta Chowdhury. Are you talking about Section 39 -- 3.9.2?

DR. SCHULTZ: Yes, 3.9.2.

MR. CHOWDHURY: Yes, so the safety evaluation for this particular presentation really states that the DWO will be addressed in Section 3.9.2 of the -- of FSAR 20. The evaluation is completed by that. So the advanced safety evaluation that we have issued for this particular one does not have any open item, but it simply points to Section 3.9.2 for DWO and related -- other related sources.

DR. SCHULTZ: Okay. I'll take another look at that. Thank you.

MR. TESFAYE: Chair, may I suggest -- may I say something? For the record --

CHAIR KIRCHNER: Go ahead, Getachew, and identify yourself.

MR. TESFAYE: This is Getachew Tesfaye, the project manager for SDA. Oh, this is Getachew Tesfaye.

Just for the record, the subject matter experts that you see in front of you do not include all those things that worked on the combustible gas and PAR. So when we present Chapter 6 and Chapter 19, tentatively scheduled for March, I think all those things will be discussed in detail. And again, on 3.9.2 it's not -- this presentation doesn't include that. So just wanted go on the record saying that. We don't have any experts on PAR in (audio interference) in this presentation. Thank you.

MR. CHOWDHURY: 3.9.3, ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures. There are some differences. As you see on the slide, upper and lower sections of the reactor vessel are constructed from different materials that have different coefficients of thermal expansion which is considered in the stress qualification of the closure bolts and flanges. So there were lot of discussions on bolted connection and its design with NuScale. NuScale provided preliminary finite element analysis results. So the SDAA conclusion did not change from DCA conclusion on the different materials that are used.

Next? 3.9.4, Control Rod Drive Systems. There are differences. Use of DCA drop and shaft alignment testing for SDAA design. Use of threaded connections instead of welded connections between CRDM and reactor pressure vessel. This is further discussed in 3.13. Rod holdout mechanism failure -- feature. Sorry. Steam generator tube support assembly, consider impact to CRDS.

NuScale provided adequate justification to apply DCA testing to SDAA design, reconciling the differences; analysis of threaded connections, again discussed in Section 3.13 slide that's coming up; justification that rod holdout mechanism failure would not adversely impact safety function of inserting rods; details of assemblies, purposed inspections to monitor for degradation.

There were seven audit questions and two RAIs. All were resolved. From the staff have Nick Hansing present here in the room if there are any questions.

3.9.5, Reactor Pressure Vessel Internals. Again, there are no significant differences, and the conclusion did not change from the DCA.

3.9.6. There are some design differences, and we have Tom Scarbrough here from the staff in the room to answer any technical questions.

So redesign of ECCS valve system requiring 10 CFR 50.43(e) testing and lessons learned to plan for ASME QME-1 qualification testing. Need to address 2017 edition of ASME OM Code with motor-operated valve and air-operated valve diagnostic testing requirements beyond 2012 edition in DCA.

NuScale provided audit access to ECCS valve system proof-of-concept test specification and reports to support compliance with 10 CFR 50.43(e); updated relief and alternative requests to reflect 2017 edition of ASME OM Code; draft revision to FSAR and ECCS test description in response to NRC review and audit findings. And then the conclusion did not change from DCA to SDAA.

CHAIR KIRCHNER: So this is an area that was identified as -- probably don't have the right terminology that the staff would use, but requiring further work and testing. And then several changes were made to the ECCS valves and such. So could you or John --

MR. CHOWDHURY: Yeah.

CHAIR KIRCHNER: John, could you give the Committee an update of where things stands with regard to the ECCS testing and your expectations?

MR. SCARBROUGH: This is Thomas Scarbrough. I'm (audio interference) branch 46 years. Yes, originally what we did for the DCA was they had some initial testing that was -- we did consider to meet 50.43(e). And we worked with them. They developed a new testing plan. We observed that testing of the target rods during -- and the conclusion was the testing they did of that 50.43(e), but they still had to follow through with QME-1 standard qualifications after that.

Now jump ahead to SDA, they right off the bat conducted the proof-of-concept testing -- proof testing that's need for 50.43(e). So that was already completed by the time they submitted their application. So we asked for all of those test results, the test specification, all of the tests for the ECCS valves, RVV, RRV, the IAB. We asked for all of that test information, and we reviewed it as part of audit. They put it in electronic reading room for -- and, as you saw, we had a large number of questions on what was done.

They did find some interesting things when they were doing the testing, just like they did with DCA where they had to do some adjustments in terms of different things, but the bottom line was we felt that they had met 50.43(e) to demonstrate the design feature. However, they still will need to demonstrate that the entire system will perform its safety function through the QME-1 qualification method.

So they're going to have to match the plant conditions, they're going to have to look at boron. They didn't do boron in this version. We had them do boron in the first version, the DCA. And they showed that there was not really an effect. So for the SDA we did not require them to do the boron condition testing. But they will have to do it for QME-1 qualification.

So there's a number of lessons learned that they came out with that were in the reports and we summarized them in the safety evaluation. They had some findings of different aspects. They're going to be looking at the fundamental frequency, more things of that nature. They're going to follow up on a number of different areas like that in terms of the -- the stroke-time of the valve. They're looking at that. There are a number of different areas. There was some leakage. They're going to look at all those aspects during the qualification. So there were a number of lessons learned from this particular testing, the proof testing that they did for 50.43(e), but they still have quite a bit of work to do for qualification under QME-1, which they'll have to meet. When the COL comes in, they'll have to be able to meet those provisions in QME-1. So that's sort of where we are right now.

CHAIR KIRCHNER: Okay. So how do you capture that? Does that become an ITAAC?

MR. SCARBROUGH: Well, it's -- we summarized it high-level in the safety evaluation. We mentioned some of those things I just mentioned.

CHAIR KIRCHNER: Right.

MR. SCARBROUGH: They will have to follow through. And those reports -- we summarized the reports. And so when a COL comes in, they're going to have to pick it up from there and make sure the QME-1 qualification testing is complete. And the lessons learned from this testing will have to be applied instructing the testing. So the staff, when we -- when a COL applicant comes in and says we're going to do QME-1 testing, we'll pick up our safety evaluation and look at where we summarized these were issues that need to be continued on. And we'll use that as part of reviewing the test procedures for the QME-1 qualification.

So I think we have it documented to make sure there's no loss of information there so that we can make sure the QME-1 testing is adequate.

CHAIR KIRCHNER: Okay. Now a follow-on question. I remember that you, the staff, had a concern about boron in the static lines of the ECCS valve design. So without going into anything proprietary, is that part of the qualification testing, time and temperature with boron?

MR. SCARBROUGH: Yes, it will. They did address our concerns during the DCA for that.

CHAIR KIRCHNER: Yeah.

MR. SCARBROUGH: And that was part of one of the questions we had about the precipitation aspect. And so they were able to resolve that for that. For QME-1 qualification testing for the SDA they will have to address that as part of qualification testing.

CHAIR KIRCHNER: Okay. Thank you.

MR. CHOWDHURY: 3.10, Seismic and Dynamic -- sorry, my microphone was off. Section 3.10, Seismic and Dynamic Qualification of Mechanical and Electrical Equipment. Basically no change, and no change in the conclusion.

Next. 3.11, Environmental Qualification

of Mechanical and Electrical Equipment. There have been changes. Changes to FSAR Table 3.11-1 for equipment and qualification. Potential use of IEEE standards not endorsed by NRC Regulatory Guides. Chapter 15 accident scenarios with lower coolant levels for longer duration than DCA.

So NuScale provided adequate justification for NRC staff to rely on past experience from DCA review to inform SDAA review; proposed FSAR revisions to support NRC safety findings.

The staff found that all applicable regulatory requirements were adequately addressed. Just to mention that there have been a significant number of interactions between the staff and NuScale on this topic, and all issues raised were resolved within audit.

We have Jorge Cintron-Rivera here, the expert, and Ed Stutzcage on the line, and they're the technical experts for this area of review, if you have any questions.

3.12, ASME BPV Code Class 1, 2, and 3 Piping Systems and Associated Support Design. No significant changes between DCA and SDAA, and no changes in the DCA conclusion -- in the SDAA conclusion from DCA.

3.13, Threaded Fasteners, ASME BPV Code Class 1, 2, and 3. The RVVs and RRVs were changed to -- are not changed, right, to bolted, but there have been some changes in the bolted connections related to the vessel nozzle. These four bolted flange connections were classified as break exclusion areas. Added augmented examination requirements for ASME Class 1 threaded inserts and seal welds.

NuScale providing engineering study of stresses of the bolted flange connections that adequately show that the probability of gross rupture of the ECCS valves bolted connections is extremely low.

Sampling plan and expansion criteria from the -- for the steam and feedwater plenum that can be credited for RVV and RRV break exclusion locations. That was the part of DCA -- SDAA conclusion.

We have Dr. Cory Parker in the staff who can respond to any technical questions in this area of review.

So this is the concluding slide for NuScale SDAA Chapter 3 review except for Sections 3.7, 3.8, and 3.9.2. Overall very high level conclusion is that while there are some differences as we indicated through some of the slides between the DCA and SDAA, the staff found that the applicant provided sufficient information to support the staff's safety finding. The staff found that all applicable regulatory requirements are adequately addressed. That's the end of the staff presentation.

CHAIR KIRCHNER: Thank you. Members, any specific questions to this Chapter 3?

MEMBER ROBERTS: Yes.

CHAIR KIRCHNER: Go ahead.

MEMBER ROBERTS: Tom Roberts. Can you back to slide 12? Slide 12 has a conclusion that the control building is not required for safety. And I was looking through your safety evaluation report while you were talking, and it looks like -- you say in the report the staff has not verified whether the control room and its operators are not needed or credited to ensure that the criteria are met. If the criteria are not met then an analysis of the barriers of the CRB prior to trajectory missile would have to be performed.

So it sounds like it's an open item in your view that whether or not the control building really should be exempted from the turbine missile or high-trajectory criteria. I wondering if you could comment how you reached the conclusion on the slide that --

MR. CHOWDHURY: Yes.

MEMBER ROBERTS -- the CRB is not considered essential.

MR. CHOWDHURY: Okay. John, just a second please.

So I don't know if you are looking at the initial draft safety evaluation we sent to you, because between then and just a few days ago we had some back and forth discussions with NuScale on this matter, on this subject. And then we finalized the safety evaluation. I don't think the safety evaluation has an open item in this area, but John Honcharik is the subject matter expert technical reviewer for this area.

John, go ahead. Please introduce yourself first.

MR. HONCHARIK: Hi, I'm John Honcharik, senior materials engineer in NRR. I've been at the NRC for 22 years and another 15 years at a shipyard building nuclear-powered submarines and aircraft carriers.

So, you're correct. I think, initially, there was some discussion that -- there was still some discussion of whether or not there were essential equipment in the control room that needed to be protected. But there were -- like Prosanta said, there were other interactions that finally came to the conclusion that there are none, and they don't need that, because there are some redundant systems in the reactor building, so that even if they didn't have the control room, they could safely shut down the reactor in accordance with the guidance in Reg Guide 1.115, so that they wouldn't have to protect that control room building.

MEMBER ROBERTS: So you looked at the loss of indications and manual controls and the other things that are in the main control room to mitigate scenarios that aren't ones specifically called out in the safety analysis report? Just seems like wiping the entire control building was something that would have to require some thought in terms of looking, okay, what are all the scenarios that could be challenged by that and whether that would warrant some additional protection from certain events. So I was wondering how you got there.

Is this something in the PRA that looks at, okay, if the entire control building were lost, then here's how the plan would be to restore it? Or how did you get there?

MR. HONCHARIK: Well, we didn't look specifically at the PRA, but there was a lot of discussion back and forth on this topic of whether or not you really need the control room building. And I think there was some major changes in the FSAR that are proposed and will probably be in the next revision where basically it stated what are the requirements for the Reg Guide, where it says these are necessary to be protected. And in order to meet the guidance you have to be able to safely shut down the reactor and keep it in a safe shutdown condition.

So they provided information that showed that all the equipment that is there is either redundant or can be observed or initiated somewhere else. And also there's automatic -- it's mostly automated. So, with that, there's the failsafe that, if they can't, they can always use the main controls in the reactor building.

So that was basically the conclusion for that. Now, this is just for the high-trajectory missile, for the -- it's still protected from all the other missiles based on conservative design philosophy.

MEMBER ROBERTS: Yeah, I would imagine the likelihood of the scenario is pretty low because, like you said, the low-trajectory, apparently, is protected just by the location of the building.

MR. HONCHARIK: Right.

MEMBER ROBERTS: High-trajectory missile presumably are less likely. I just am, again, wondering how you support that conclusion. It seems like, from a defense-in-depth perspective, loss of all of the systems in the control building on one event could significantly challenge some accident progression, maybe not the design basis accidents. And I was wondering if that's something that comes up again in Chapter 19 or in the PRA and looking at, okay -- looking at likelihood and consequences or some scenario outside the design basis that would be challenged by that. Do you expect that to be looked at in Chapter 19, or is this all we're going to --

MR. HONCHARIK: Yeah, I think -- I don't know, Prosanta, if there is anything in Chapter 19 that will be coming.

MR. CHOWDHURY: Could be when we present Chapter 19.

MR. HONCHARIK: Yeah, not sure about that. Might have to get back to you on that, but --

MEMBER ROBERTS: Yeah, I can raise the question then. Thank you.

CHAIR KIRCHNER: Let's see. Vesna and Vicki, any further questions on 3?

MEMBER DIMITRIJEVIC: No, we are good.

MEMBER BIER: Yeah, not right now.

(Simultaneous speaking.)

MEMBER DIMITRIJEVIC: As I remember, there is no really control of -- loss of control building was not part of the Chapter 19 analysis in the DCA, so.

CHAIR KIRCHNER: Go ahead.

MR. TANEJA: This is Dinesh Taneja. I am the RNC (phonetic) technical reviewer. In Chapter 7, when we discussed that, there is a PDC 19, which is the remote shutdown capability. In that review in PDC 19, the capabilities are in the reactor building. If we lost the accessibility of the control room for any reason, you can go to the reactor building and do the necessary manual initiations if you need to, if the automatic did not, for some reason, work.

So I just wanted to add that to the discussion, that we did look at that as part of Chapter 7 and Chapter 18 evaluation.

CHAIR KIRCHNER: Okay. Let's, at this point, stop and take a break, a well-deserved break. Thank you for the presentations, both applicant and staff.

It is 3:32. Let's reconvene at 3:50 Eastern Time. Take a little bit longer break. And then we'll turn to Chapter 8 at that point. Thank you.

(Whereupon, the above-entitled matter went off the record at 3:32 p.m. and resumed at 3:50 p.m.)

CHAIR KIRCHNER: Okay, we're back in session. We're turning to Chapter 8, Electrical Systems, and we'll start with NuScale.

Who's the lead here for NuScale? David, go ahead, take it away, please. And, again, just remember pull those microphones close to you. They're really quite sensitive and if they're far off, we're not really getting a good transcription for the court reporter. Thank you.

MR. RICKENBACH: Good afternoon. I'm Dave Rickenbach. I'm the Electrical Engineering Manager here at NuScale. I have 18 years' experience in nuclear power, drawing from the naval nuclear power, electrical system engineering and the BWR fleet. For the past six years, I've been at NuScale focusing on stationary DC power design and engineering management. Today, I'm going to present Chapter 8, Electrical Power. Next slide.

Here's our overview for Chapter 8. Chapter 8 is broken into four sections. We'll talk about the overview, offsite tower systems, onsite power systems, station blackout, SBO. We're going to discuss at a high level the changes from SDAA to DCA, including the conforming changes in the SDAA reflect US 460 standard design, which is functionally, equivalent to the DCA.

Our DCA included six COL items. There are none in the SDAA. FSAR content was optimized from the US 600 DCA and in the example that would remove specific wattage of plant loads from the FSAR tables. We resolved 14 audit questions. Next slide.

Here is a high level overview of our design changes from DCA to SDAA. I have broken it into two sections. We have AC power and DC power. I'll start with AC power.

Our design now includes a common load AC power. It's provided by redundant transformers. We made changes to the high voltage AC electrical distribution configuration. We made changes to the backup power supply system configuration.

For DC power, we now have a single battery string for each augmented DC power system, which I'll refer to as EDAS from now on, EDAS power channel. Our

EDAS divisions are physically separated in independent rooms and our EDAS includes power channel cross-connects. Next slide.

For our Section 8.1 overview, this section provided a high level overview of onsite and offsite power sources. The technical content reflected the US 460 plant systems instead of US 600 plant systems. Our GGC conformance is unchanged from US 600 DCA.

Audit results. We changed our FSAR Table 81-1. We revised it to include more information from the US 6-400 standard plant design. This really had to do with including IEEE standards applicable to EDAS. There were no RAI questions. Next slide.

From Section 8.2, Offsite Power Systems, the technical content is generally unchanged. Our COL items were removed in SDAA. Removed COL item 8.2-1, which is a description of the site-specific plant switchyard. We removed COL item 8.2-2, the description of the site-specific offsite power, the grid study. We removed COL item 8.2-3, the description of the required testing. The plan supports a GDC 17 and 18 exemption. The site does not rely on offsite power, so the DCA suitable items were unnecessary. There were no audit questions nor RAI questions.

From Section 8.3, Onsite Power Systems. Technical content is revised to reflect design on US 460 electrical power systems. COL items removed in SDAA, we removed COL item 8.3-1, US 460 design does not have an auxiliary AC power system. Removed COL item 8.3-2, there is no electrical heat tracing. We removed COL item 8.3-3. Our site-specific information was not needed to demonstrate compliance with Reg Guide 1.204 in the DCA. The US 460 standard design maintains conformance with the Reg Guide 1.204.

Real audit results. We made an addition of Table 8.3-3 to describe EDAS augmented system design qualification and quality assurance provisions. There were no RAI questions.

MEMBER ROBERTS: Dave, can you go back a couple of slides? I think this slide might be collaboration, but the slide you had the overview of design changes, maybe three slides ago, it describes three changes you made to the AC power system, but doesn't really explain what they were. The amount of detail that's in the chapter now is pretty light compared to the previous chapter. In terms of electrical schematics there were probably, I don't know, 50 sheets before and now it's only six, but can you just give a quick synopsis of what those changes were?

MR. RICKENBACH: Yes. Our common load, if we remember in the DCA, the common loads were provided off modular-specific power systems. We split those out onto its own specific common system, provided by two transformers that are 100 percent redone. Those come off the point of the common coupling or a plant switchyard.

For our high voltage AC electrical distribution change, so our turbine generators now connected distribution voltage to the point of common coupling, which is our plant's switchyard. We also include by module a generator set up of transformer and unit auxiliary transformer, where before those were shared in the DCA.

For our backup power supply system configuration, we removed the AAPS and integrated those functions into our backup diesel generators.

MEMBER ROBERTS: The schematic on the connection between the generators and the unit auxiliary transformers doesn't clearly show what sort of protective measures there are between them. We had a presentation back, I think it was in March, that did talk about one of the most common risks for high energy and lack of a protective device at the generator output. Do you have generator output breakers in there or is the first protection at the transformer or downstream with the transformer?

MR. RICKENBACH: US 460 guideline includes generator circuit breakers.

MEMBER ROBERTS: Okay, so you've got an arcing fault and then a transformer or in the upstream wiring, you would trip the inner circuit breaker?

MR. RICKENBACH: That's correct.

MEMBER ROBERTS: And I think the DC power, as you described in later slides, great keep going.

MR. RICKENBACH: For Section 8.3, Onsite Power Systems, our technical content is revised --

(Simultaneous speaking.)

MR. RICKENBACH: Let me get back to my slide. Yeah, the addition of Table 8.3-3 describes EDAS augmentations and that's our system design, qualification, and quality assurance. There were no RAI questions.

MEMBER ROBERTS: I don't think we've seen that table and I have a general question maybe I'll ask that now. The EDAS system is not safety-related, but it's also not exactly non-safety either because it's got some important functions. You've augmented the quality to kind of split the difference. What's very hard to figure out is what you're doing that's beyond non-safety, which this table probably answers and then what you're not doing that would be part of quality and safety-related.

Do you have a quick synopsis of the kinds of things that you would have to add to make it safety-related or Class 1E or is it basically, well, I guess I'll end the question there.

MR. RICKENBACH: I have a slide on the reliability in EDAS. So I can answer that question then or right now.

CHAIR KIRCHNER: Okay.

MEMBER ROBERTS: Yeah, the question is the reliability and availability and all is great, but in the question, if you call it safety-related, what more would there be? And then, what kind of compromises you're making relative to -- calling it safety-related is very questionable in that case, so if that comes as a later slide, great.

MR. RICKENBACH: Yes. Section 8.4, Station Blackout. US 460 station blackout is similar to the DCA and the conclusion is the same. SBO does not pose a significant challenge to the plant because the plant does not rely on AC power for performing safety functions. A safe and stable shutdown is automatically achieved and maintained for 72 hours without operator actions. Next slide.

So, here's our slide on reliability and availability of EDAS. Of those 14 audit questions, the majority were spent on the EDAS system and I have condensed it down to these four bulleted points here.

I'll start off to address your question directly on a gap analysis. We didn't actually perform a gap analysis between EDAS being a safety-related system and a non-safety-related system. The EDAS system, when we were designing it, it did not meet the definition, R50.2 definition, for a safety-related system and that is where we started the design from. That being said, EDAS has augmented provisions for design and quality that satisfy asset protection and production quality.

(Audio interference.)

DR. BLEY: Did people stop talking or did I just lose sound?

COURT REPORTER: This is the court reporter, I believe the room has been muted.

MEMBER VLAHOVICH: Yeah, I lost sound, too. I don't hear anything either.

CHAIR KIRCHNER: Court reporter, can you hear us now?

COURT REPORTER: Yes, we can.

CHAIR KIRCHNER: Okay. Sorry, okay. Thank you. Let's proceed. You might need to back up a little bit, David.

MR. RICKENBACH: Okay.

DR. BLEY: This is Dennis. Can I sneak a question in for your or a comment? Sort of a memory test for me. My memory was the big deal was the batteries you were using weren't available in safety grade at the time and you needed those to control the size of the building, which made sense at the time and the stuff we looked up on the batteries looked very good, but they weren't available as qualified at the time. Is my memory right or did I just miss the boat there?

MR. RICKENBACH: That is correct and I can address that. The EDAS system uses a valve regulated lead acid cell, which contrary to a vented lead acid cell is not available at a safety-related grade or quality. That being said, we have applied augmentations to our non-safety-related EDAS where we think our reliability and availability suit the functions that it performs for acid protection in production criticality.

The EDAS batteries will be environmentally qualified for IEEE 323. This really takes into account that we could just seismically qualify them, but we want to make sure that we take into account aging mechanisms that are applied through an environmental qualification program and we address those. Very similar to what you do with a vented cell.

Stepping forward, portions of the non-safety-related EDAS supplying our DC power to ECCS valves are augmented. Additionally, these augmentations are sided one components. They're protected from natural phenomenon per GDC 2. They're protected from environmental conditions for GDC 4. They're not shared between modules per GDC 5. There's an individual, module-specific EDA subsystem for each module. We protect from fire per Reg Guide 1.189, which is GDC 3. They include physical independence per Reg Guide 1.75. We separate into redundant load groups and we designate to be single-failure proof per Reg Guide 1.53.

So, those are the mainline augmentations that we applied to the EDA system, not Sage related but we applied it for our acid protection and production criticality.

MEMBER ROBERTS: Tom Roberts here. I'm

not sure, Dennis, if you heard my question before the room got unmuted, but it sounds like you did. The question I asked is, if this were called safety-related, what more would they do? I think the answer you brought up is that because there's no qualification of a BRLA battery for a safety-related application then that would require additional work to figure out what that would involve.

When I look at this list, you have separation, independence, redundancy, single-failure proof, separate redundant load groups, all those things sound like a Class 1E electrical power system. I couldn't understand what's missing.

PARTICIPANT: And this is just the battery or is there more?

MR. RICKENBACH: It starts more fundamentally. It was designed as a non-safety system, but viewed through the lens as it's not just any regular plant system, it's important. We define the importance of it. It has production criticality, right. We talk about loads for a moment. It serves the module protection system, so a loss of power here results in a plant trip. There's a high impetus to make it as reliable from a production standpoint.

Also, asset protection, so having an

inadvertent ECCS actuation that is not something that you ever want to have, so that requisite amount of reliability was built in from the ground up, but as a non-safety system. There was no gap analysis done. We didn't say, well, if it was safety, it would be this, but because we did the EDAS, we made it this way and tried to trace requirements that way.

DR. BLEY: Hey, Tom, it's Dennis. I didn't hear your question and really with that, Charlie might have a better memory on this than I do. We also really chased to make sure there wasn't something hidden around the system that really needed power such that you could have a problem when you lost power and that looked pretty solid.

MEMBER ROBERTS: Yeah, the piece of the chapter that I really liked was the table. What Dennis said just carried the thought that a lot of people look at loss of power as a concern, but when I got out of your table is it looked at other failure modes, like oscillating voltage and under voltage and high voltage and things that happen in real life that don't fail as cleanly in maybe as deterministic a way as loss of power, so you did look at that. That's another aspect of this that probably gets you more confidence in terms of knowing what all your consequences of failure are.

I think this is your last slide and one question that remains, we may have to follow up in a closed session because some of this comes from proprietary material you provided. There's a scenario that you call smart failure and there's a question about whether or not smart failures need to be covered within the design basis and that aspect of it, we probably need to cover in closed session.

The question I had on that, the small failure as I understand it, is that the EDAS chooses to fail at the exact same time as the modular protection system says I need to make a trip, so that does something to performance. I was trying to understand what, because it seems like if you lose power at the same time as you need a trip, then the loss of power will cause the trip, right? By tripping the RCBs, the under strip. So, can you just give a description of what the scenario is that causes the concern with the smart failure?

MR. RICKENBACH: I'll discuss it from an electrical standpoint and then I'll turn it over to Kris Cummings for any safety analysis look at it. One of the things we EDAS, when it's powering the module protection system, based on the process variables that are being monitored, the module protection system goes through a sequence of trips. It can do a SRAM, but not an ECCS actuation.

The smart failure we're talking about removes that decision that the MPS and the SRAM, so that really is the difference there.

As far as the set up to that smart failure, I'll turn it over to Kris to speak to that.

MR. CUMMINGS: Great, thank you, Kris Cummings, NuScale. I've been with NuScale for a little over four years and have 25 years' experience in the industry working for various reactors and dry cask storage, transportation task vendors.

In particular, you're right. There is a smart failure event that was a topic, I'll call it a stylized event, that was a topic of interest that we've had significant discussions with the NRC in Chapter 15. I'm going to address it very high level because we haven't yet seen the NRC's evaluation of Chapter 15 and how they disposition this in the end. The particular event of interest here, involves a reactivity addition event, i.e., a failure of the control rod drive system and that that failure then causes the rods to withdraw, increasing the reactor power and temperature. Then the reactor power and temperature are high when the RVVs would open and then during that very particularly, very limited time frame that that occurs, there would be before the reactor trip is actuated, there would be multiple failures of each train, so both trains in EDAS would both have to fail independently, randomly causing the reactor vent valves to open.

So, we provided some additional analysis to show that even in that event, you would maintain core coolability and that coolable geometry, but that would be in a very limited number of scenarios, but even in that situation, we would be safe. That's the proprietary information so we have to defer to the closed session to talk about that. But again, that's the information that we provided the NRC.

We're not confident where they're going to end up and how they're going to evaluate that in Chapter 15 because we haven't seen that Chapter 15 SER. But from a Chapter 8 perspective, which we're talking about today, the augmented requirements that we've put on EDAS including that it would fall under the maintenance rule and that we would need to put provisions into the owner controlled requirements manual, ensure that EDAS has the level of availability and reliability that we rely upon downstream in the various analyses that are considered in Chapter 15. That's, I think, where I can focus on today in this particular open session and we can try to address that.

MEMBER ROBERTS: Okay, that's helpful. So, the concern is the simultaneous ECCS valve opening and SREM causes a different --

(Simultaneous speaking.)

MR. CUMMINGS: And then a failure -- yeah, and then a failure of EDAS to cause that, yeah.

MEMBER ROBERTS: I understand. So, one question is whether that particular scenario is within design basis or outside design basis and that, again, gets into some discussion we had at that proprietary level at the previous meeting, but I was reading out of your Chapter 8, there's a conclusion drawn in Chapter 8 that says, these EDAS and EDAS C functions are not accredited to meet the accepted criteria for design bases of vent analyses in Chapter 15. So, it seems like we would have to have the Chapter 15 discussion --

MR. CUMMINGS: Right.

MEMBER ROBERTS: To really understand that and whether or not we would agree with it.

MR. CUMMINGS: That's right and so just to get a little bit into Chapter 15, we do evaluate loss of EDAS, but we do it at event initiation and not being available. It's really at event initiation that we consider it. We don't consider that smart failure of EDAS in this very kind of limited scenario at the most inopportune time. But that is a Chapter 15 discussion.

MEMBER ROBERTS: Right, so excluding that for Chapter 15 requires using all these, well not mitigations, but augmentations on this slide, are essentially making the system as reliable basically as the safety --

MR. CUMMINGS: Yes.

MEMBER ROBERTS: Related system would be.

MR. CUMMINGS: And that is one of the requirements is to ensure that EDAS has a level of reliability equivalent to a Class 1E system for exactly this reason.

MEMBER ROBERTS: So a level of reliability equivalent to a Class 1E system without calling it a Class 1E, that's where my question kind of started, is trying to understand the gap of what is it you're not doing that it would go to you, who has to do it right.

(Simultaneous speaking.)

MEMBER ROBERTS: Yeah, looking at your

list, it's pretty good here. Maybe we can leave that as an open question to ask the staff what their view as we get to them, but I think I understand now what the story is, which is essentially as good as Class 1E without calling it 1E because you want it to be that reliable to include the scenario from the design basis that has the failure at the exact wrong time.

MR. CUMMINGS: That's right and that reliability is to ensure that we don't have an inadvertent ECCS --

(Simultaneous speaking.)

MEMBER ROBERTS: There's lots of reasons for the system to deal with.

MR. CUMMINGS: That's right. We don't want those ECCS valves to open unless they get a reactor trip signal, right? We don't want that to occur and then have to go back to the gray dock to evacuate and clean up the system, right, but it's not from a safety perspective. If EDAS is either not available or it fails as an event initiator, we've shown in Chapter 15 that that is not a safety issue.

MEMBER ROBERTS: Okay, thanks.

CHAIR KIRCHNER: So, David or Kris, let me just follow up on our earlier conversation about flood zones and internal flooding. Now, you point out here that these, you know, you're obviously going to protect these EDAS systems from natural phenomenon, flooding and environmental conditions, so internal flooding.

This suggests that they're not shared. Are they in separate rooms or do they share the same room? Could you have common mood, common cause failure from internal flooding of the EDAS systems for multiple functions or are you going to separate them?

MR. RICKENBACH: So, they're protected from environmental conditions per GDC 4. Really they sit in their own separate rooms on separate floors of the reactor building and those rooms have to be precluded to be a mild environment by design.

CHAIR KIRCHNER: Right. So, not to belabor it, but I can't help but repeat the point I was trying to make, this is important. You're going through all of these things to ensure the reliability and availability, why wouldn't you define the configuration in layout for these and the reactor building to make sure that, for example, the COL applicant doesn't put them in the basement or wherever? It seems to me that this rises to a level that it should be specified in a standard design.

So, I'll ask the same question of the

staff. What's your position? Are you going to provide some specs on the reactor building that accommodates providing this protection from the environmental conditions?

MR. RICKENBACH: When we specify standard plant design, it's with the understanding that these sets of equipment, EDAS, MPS, are in a defined portion of the building. So, I wouldn't say that the COL applicant has much option to relocate these. My understanding of the flooding analysis, they may have some leeway to address how they want to address flooding, but that wouldn't be by moving EDA or MPS to a different location in the building. It's defined.

MR. CUMMINGS: Yeah, Kris Cummings, NuScale. I think the misnomer even in the earlier discussion on flooding was like there was some perception that it hasn't been specified. We've specified the particular room and location where EDAS, the different trains of EDAS and the MPS are going to be, are intended to be placed.

CHAIR KIRCHNER: And the expectation then is that the build out will follow that specification?

MR. CUMMINGS: That's intended, I mean, again as with any standard design in a COLA, if somebody wants to deviate from it they are, but that's a larger generic issue. We wouldn't anticipate somebody wanting to make that change at this time.

MR. RICKENBACH: Yes, we agree. We want it standardized. We want all of our plants to be the same.

CHAIR KIRCHNER: I belabored that point enough, but okay. Thank you. Is that it, David? Is that the last slide?

MR. RICKENBACH: Yes, that's the last slide.

CHAIR KIRCHNER: Okay.

MR. RICKENBACH: I'll turn it over to Tyler Beck.

CHAIR KIRCHNER: Thank you.

(Simultaneous speaking.)

CHAIR KIRCHNER: Okay, yeah, we're going to do a little mix and match here. For NRC, Sheila, are you going --

MEMBER ROBERTS: Let me ask one more question before we move along.

CHAIR KIRCHNER: Okay.

MEMBER ROBERTS: The FMEA for the EDAS looked, like I said earlier, that they were both adjusting voltage and all. For the non-safety AC systems, did you do a similar FMEA?

MR. RICKENBACH: We didn't.

MEMBER ROBERTS: Because what I'm wondering is things like open phase conditions that can cause some very strange transients into the plant. Did you look at any of the important loads to see if there could be some effect from something like an open phase condition that might take you outside of the bounds of analysis in Chapter 15? Again, not a simple load, but some sort of strange transient on that load?

MR. RICKENBACH: So, a loss of voltage or degraded voltage condition or other electrical transient on our non-safety AC related power system, it doesn't adversely affect the performance of plant safety-related functions. So, we wouldn't include that, so the example of open phase, you can look at it from an aspect of execution functions. There's no equipment to process coupling between our non-safety AC systems and safety-related functions.

MEMBER ROBERTS: Right, but a safety-related function is reliant on having to find the design basis events that need to be protected and part of looking at the bounds of what an electrical system can do, is can it take you outside of the defined transients are?

MR. RICKENBACH: This is a --

MEMBER ROBERTS: Say an oscillating pump, for example, vice a loss pump, you know that kind of thing .

MR. RICKENBACH: I would say this is bounded in Chapter 15 and when we look at items like open phase and oscillating voltage, those types of events don't have a couple into the plant, right? There's no safety-related pumps for instance. The only real coupling is through the MPS system itself.

MEMBER ROBERTS: Right, the transients are defined and then the MPS is shown to protect for those transients and so if you have a transient, it could be worse, but it's currently defined because of something like an open phase condition and presumably you would need to define that as a new transient for analysis or somehow bound it. That's really the question I'm asking is, there's more to it than just the module protective system. There's the transients you're evaluating the MPS against bounded by what the electrical system could do to those loads.

Your plant is not without reactor cooling ponds, it's not clear there's much that could be in that category, so it may be relatively trivial for this design, I just wanted to make sure that you looked at that.

MR. RICKENBACH: Yes.

MEMBER ROBERTS: It's not just about our loss of voltage, there's all these other failure modes and as long as the transients that are assumed in Chapter 15 are bounded by whatever you could possibly do to those loads, then that should be fine.

MR. RICKENBACH: That's correct. That's my understanding of Chapter 15. It bounds from a loss to full flow and then a spectrum in between.

MEMBER ROBERTS: Okay, thanks.

MR. VIVANCO: Good afternoon, everyone. My name is Ricky Vivanco. I'm the Project Manager for Chapter 8 Electric Power. I've been with the NRC for almost three years and before this, I was Senior Actor/Operator at Calvert Cliffs Power Plant.

The time line for Chapter 8 is the same as the previous chapters. We received revision zero in December 2022. We received revision one on October 31, 2023. Chapter 8 performed its audit from March 2023 to August 2023 and generated 24 issues. Fourteen of those issues were resolved in the audit with 10 of them being retracted due to the information presented earlier for their audit issues. No RAIs were issued as a result of the audit.

Joining me are Sheila Ray and Liliana

Ramadan. They're the technical reviewers for this chapter. Again, I'm the project manager and Gatachew Tesfaye was the lead for this project.

This presentation focuses on the acceptability of the design of the electrical power system. Staff discussed their findings and they quickly associated design in the following sections the introduction, offsite power system, onsite power system, station blackout.

The staff utilized a risk-informed, graded approach consistent with the commission SECY-19-0036, to evaluate the augmented quality aspects of EDAS. Based on the information in FSAR Table 8.3-3, staff considered the description of the augmented design provisions adequate. These provisions in conjunction with the availability controls discussed in Chapter 19 support the staff safety conclusions.

I'll open it up to questions there.

MEMBER ROBERTS: Yeah, Tom Roberts again. I'm not quite seeing the connection with that SRM, I'm wondering if you could talk more about that. That SRM was looking at single-failure criteria of inadvertent blackouts. I remember reading and the question was whether or not you really had to have a rigorous application of the single-failure criteria for a scenario where the likelihood was very, very low and then some information said, yeah, you ought to use a little more judgment in scenarios like that.

In this case, there's an electrical distribution system that is essentially the equivalent of Class 1E, although it's got some deviations that we haven't really fully fleshed out yet, but probably related to the battery and the status of how you qualify the side battery to the Class 1E qualification, but everything else is there. So, what you're showing here is that this single-failure criteria for the valve thought process kind of applied to that, where maybe the common feed is the likelihood is pretty low to have the EDAS chose that time to go away for the specific scenario that's going on. So, there was a relatively low likelihood that you could glean from that.

I'm just trying to get more perspective on how that SRM applied.

MR. VIVANCO: I think like you just said we formed the approach of taking into account the low frequency of that smart failure along with considering the availability controls and the augmented qualities is what we used to support our conclusions.

MEMBER ROBERTS: Risk-informed is more

judgment than using a PRA to go do some scenario of comparison. Is that right?

MR. VIVANCO: Chapter 19 does discuss the PRA considerations associated with the EDAS.

MR. MORTON: Ricky, can I step in for a second?

MR. VIVANCO: Wendell Morton, he's the Branch Chief for the Electrical Branch. He's going to speak to it today.

MR. MORTON: Thank you for the intro, I appreciate it. The SRM itself at a fundamental level grants the staff the flexibility to take risk-informed graded approach so that's not necessarily about the valve that was the subject of the SRM, but the flexibility the commission gave the staff to take a risk-informed approach to evaluating these kinds of systems and the classification may not necessarily be on that level. That's the basis of SRM and the risk-informed graded approach is consistent with the commission's flexibility that they grant the staff to make those kinds of approaches. Just to give you some conditional perspective to what Ricky was saying.

MEMBER ROBERTS: From my interpretation, the single-failure criterion is a deterministic criterion that gave you the authority to use judgment and when it's very low, in this case it's the Class 1E definition of an electrical power system that's the equivalent maybe of the single-failure criteria whereas because of the issue with the battery and the current status of qualification methodology for the battery, you can't call it literally Class 1E, but as Kris pointed out, it's the equivalent of Class 1E. So, you're getting into the same place with a slightly less literal interpretation of the regulation. Is that a fair description?

MR. MORTON: I think that's fair, but like Ricky said, combined with the augmentations in place, the process controls they have in place, etc., allows us to get to that place, yes.

MEMBER ROBERTS: Thanks, that makes sense to me.

MR. RICKENBACH: I'll just add on that, that it's not just the performance, it's also consequences, right, and that's where that additional analysis went, which is why we did it was to show that even if this event occurred, this is a non-consequential event. We can get into more of that in Chapter 15 if need be, but that was where we are applying the risk-informed performance based approach, right. Performance based is here's the augmented requirements. So, risk-informed is this does happen much.

MR. VIVANCO: So, in conclusion, while there are differences between the DCA and the SDA design, the staff found that the applicant provided sufficient information to support staff's safety finding.

CHAIR KIRCHNER: Okay, members, any questions on Chapter 8 of the staff or NuScale? Vesna or Dennis, Steve and Charlie, any questions?

MR. BROWN: No.

MEMBER DIMITRIJEVIC: I'm good.

CHAIR KIRCHNER: Thank you. Well, thank you all. You've beat Chapter 3 by about an hour and a half. Thank you very much.

Let's move on, then, to our last chapter for today, which is 14, Initial Test Program. For those of you joining by Teams, we'll pause here for a little bit to change out presenters.

(Whereupon, the above-entitled matter went off the record at 4:29 p.m. and resumed at 4:31 p.m.)

CHAIR KIRCHNER: Okay, we're going to reconvene and turn to Chapter 14 and Tyler Beck from NuScale.

MR. BECK: Hello, my name is Tyler Beck

and I will be presenting Chapter 14. I am the Chapter 14 licensing engineer with NuScale. I've been with NuScale for over two years. Prior to my time at NuScale, I worked for the NRC as a Reactor Systems Engineer in the Generic Communications and Operating Space Branch.

My educational background is a Bachelor's of Science in Nuclear Engineering from the University of Tennessee. Next slide.

This slide has an overview of Chapter 14 and the audit. For Section 14.0, that is just a high level overview of verification programs and it's less than one page. It is unchanged from the DCA. Section 14.1 essentially has the regulatory requirements relevant to the initial test program and ITAAC. It is also unchanged from the DCA.

Section 14.2 is the initial test program and we'll have a slide on that in a couple of slides. Section 14.3 presents the ITAAC selection methodology. Part A includes the ITAAC for the US 460 Standard Design Approval Application. In terms of changes, the changes, these are verification programs and they reflect the design, so the changes are a reflection of the design changes from the DCA to the SDA.

During the audit, there were 22 audit

items directly tied to Chapter 14 or Part A; however, there were several additional audit items from other chapters relating to ITAAC or ITP. Next slide.

The last slide we showed that Section 14.0 and 14.1 are unchanged from the DCA so we're just starting with Section 14.2, which is the initial plant test program. At a high level, the methodology and general content of ITP are unchanged from the DCA. We have revised some test abstracts due to design changes or specific issues from the NRC staff and so an example we have here is there was an audit item resulting in clarification of some test objectives for our ECCS blow down test. We wanted to really clarify the ECCS blow down test sequence and objectives and those were the changes there.

Another change is that we have removed the overhead heavy load handling system interlock tables. Those were in the DCA, Section 14.2, now they are not because those interlocks are described in Chapter 9. And then there have been some minor test updates. If you were to go through and compare the test abstracts from the DCA to SDA, you might find that the test sequences are slightly revised, but functionally, we are still testing the functions and the functions from the DCA to the SDA are largely unchanged. So, those changes are just rearranged testing sequences and approved numbering schemes for ease of operations. Next slide.

Section 14.3 is titled ITAAC. However, for us, it is just the ITAAC selection methodology because Part 8 of the application presents the ITAAC and ITAAC discussions. The selection methodology is largely unchanged from the DCA; however, because of the difference between a design certification and a standard design approval, such as design certifications including Tier 1 information, there is some restructuring on how we refer to things that is different, so you might in DCA have Tier 1 design info now it's top level design features, things like that. However, the selection methodology is largely unchanged. As I said, Part 8 presents the SDA ITAAC and ITAAC discussions. Next slide.

So, the next three slides will talk about the changes of ITAAC between the DCA and SDA. We have those listed out. This slide is for additions and includes the ITAAC we've added. We've added an ITAAC for the passive auto catalytic recombiner. It includes fair final recombination rate, qualification, functional arrangement. We've added ECCS supplemental boron which is a new design feature to the SDA. We've added an ITAAC to verify containment vessel net pre-volume and that was a result of the NRC staff's audit.

We've added ITAAC to verify -- there are new automatic system responses for what's listed in that sub-bullet there so main steam line, splash boiler system, demineralized water system, reactive waste drain system, site cooling wash system. There were alarms in the DCA, however, we have added automatic system response in the SDA and so that's what the ITAAC is verifying.

We've added an ITAAC to verify travel limits of the new fuel elevator and that is because in the SDA, the new fuel elevator has the potential to hold irradiated fuel for inspection, whereas in the DCA, it did not. We've added an ITAAC to verify integrated system validation for human factors engineering, which is a result of the NRC staff's Chapter 18 audit. Next slide.

MR. BROWN: Can I ask a question? On the containment vessel free volume, why do you only do that to the first nuclear power module?

MR. BECK: That came through our negotiations and audit with the NRC staff and --

MR. BROWN: I mean, there's six of them total.

MR. BECK: Yes, so that will be performed for the first MPM. The containment free volume is not -- the modules are standard. The geometry is going to be unchanged module to module and so this is really to reconcile any construction deviances for the first module that is not something that's going to be subject to change between modules.

MR. BROWN: Okay, so you do know in geometry basis then? Construction geometry?

MR. BECK: Yes, how exactly we're going to perform it is not identified right now. That will be performed by the co-applicant, but yes, that is the requirement.

MR. BROWN: Thank you.

MR. BECK: This slide presents the ITAAC we have removed in the SDA from the DCA and simple one-line description as to why. Earlier, you heard about a leak before break, there is no leak before break analysis in the SDA, thus there is no ITAAC.

For Chapter 5, there is not an RVV material surveillance program and so that will be presented with Chapter 5, but as a result, there is no ITAAC associated with that. In the DCA, we're ITAAC verifying ASME Class III conformance for CVCS piping and components. For the SDA, that has been reclassified to ASME B31.1, and so there's no ITAAC for that.

There are no important human actions in the SDA. There was previously an ITAAC verifying new fuel jib crane travel limits; however, in the SDA, it is now a single-failure proof design and it has the potential to travel over spent fuel and so this travel limit still exists.

The DCA had an ITAAC verifying normal main control room lighting and in the SDA that is not a top level design feature. One reason is because there are no important human actions. The DCA had eight-hour battery pack emergency lighting fixtures, those are not included in the SDA and that's in Section 5.3 of the SR. There was an ITAAC verifying the automatic system response to a high radiation signal in the pool surge control system. In the SDA, the automatic action is no longer there. There is an alarm function still, but there's no automatic action.

I left one off of the slide accidentally, but we also removed the ITAAC associated with verifying the attenuating capability of the reactor building's shielding doors. There are no accredited shielding doors in the reactor building for the SDA, thus no ITAAC for that. Next slide.

This is the last slide and it presents the ITAAC that we have changed from the DCA to the SDA. The first one discusses the inability of the drain down of the ultimate heat sink, so in the DCA it was making sure that just truly based off of level. In the SDA, we have piping penetrations that go below the level that we need to maintain and thus, we have an added anti-siphon devices. So, the ITAAC includes the verification of those anti-siphon devices.

We have revised our ITAAC for the single-failure proofness for our overhead heavy load handling system components. There used to be separate ITAAC for the various cranes and now they're just revised into one ITAAC. In the DCA, there was what's called a module lift adapter or module lifting fixture. In the SDA, that is now the lower block assembly and top support structure so the ITAAC reflects that design change.

Then, the last one is the verification of the Rad Waste Building, the RW-IIa, structure. In the DCA, it was RW-IIa and in the SDA, only portions of the building are classified as RW-IIa and so the ITAAC reflects those portions. And that is it for Chapter 14 and Part 8.

CHAIR KIRCHNER: Thank you, Tyler. Before we turn to the NRC, I wanted to point out that Matt Sunseri is the Lead for Chapter 14 on the committee. He joined us at 2:30 Eastern Time and so I'll turn to you first, Matt, do you have any questions of NuScale?

MEMBER SUNSERI: Thanks, Walt. This is Matt Sunseri. I don't have any questions in particular. I thought the chapter looked pretty good from my perspective, that the summaries were representative of the kind of tests I'm accustomed to seeing performed on initial startup plans. I did sample a couple, there's a lot of information there, but I did sample a few of them to make sure they followed their methodology for the ITAAC construction and it looks like they did, so I don't have any concerns or questions about what they've done.

CHAIR KIRCHNER: Thank you. Other members? With that, I'll turn to the NRC staff. Who's going to be the lead? River, are you?

MS. ROHRMAN: Yeah, I'm the --

CHAIR KIRCHNER: Go ahead.

MS. ROHRMAN: Okay.

CHAIR KIRCHNER: Please.

MS. ROHRMAN: Once we get the slides up. Hello, I'm River Rohrman, Project Manager, NRR. With me, I have Angelo Stubbs and Nick Hansing. I will be presenting the staff's review of the NuScale US 460 SDA Chapter 14, Initial Test Programs and Inspections, Tests, Analyses and Acceptance Criteria. Next slide, please.

For an overview of the review process, NuScale submitted revision zero of Chapter 14 on December 31, 2022, and revision one on October 31, 2023. The NRC conducted a regulatory audit of Chapter 14 starting in March 2023 and ending in December 2023. Through the audit, 22 audit issues were identified and resolved, four of which resulted in NuScale submitting supplemental information to address questions and zero RAIs were issued.

The staff completed Chapter 14 review and issued an advanced safety evaluation to support today's ACRS Sub-Committee meeting. Next slide, please.

There are a lot of contributors to the review of Chapter 14 due to the many different topics covered. I'll not be going through each person here, but thank you to everyone who worked on this chapter for your contributions.

The sections of the SDA evaluated in this chapter are Sections 14.2, Initial Test Program or ITP, Section 14.3 and SDA Part 8, Inspections, Tests, Analyses and Acceptance Criteria or ITAAC. As a note, the ITP and ITAAC may change to address information required to make a safety finding and upper chapters as needed. The changes will be discussed in the high upper chapters presentation as noted in the SE. Next slide, please.

The ITP was reviewed and the reviewers found that the design changes between the DCA and SDAA were appropriately captured in the applicant's test programs, middle end revisions. No significant changes to the ITP itself were noted by the staff and staff concluded that the SDAA ITP submittal, as revised, conforms to the NUREG-0800 Standard Review Plan for Additional Test Programs.

A comprehensive review of the following sections was performed and compared to the DCA system, ITAAC and no significant changes to the ITAAC program itself were noted by the staff. The staff concluded that the SDAA ITAAC submittal for these sections, as revised, conforms to the NUREG-0800 Standard Review Plan for Additional Test Programs.

The NCAA proposed piping systems and components ITAAC were reviewed and compared to the DCA. The design changes were appropriately captured in the applicant's proposed ITAAC, such as the addition of the ECCS supplemental boron dissolvers and the CNV lower mixing tubes. The staff concluded that the SDAA proposed piping systems and components ITAAC, as revised, meets the regulatory requirements for the ITAAC as described in the SER.

The SDAA plant systems ITAAC were reviewed and compared to the DCA changes to the plant systems ITAAC used to perform fuel handling and for systems used to conduct heavy load movements. The staff finds that the SDAA plant systems ITAAC submittal, as revised, provides reasonable assurance that the facility built would be constructed and operated in accordance with the license the AEA has amended and the commission's rules and regulations.

The human factors engineering ITAAC were reviewed and while some HFE review activities related to the integrated systems validation were still ongoing, the staff concluded that the SDAA HFE ITAAC submittal, as revised, conforms with the NUREG-0800 Standard Review Plan for Human Factors Engineering.

The containment systems ITAAC were reviewed and compared to the DCA. The significant changes that resulted from Chapter 6 review are that NuScale proposed a one-time ITAAC for the first module built to verify the as built CNV free volume bounds the minimum value used in the containment design basis analysis and NuScale is proposing ITAAC for the passive autocatalytic recombiner as a result. The staff finds that the SDAA containment systems ITAAC, as revised, conforms to the NUREG-0800 Standard Review Plan for Additional Test Programs.

In conclusion, while there are some differences between the DCA and SCA, the staff found that the applicant provided sufficient information to support the staff's safety findings. The staff found that all applicable regulatory requirements were adequately addressed for the design. COL items are provided for programs and site-specific aspects similar to the DC application. Any questions?

CHAIR KIRCHNER: I'll start with Matt. Matt, do you have any questions of the staff?

MEMBER SUNSERI: No, I think the staff did a good job with their safety evaluation. I will just note for the committee though I'm sure we're going to have to questions about the removal of important human actions, you know, based on some of the changes they made. Of course, this is not the chapter to discuss those. We'll discuss those in the individual chapters, but they've added a number of systems that we haven't really dug into how they operate boron addition systems and such like that, so I can't make -- I'm not in a position to make any judgment on whether or not there are any important human actions that need to be verified through ITAAC or not at this stage. We will look at that in, as they are referred to, the high importance chapters. That's all I have.

CHAIR KIRCHNER: Thank you. I have two questions. River, we haven't reviewed yet the addition of the boron dispenser, so perhaps the question awaits when we have that material presented to us, but the applicant, Tyler, talked about functional testing, so I'm curious what you're looking for in terms of the testing of that boron dispenser that was added in the SDA design.

MS. ROHRMAN: Yes, I would defer that to Hanry Wagage online.

MR. WAGAGE: This is Hanry Wagage. I think the boron dispenser is not in the containment round. It must be repositioned. It's not our area. I think the passive recombiner system is in our, not boron dispensing.

(Simultaneous speaking.)

MS. ROHRMAN: That would be Antonio, then?

MR. BARRETT: Yeah, this is Antonio Barrett, Acting Branch Chief for Nuclear Methods --

CHAIR KIRCHNER: Just speak up a little more, please.

MR. BARRETT: Nuclear Methods and Systems, New Reactors Branch. We currently have issued an RAI that's outstanding for the testing of that system and we're still looking through that, that particular process. We're looking for basically an optimal test of the dissolution mixing involved.

CHAIR KIRCHNER: Thank you. Then, my other question, River, would be when you do the pre-volume measurements to verify the geometry and so on as it impacts containment analysis, are you also going to do it in stages so you verify how much water it takes to fill up until you get to the top of fuel level versus the rest of the containment? See, where I'm going with this is that's an important aspect of the NuScale design when you look at the re-flood of the core during ECCS performance. Will you stop somewhere along the line and say okay, this is the free volume up to the top, whatever reference point the RVV, no I misspoke, the RRV or the top of the fuel and then get the gross measurement, which would impact the containment performance drawing blow down.

MR. WAGAGE: This is Hanry Wagage again from Containment and Plant Systems Branch. I put that in the slide. This came from Chapter 6 review, which is ongoing. I think it's not completed yet. We have to wait on that.

CHAIR KIRCHNER: Okay. So, we may hear more about that particular ITAAC after we have Chapter 6?

MS. ROHRMAN: Yeah, that will be discussed in the Chapter 6 presentation.

CHAIR KIRCHNER: Okay. Thank you. Other members and consultants? I overlooked Myron during Chapter 8. Myron, if you're still out there and have any questions, go ahead. Steve and Dennis and Charlie?

DR. BLEY: I'm good.

DR. SCHULTZ: Nothing here.

CHAIR KIRCHNER: Not hearing any further questions, thank you. Thank you for being with us. Okay, members, last call. Okay, well let me summarize and thank NuScale and the staff for your presentations today. We will have summaries on each of these chapters that we will take up at our next full committee meeting in December. Thank you again. At this point, I think I would be remiss if I didn't ask for public comment.

MR. POLICH: Yes.

CHAIR KIRCHNER: So, go ahead, Mike.

MR. SNODDERLY: So, we could release some staff members. Do you still want to have a closed session?

CHAIR KIRCHNER: Unless members feel the need for a closed session, other than Tom's -- and I think Tom got the answer to the question that he thought might require a closed session, so I don't think we require that at this point.

MR. SNODDERLY: Thank you for making a decision that way some staff should be excused.

CHAIR KIRCHNER: We will not have a closed session.

(Simultaneous speaking.)

CHAIR KIRCHNER: And now I need to turn to the public, so if there is anyone here in the room or online who wishes to make a comment, please open up your mic, state your name and affiliation as appropriate and make your comment.

MR. POLICH: This is Tim Polich.

CHAIR KIRCHNER: Tim Polich, go ahead.

MR. POLICH: The discussion on Chapter 3, it seems that the design still needs some work and that there seems to be a lot of analysis that will be performed by a COL applicant. I guess my comment is that this looks like it will potentially result in additional costs for COL applicant to make sure the design is complete and to do additional analysis rather than having it being done in the design certification.

CHAIR KIRCHNER: Thank you, Tim, for your comment. Other comments from the public?

Okay, hearing none, unless there is any further business from members relevant to this topic? Okay, then thank you. We will adjourn our Subcommittee meeting.

(Whereupon, the above-entitled matter went off the record at 4:56 p.m.)

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: ACRS NuScale Design-Centered Subcommittee

Before: NRC

Date: 11-05-24

Place: teleconference

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate complete record of the proceedings.

Court Reporter

October 30, 2024 Docket No. 052-050

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SUBJECT: NuScale Power, LLC Submittal of Presentation Material Entitled “ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8),” PM-175101, Revision 0

The purpose of this submittal is to provide the presentation materials for use during the upcoming Advisory Committee on Reactor Safeguards (ACRS) NuScale Subcommittee Meeting on November 5, 2024. The materials support NuScale’s presentation of the subject chapters of the US460 Standard Design Approval Application.

The enclosure to this letter is the nonproprietary presentation entitled “ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8),” PM-175101, Revision 0.

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Jim Osborn at 541-360-0693 or at josborn@nuscalepower.com.

Sincerely,

Mark W. Shaver

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Enclosure 1: “ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8),” PM-175101, Revision 0

Enclosure 1:

"ACRS Subcommittee Meeting (Open Session) Chapters 3, 8, and 14 (including Part 8),"
PM-175101, Revision 0

ACRS Subcommittee Meeting
(Open Session)

November 5, 2024

Chapters 3, 8, and 14 (including Part 8)

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Chapter 3

Design of Structures, Systems, Components, and Equipment

(Excluding Sections 3.7, 3.8, and 3.9.2)

November 5, 2024

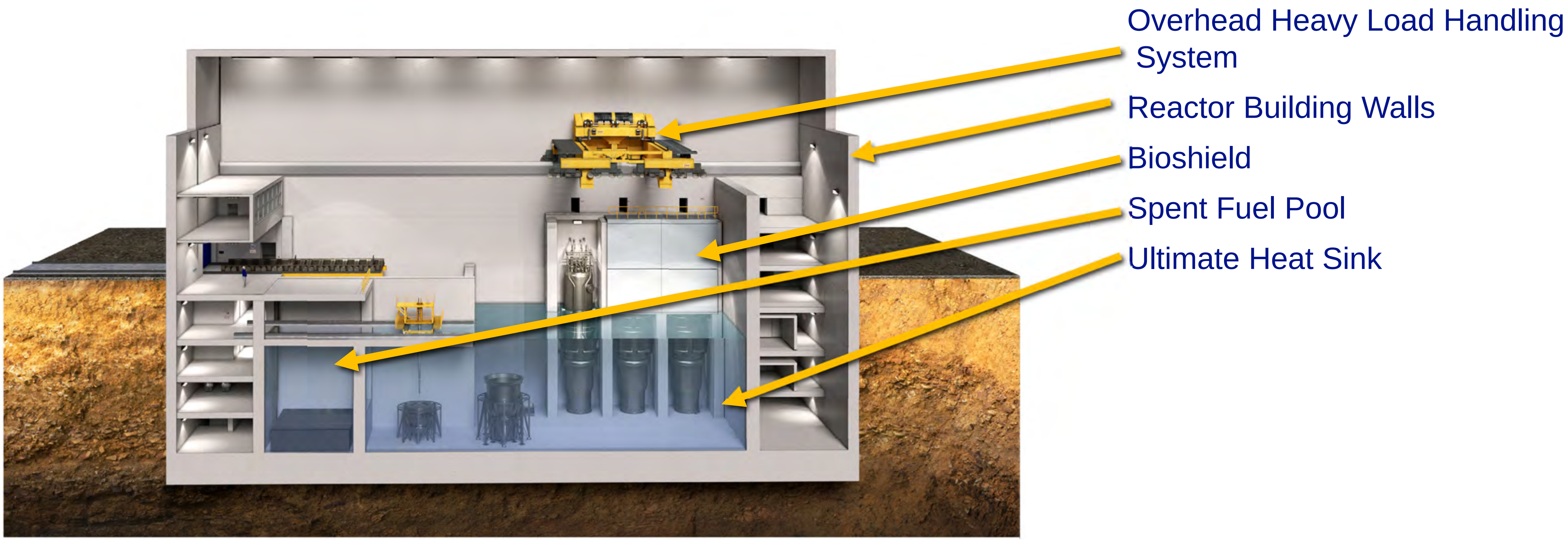
Presenters:

Peter Shaw, Andrea Mota, Daniel Diefendorf,
and Gene Eckholt

Chapter 3 Overview

- Chapter 3 describes the methodologies for design of structures, systems, and components
- SDAA is a derivative of the DCA design
- Presentation will focus on high level design and methodology changes and important audit questions and RAIs
- SDAA structures reflect 6 modules (from 12 modules in the DCA) and necessitates updated civil analysis with unchanged design basis
- SDAA design adopted the 2017 ASME BPV Code and 2017 ASME OM Code requirements

US460 Reactor Building Overview



Chapter 3 - Design of Structures, Systems, Components and Equipment

- Section 3.1 – Conformance with U.S. Nuclear Regulatory Commission General Design Criteria
- Section 3.2 – Classification of Structures, Systems, and Components
- Section 3.3 – Wind and Tornado Loadings
- Section 3.4 – Water Level (Flood) Design
- Section 3.5 – Missile Protection
- Section 3.6 – Protection against Dynamic Effects Associated with Postulated Rupture of Piping
- Section 3.9 – Mechanical Systems and Components (excluding 3.9.2)
- Section 3.10 – Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment
- Section 3.11 – Environmental Qualification of Mechanical and Electrical Equipment
- Section 3.12 – ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Associated Supports
- Section 3.13 – Threaded Fasteners (ASME Code Class 1, 2, and 3)
- Appendix 3C – Methodology for Environmental Qualification of Electrical and Mechanical Equipment

Section 3.1 – Conformance with U.S. Nuclear Regulatory Commission General Design Criteria

- Differences from DCA
  - General design criteria conformance is unchanged from DCA with the following exceptions:
    - GDC 27 conformance simplified for SDA with emergency core cooling system supplemental boron
      - Further discussion in Chapters 4, 6, and 15
    - GDC 32 lower RPV changed to stainless steel so no material surveillance required, Exemption 6 requested
      - Further discussion in Chapter 5
    - GDC 41, PDC 41 updated with passive autocatalytic recombiner maintaining inert atmosphere
      - Further discussion in Chapter 6
      - Similar update to GDC 42 and GDC 43

- Audit Results
  - No audit questions

- RAI Results
  - No RAI questions

Section 3.2 – Classification of Structures, Systems, and Components

- Differences from DCA
  - DCA Table 3.2-1 split to align with guidance for Regulatory Guide (RG) 1.26 and 1.29
    - SDAA Table 3.2-1 lists seismic classification of buildings
    - SDAA Table 3.2-2 lists Seismic Category I pressure retaining mechanical systems and components
  - Specific component classifications moved to system chapters
  - COL Item 3.2-1 removed, no applicants expected to add components to these tables in a COL application

- Audit Results
  - No audit questions

- RAI Results
  - No RAI questions

Section 3.3 – Wind and Tornado Loadings

- Differences from DCA
  - SDAA uses more conservative wind loads than required by regulatory guidance to consolidate analysis

- Audit Results
  - Eight audit questions resolved
  - Clarifications in the FSAR to specify which codes inform wind speeds and importance factors

- RAI Results
  - No RAI questions

Section 3.4 – Water Level (Flood) Design

- Differences from DCA
  - SDAA evaluates flood zones instead of rooms
  - COL Items removed for clarification, and to reflect removal of the personnel access tunnel from Reactor Building to Control Building (CRB)

- Audit Results
  - 17 audit questions resolved

- RAI Results
  - RAI 10167 (Question 3.4.1-3)
    - Updated considerations and assumptions used in the flooding analyses
    - Added tables for flooding sources and flooding zones
    - COL Item 3.4-2 updated to clarify the on-site program will be consistent with Section 3.4.1 methodology and flood levels

Section 3.5 – Missile Protection

- Differences from DCA
  - No essential equipment and no turbine missile evaluation for CRB

- Audit Results
  - 12 audit questions resolved
  - Added FSAR clarification regarding CRB and no essential equipment, therefore no turbine missile evaluation required
  - Added inputs used in the turbine analysis and a table for turbine missile parameters
  - Added a table identifying essential structures, systems, components and their locations
  - Added missile parameters for RW-IIa structures

- RAI Results
  - No RAI questions

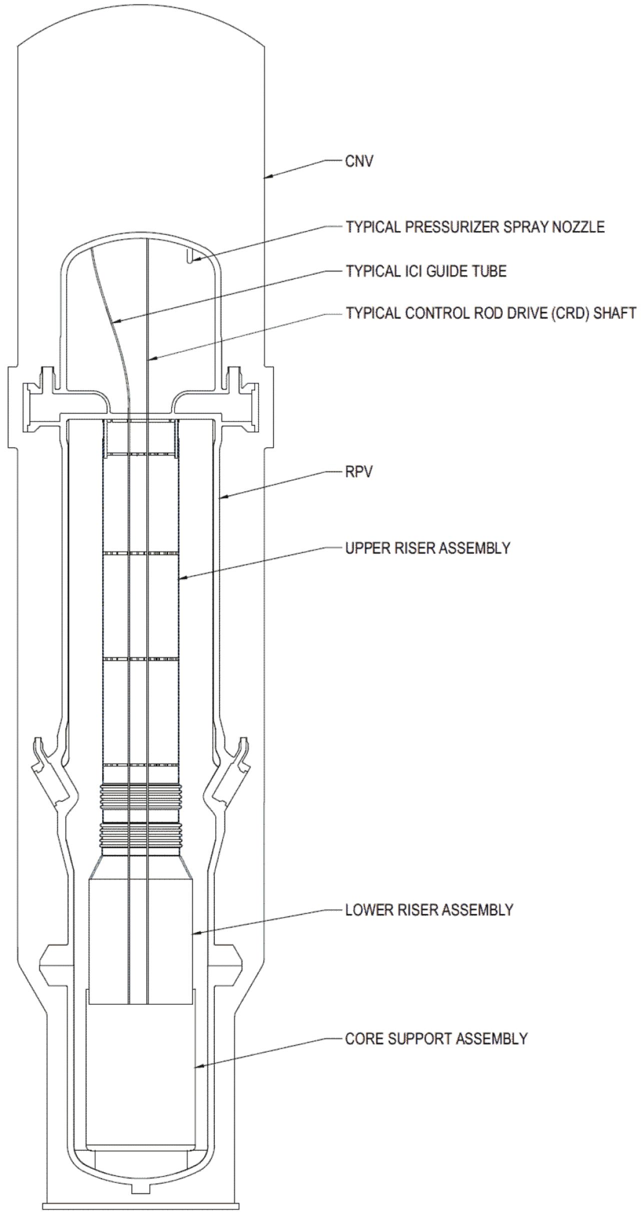
Section 3.6 – Protection against Dynamic Effects Associated with Postulated Rupture of Piping

- Differences from DCA
  - Postulated pipe rupture hazards analysis updated for the SDA design
  - Leak-before-break methodology replaced with Branch Technical Position (BTP) 3-4 B.1(ii) methodology
- Five Audit questions resolved
- RAI results
  - RAI 10134 (Question 3.6.3-1)
    - Provided clarification on methodology change from leak-before-break to BTP 3-4 B.1 (ii)
    - Resulted in no changes to the SDA
  - RAI 10135 (Question 3.6.2.7-2)
    - Provided clarification on the leakage detection system in regards to RG 1.45
    - Resulted in no changes to the SDA
  - RAI 10177 (Question 3.6.2-2)
    - Demonstrated compliance with BTP 3-4 requirements
    - Emphasized margin to demonstrate robustness of the design
    - Weld examinations clarified in the FSAR

Section 3.9.1 – Special Topics for Mechanical Components

- Differences from DCA
  - Additional transients: density wave oscillations, loss of feedwater, initial test program, secondary leakage tests, control rod drive system piping failure
  - Removed transients: hydrogen detonation and hydrogen detonation with deflagration-to-detonation transition
  - Transients with cycle changes: containment flooding and drain, power ascent from hot shutdown, and turbine trip without bypass
- Audit Results
  - Three audit questions resolved
- RAI Results
  - No RAI questions

Detail from FSAR Figure 3.9-1



Section 3.9.2 – Dynamic Testing and Analysis of Systems, Components, and Equipment

- To be presented at a later ACRS meeting

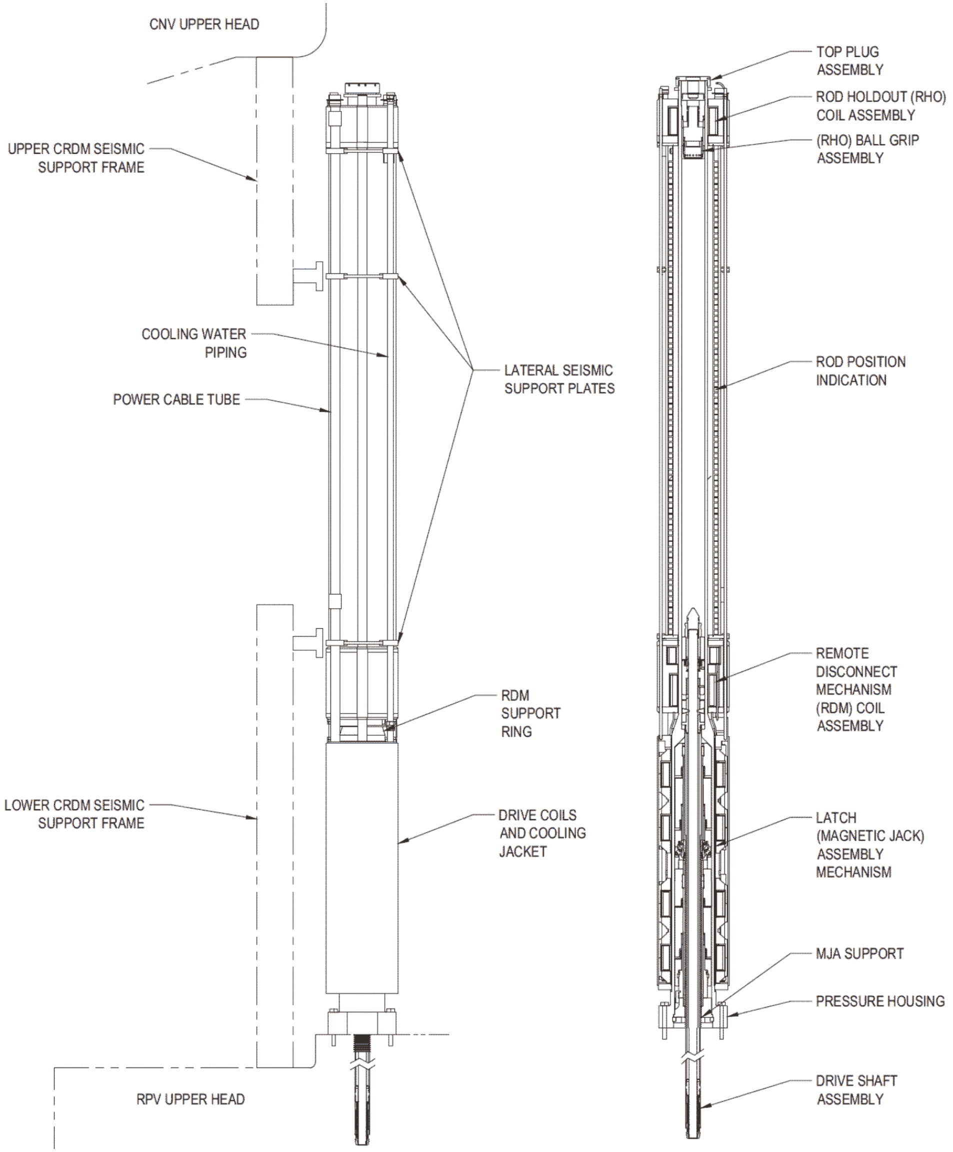
Section 3.9.3 – ASME Code Class 1, 2, 3 and Non-Code Components, Component Supports, and Core Support Structures

- Differences from DCA
  - Updated to the 2017 Edition of ASME BPVC
- Audit Results
  - 12 audit questions resolved
- RAI Results
  - RAI 10150 (Question 3.9.3-11) response submitted
    - Provided additional information for the RPV flange bolted connections
    - Resulted in no changes to SDAA

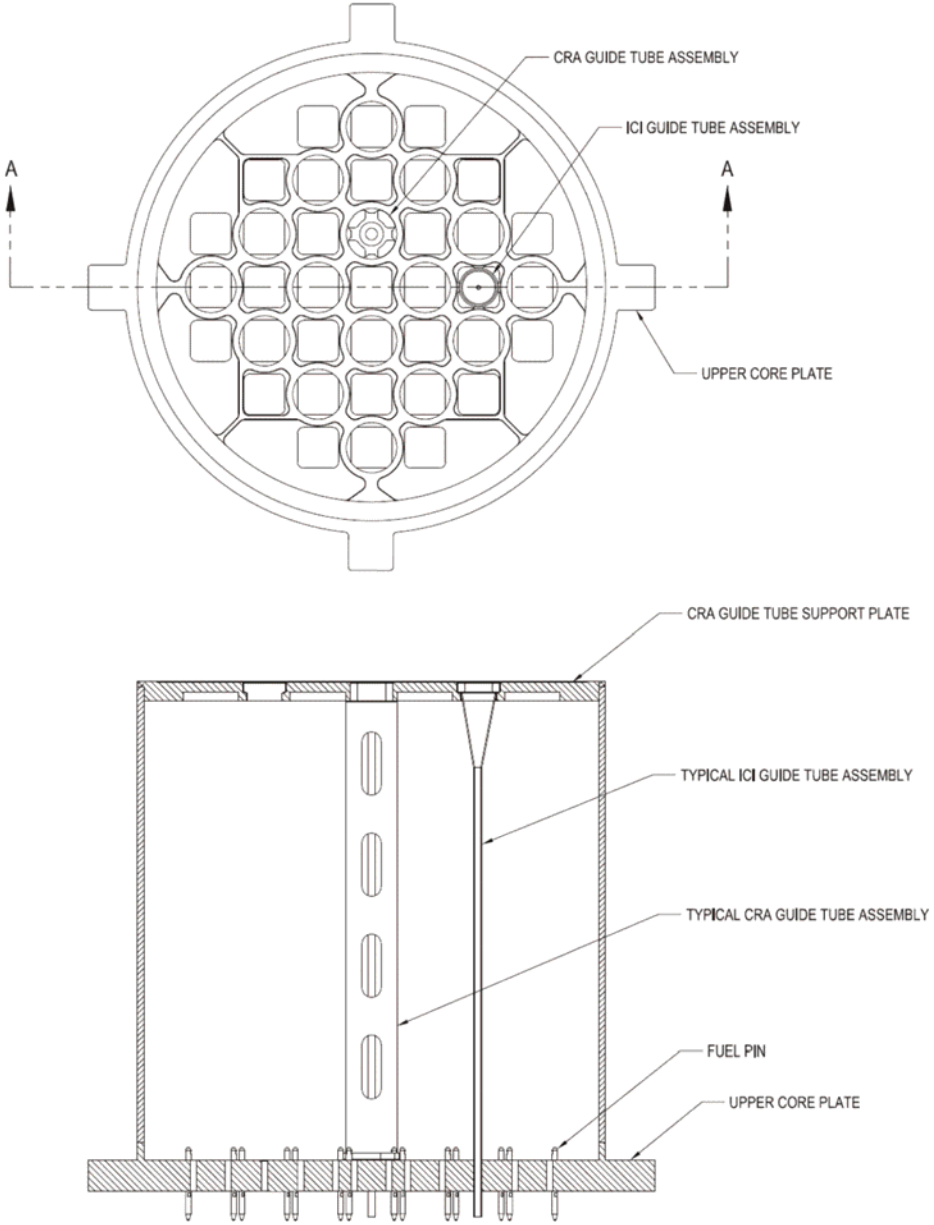
Section 3.9.4 – Control Rod Drive System

- Differences from DCA
  - Change from welded connection to bolted connection
- Audit Results
  - Seven audit questions resolved
- RAI Results
  - RAI 10131 (Question 3.9.4-8)
    - Provided additional information for steam generator set screws
    - Added additional augmented visual examinations
  - RAI 10131 (Question 3.9.4-9)
    - Provided additional information for the control rod drive mechanism housings and associated connections
    - Resulted in no changes to the SDAA

Detail from FSAR Figure 4.6-2



Detail from FSAR Figure 3.9-3



Section 3.9.5 – Reactor Vessel Internals

- Differences from DCA
  - Upper Steam Generator Support – Reclassified from internal structure to a Class 1 Support
- Audit Results
  - No audit questions
- RAI Results
  - No RAI questions

Section 3.9.6 – Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints

- Differences from DCA
  - Updated requirements from ASME OM Code, 2012 Edition to ASME OM Code, 2017 Edition
  - Updated to ASME QME-1-2017
  - Updated requirements from 10 CFR 50.55a for New Reactors
- Audit Results
  - 16 audit questions resolved
- RAI Results
  - No RAI questions

Section 3.10 – Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment

- Differences from DCA
  - Newer versions of regulatory guidance and industry standards adopted
  - Three COL Items related to administration of qualification program removed
    - A COL Application will incorporate the seismic and dynamic qualification program described in the SDA by reference
- Audit Results
  - One audit question resolved
- RAI Results
  - No RAI questions

Section 3.11 – Environmental Qualification of Mechanical and Electrical Equipment

- Differences from DCA
  - List of environmentally qualified equipment updated to reflect US460 design

- 11 audit questions resolved
  - Created new equipment qualification zones for control building and for harsh environments with electronic equipment
  - Clarified application of industry standards
  - Evaluated design-basis accident dose contributions for the limiting collapsed liquid level event

- RAI Results
  - No RAI questions

Appendix 3C – Methodology for Environmental Qualification of Electrical and Mechanical Equipment

- Differences from DCA
    - Updated to reflect US460 design
        - Environmental qualification zones
        - Harsh/Mild environment areas
        - Post-accident operating times
        - Normal operating conditions
        - Design-basis event environment conditions
        - Limiting design-basis accident environmental qualification radiation dose
- Audit Results
    - One audit question resolved
- RAI Results
    - No RAI questions

Section 3.12 – ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Associated Supports

- Differences from DCA
  - Removed reference to NUREG-1367, “Functional Capability of Piping Systems”
- Audit Results
  - 12 audit questions resolved
    - Clarified how the functional capability guidance of NUREG-1367 is addressed by NuScale
- RAI Results
  - No RAI questions

Section 3.13 –Threaded Fasteners (ASME Code Class 1, 2, and 3)

- Differences from DCA
  - Containment vessel pressure retaining threaded fasteners are examined in accordance with ASME BPVC, Section XI, Subsection IWE.

- Audit Results
  - Three audit questions resolved

- RAI Results
  - RAI 10133 (Question 3.13-1) response submitted
    - Added augmented visual examination requirements for ASME Class 1 threaded inserts and seal welds

Chapter 8
Electric Power

November 5, 2024

Presenter: David Rickenbach

Chapter 8 Overview

- Section 8.1 – Overview
- Section 8.2 – Offsite Power Systems
- Section 8.3 – Onsite Power Systems
- Section 8.4 – Station Blackout (SBO)

- SDAA changes from DCA :
  - Conforming changes in SDAA reflect US460 standard design, which is functionally equivalent to the DCA
  - DCA included six COL items, none in the SDAA
  - FSAR content optimized from the US600 DCA
    - Example: Removed specific wattage of plant loads from FSAR tables

- 14 audit questions resolved

Overview of Design Changes

- AC power
  - Common load AC power provided by redundant transformers
  - High voltage AC electrical distribution configuration
  - Backup power supply system configuration
- DC power
  - Single battery string for each augmented DC power system (EDAS) power channel
  - EDAS divisions are physically separated in independent rooms
  - EDAS includes power channel cross-connects

Section 8.1 – Overview

- High-level overview of onsite and offsite power sources
- Technical content reflects US460 plant systems instead of US600 plant systems
- GDC conformance is unchanged from US600 DCA

- Audit Results
  - FSAR Table 8.1-1 revised to include more information for the US460 standard plant design, such as the IEEE standards applicable to EDAS
- RAI Results
  - No RAI questions

Section 8.2 – Offsite Power Systems

- Technical content is generally unchanged
- COL items removed in SDAA:
  - Removed COL Item 8.2-1, description of the site-specific plant switchyard
  - Removed COL Item 8.2-2, description of the site-specific offsite power (grid study)
  - Removed COL Item 8.2-3, description of required testing
  - With GDC 17 and 18 exemption, site does not rely on offsite power
    - DCA COL items were unnecessary
- Audit Results
  - No audit questions
- RAI Results
  - No RAI questions

Section 8.3 – Onsite Power Systems

- Technical content is revised to reflect design on US460 electric power systems
- COL items removed in SDAA:
  - Removed COL Item 8.3-1, as the US460 design does not have AAPS
  - Removed COL Item 8.3-2, no electrical heat tracing system: not required for a safety finding in DCA
  - Removed COL Item 8.3-3, site-specific information was not needed to demonstrate compliance with RG 1.204 in DCA
    - US460 standard design maintains conformance with RG 1.204

- Audit Results
  - Addition of Table 8.3-3 to describe EDAS augmented system design, qualification, and quality assurance provisions

- RAI Results
  - No RAI questions

Section 8.4 – Station Blackout

- The US460 SBO is similar to the DCA.
- An SBO does not does not pose a significant challenge to the plant, because the plant does not rely on AC power for performing safety functions. A safe and stable shutdown is automatically achieved and maintained for 72 hours without operator actions.

Reliability and Availability of EDAS

- EDAS batteries are environmentally qualified per IEEE 323
- Portions of the nonsafety-related EDAS supplying DC power to ECCS valves are augmented:
  - SC-I components
  - Protected from natural phenomena (GDC 2)
  - Protected from environmental conditions (GDC 4)
  - Not shared between modules (GDC 5)
  - Protected from fire per RG 1.189 (GDC 3)
  - Include physical independence per RG 1.75
  - Separated into redundant load groups
  - Designed to be single-failure proof per RG 1.53
- Validated EDAS is within the scope of the Maintenance Rule Program
- Included EDAS in owner-controlled requirements manual

Chapter 14 (including Part 8) Initial Test Program and ITAAC

November 5, 2024

Presenter: Tyler Beck

NUSCALE™ Power for all humankind

Chapter 14 Overview

- Section 14.0 – Verification Program (overview)
  - Section 14.0 is unchanged from the DCA
- Section 14.1 – Specific Information to be Addressed for the Initial Plant Test Program (describes relevant regulations)
  - Section 14.1 is unchanged from the DCA
- Section 14.2 – Initial Plant Test Program (ITP)
- Section 14.3 – Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC), including the ITAAC selection methodology
- Part 8 includes the ITAAC for the US460 standard plant design
- Changes from the DCA generally reflect system design changes to the US460
- 22 audit items directly in Chapter 14 or Part 8
  - Several additional audit items tied to ITP or ITAAC originate through other chapters

Section 14.2 – Initial Plant Test Program

- The methodology and general content of ITP is unchanged from the DCA
- Revised test abstracts are due to design changes or specific issues from the NRC staff
  - Example: Audit item request resulting in clarification of test objectives for the emergency core cooling system (ECCS) blowdown test (e.g., “Verify ECCS RRVs remain closed above the IAB block threshold differential pressure setpoint”)
- Overhead heavy load handling system interlock tables removed from Section 14.2
  - Interlocks described in Chapter 9
- Test updates to reflect ease of testing and operations (e.g., rearranged testing sequences, improved numbering scheme for test method)

Section 14.3 – Inspections, Tests, Analyses, and Acceptance Criteria

- Section 14.3 presents the ITAAC selection methodology
  - ITAAC selection methodology is unchanged from DCA
  - DCA Section 14.3 reflected ITAAC being included in Tier 1 → there is no Tier 1 for SDAA
  - DCA Section 14.3 included ITAAC discussions and → SDAA includes these in Part 8
- Part 8 presents the SDAA ITAAC and associated ITAAC discussions
  - This information was included in Tier 1 and FSAR Section 14.3 in the DCA

Part 8 – ITAAC

- SDAA ITAAC additions:
  - Passive autocatalytic recombiner
    - ITAAC verifying recombination rate, qualification, functional arrangement
  - ITAAC verifying functional arrangement for ECCS supplemental boron
  - ITAAC verifying containment vessel net free volume (applicable to first NuScale Power Module only)
  - ITAAC verifying automatic system response to new high radiation signals:
    - New automatic high radiation actions in main steam lines, auxiliary boiler system, demineralized water system, radioactive drain waste system, and site cooling water system
  - ITAAC verifying travel limits of the new fuel elevator
  - ITAAC verifying integrated system validation for Human Factors Engineering

Part 8 – ITAAC (continued)

- SDAA ITAAC removal based on design changes:
  - ITAAC verifying leak-before-break (LBB) analysis → no LBB analysis (Section 3.6)
  - ITAAC related to RPV material surveillance specimens → no RPV material surveillance program (Section 5.3)
  - ITAAC verifying ASME design and data reports for Class III chemical and volume control system piping and components → reclassified to ASME B31.1 piping (Section 9.3.4)
  - ITAAC verifying controls for important human actions → no important human actions (Section 18.6)
  - ITAAC verifying the new fuel jib crane travel limits → no travel limits due to single-failure proof design (Section 9.1.4)
  - ITAAC verifying normal main control room lighting → not a top-level design feature (Section 14.3)
  - ITAAC verifying 8-hour battery-pack emergency lighting fixtures → not included in the design (Section 9.5.3)
  - ITAAC verifying automatic system response to high radiation signal in pool surge control system → this automatic system action is not included in the design (Sections 9.1.3 and 11.5)

Part 8 – ITAAC (continued)

- SDAA ITAAC updates:
  - ITAAC verifying inability for drain down of ultimate heat sink → revised to include anti-siphon devices on piping that extends below 49.5 ft pool level (Section 9.1.3)
  - ITAAC verifying single-failure proof overhead heavy load handling system components → revised to one ITAAC
  - ITAAC verifying features of the module lift adapter and module lifting fixture → incorporated into lower block assembly and top support structure (Section 9.1.5)
  - ITAAC verifying Radioactive Waste Building as an RW-IIa structure → revised to reflect only the RW-IIa portions of the building (Section 3.8.4)

Acronyms

ACRS	Advisory Committee on Reactor Safeguards
ASME	American Society of Mechanical Engineers
BDG	Backup Diesel Generator
BTP	Branch Technical Position
BPVC	Boiler and Pressure Vessel Code
COL	Combined Operating License
CRB	Control Building
DCA	Design Certification Application
ECCS	Emergency Core Cooling System
EDAS	Augmented DC Power System
EQ	Environmental Qualification
FSAR	Final Safety Analysis Report
GDC	General Design Criterion
IAB	Inadvertent Actuation Block
IEEE	Institute of Electrical and Electronics Engineers
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
ITP	Initial Test Program
NPS	Nominal Pipe Size
NRC	Nuclear Regulatory Commission
OM	Operation and Maintenance
PDC	Principal Design Criteria
RAI	Request for Additional Information
RG	Regulatory Guidance
RPV	Reactor Pressure Vessel
RRV	Reactor Recirculation Valve
RWB	Radioactive Waste Building
SDAA	Standard Design Approval Application
SDA	Standard Design Approval

Presentation to the Advisory Committee on Reactor Safeguards Subcommittee Staff Review of NuScale's US460 Standard Design Approval Application Final Safety Analysis Report, Revision 1

Chapters 3 (Except Sections 3.7, 3.8, 3.9.2), 8, and 14

November 5, 2024
(Open Session)

Non-Proprietary

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

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NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

Overview

- NuScale submitted Chapter 3, “Design of Structures, Systems, Components and Equipment,” Revision 1, of the NuScale SDAA FSAR on October 31, 2023.
- NRC performed a regulatory audit as part of its review of Chapter 3, from March 2023 to December 2023.
- Questions raised during the audit were resolved within the audit. Seven RAIs were issued.
- The staff completed the review of Chapter 3 (Except for Sections 3.7, 3.8, 3.9.2) and issued an advanced safety evaluation to support the ACRS Subcommittee meeting.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

<u>Sections Evaluated</u>

- Section 3.1 – Conformance with the U.S. Nuclear Regulatory Commission General Design Criteria
- Section 3.2 – Classification of Structures, Systems, and Components
- Section 3.3 – Wind and Tornado Loading
- Section 3.4 – Water Level (Flood) Design
- Section 3.5 – Missile Protection
- Section 3.6 - Protection against Dynamic Effects Associated with the Postulated Rupture of Piping
- Section 3.9 (except 3.9.2) - Mechanical Systems and Components
- Section 3.10 - Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
- Section 3.11 - Environmental Qualification of Mechanical and Electrical Equipment –
- Section 3.12 - ASME BPV Code Class 1, 2, and 3 Piping Systems and Associated Support Design
- Section 3.13 - Threaded Fasteners—ASME BPV Code Class 1, 2, and 3

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NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):

- Sections 3.1 Conformance with the U.S. Nuclear Regulatory Commission General Design Criteria
  - Discussed in applicable sections of the SE.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):

- Sections 3.2 Classification of Structures, Systems, and Components
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale provided SSC seismic classification of Category I, II and III in FSAR Tables 3.2-1 and 3.2-2, consistent with regulations and guidance.
  - SDAA SE conclusion is the same as DCA SE conclusion.

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NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.3 Wind and Tornado Loading
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - High wind speed 190 mph and maximum tornado wind speed 270 mph.
    - Using ASCE/SEI 7-16 to establish the wind load pressure for RW-IIa structures.
  - NuScale provided adequate justification for applying the wind load pressure on the RW-IIa structures by using ASCE/SEI 7-16.
  - SDAA SE conclusion is the same as DCA SE conclusion.
- 7 Audit Questions
  - All were resolved during the audit.

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NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.4.1 Internal Flood Protection for Onsite Equipment Failure
  - Significant differences between NuScale DCA FSAR and SDAA FSAR.
    - Flood analysis methodology defined bounding flood levels for building zones (individual rooms not discussed, such as battery rooms or instrument rooms).
    - Maximum SDAA flood heights are significantly greater than DCA.
    - Location of SSC subject to flood protection not identified.
  - NuScale provided
    - Flood analysis results table of zone, limiting flood source, and max flood height
    - COL Items 3.5-1, 3.5-2 and 3.5-3 confirm the final location and mitigation of SSC subject to flood
  - SDAA SE conclusion is the same as DCA SE conclusion, with addition of COL applicant to further evaluate SSC protection from flood levels.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.4.2 Flood Protection from External Sources
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale provided:
    - The analysis procedures to transform the static and dynamic effects of the highest flood and groundwater levels into effective loads.
    - COL Items 3.4-4 and 3.4-5.
  - SDAA SE conclusion is the same as DCA SE conclusion.
- 11 Audit Questions
  - All were resolved during the audit.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.1.1 Internally-Generated Missiles (Outside Containment)
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale provided:
    - The evaluation of internally-generated missile from plant equipment and credibility of missiles.
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.1.2 Internally-Generated Missiles (Inside Containment)
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale described:
    - no credibility of missiles inside containment based on plant design.
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.1.3 Turbine Missile
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Increased bounding turbine missile parameters - mass and velocity (77MWe vs 50 MWe turbine)
    - Orientation of Control Building (CRB) is more favorable with regard to turbine missile trajectory; however, the CRB is not considered essential to be protected from turbine missiles (high trajectory)
  - NuScale provided:
    - Bounding missile parameters and barriers analysis of Reactor Building (discussed in Section 3.5.3 of the SER)
    - SCC required to be protected
    - COL Items 3.5-1 and 3.5-3- demonstrate site specific turbine missile parameters are bounded by analysis, and evaluate other nearby facilities turbine parameters
  - SDAA SE conclusion is the same as DCA SE conclusion that essential SSCs are protected from turbine missiles using barriers.
- 2 Audit Questions
  - All were resolved in audit

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.1.4 Missiles Generated by Tornadoes and Extreme Winds
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale described:
    - Defined missile types and parameters from extreme wind missiles evaluated in design.
    - COL 3.5-2 to confirm automobile missile velocity and altitude of impact parameters will bound extreme wind conditions at site
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.1.5 Site Proximity Missiles (Except Aircraft)
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale provided:
    - COL Item 3.5-3 to evaluate site-specific hazards from nearby or co-located facilities for more energetic missiles than defined in SDAA
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.2 Structures, Systems, and Components to be Protected from External Missiles
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - NuScale provided:
    - Safety-related and risk significant SSC that must be protected are from external missiles are located inside Seismic Category I RXB and Seismic Category I portions of CRB.
    - CRB is not considered essential to be protected from turbine missiles (see slide for Section 3.5.1.3)
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.5.3 Barrier Design Procedures
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Steel-Plate Composite Walls (not available for DCA)
    - Steel Barriers (not available for DCA)
  - NuScale provided:
    - Three-step design approach based on Bruhl Equations to prevent perforation of SC walls from missile impacts.
    - Ballistic Research Laboratory (BRL) Formula to determine the minimum steel missile barriers with 25% thickness increase.
  - SDAA SE conclusion is the same as DCA SE conclusion except for Steel-Plate Composite Walls and Steel Barriers.
- 8 Audit Questions
  - All were resolved during the audit.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.6 "Protection against Dynamic Effects Associated with the Postulated Rupture of Piping"
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - LBB methodology no longer used for MSS and FWS inside CNV – BEZ to use BTP 3-4
    - Leak Detection sensitivity changed from 0.005 gpm to 0.01 gpm - no LBB
    - Added CITF between CNV Nozzle safe end and CIV for lines outside CNV in the BEZ under Bioshield
  - NuScale provided:
    - Preliminary analysis results for MSS & FWS show acceptability for change to BTP 3-4
    - Leakage detection sensitivity change, stated above, meets RG 1.45 limit of 0.5 gpm
    - Preliminary analysis results for welds in BEZ outside CNV under bioshield justifies break exclusion (with CITF)
    - Preliminary stress analysis for ECCS RRV/RVV bolted connections with threaded inserts (unchanged from DCA) is representative for other bolted connections with threaded inserts
  - 5 Audit Questions and 3 RAIs - resolved
  - SDAA SE conclusion is the same as DCA SE conclusion

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.9.1 "Special Topics for Mechanical Components"
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Heatup rate for Reactor Heatup to Hot Shutdown transient changed
  - NuScale provided:
    - The final component stress analysis will use the latest transients' input for ITAAC.
  - SDAA SE conclusion is the same as DCA SE conclusion
  - This does not include evaluation of DWO

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.9.3 "ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures"
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Upper and lower sections of the Reactor Vessel are constructed from different materials that have different coefficients of thermal expansion, which is considered in the stress qualification of the closure bolts and flanges.
  - NuScale provided:
    - Discussion of bolted connection and its design
    - Preliminary FEA results
  - SDAA SE conclusion is the same as DCA SE conclusion

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.9.4 "Control Rod Drive Systems"
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Use of DCA drop and shaft alignment testing for SDAA design
    - Use of threaded connections instead of welded connections between CRDM and RPV (further discussed in Section 3.13)
    - Rod holdout mechanism feature
    - Steam generator tube support assembly (consider impact to CRDS)
  - NuScale provided:
    - Adequate justification to apply DCA testing to SDAA design, reconciling differences.
    - Analysis of threaded connections (discussed in Section 3.13)
    - Justification that rod holdout mechanism feature would not adversely impact safety function of inserting rods
    - Details of assemblies, proposed inspections to monitor for degradation
  - SDAA SE conclusion is the same as DCA SE conclusion.
  - Audit Questions and RAIs:
    - 7 Audit Questions were resolved in audit
    - 2 RAIs resolved

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.9.5 "Reactor Pressure Vessel Internals"
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.9.6, “Functional Design, Qualification, and Inservice Testing [IST] Programs for Pumps, Valves, and Dynamic Restraints”
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Redesign of ECCS Valve System requiring 10 CFR 50.43(e) testing and lessons learned to plan for ASME QME-1 qualification testing
    - Need to address 2017 Edition of ASME OM Code with motor-operated valve and air-operated valve diagnostic testing requirements beyond 2012 Edition in DCA
  - NuScale provided:
    - Audit access to ECCS valve system proof-of-concept test specification and reports to support compliance with 10 CFR 50.43(e).
    - Updated relief and alternative requests to reflect 2017 Edition of ASME OM Code
    - Draft revision to FSAR and ECCS test description in response to NRC review and audit findings.
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Section 3.11, “Environmental Qualification of Mechanical and Electrical Equipment”
  - Significant differences between NuScale DCA FSAR and SDAA FSAR include:
    - Changes to FSAR Table 3.11-1 for equipment and qualification
    - Potential use of IEEE standards not endorsed by NRC regulatory guides
    - Chapter 15 accident scenarios with lower coolant levels for longer duration than DCA
  - NuScale provided:
    - Adequate justification for NRC staff to rely on past experience from DCA review to inform SDAA review.
    - Proposed FSAR revisions to support NRC safety findings.
  - Conclusion:
    - The staff found that all applicable regulatory requirements were adequately addressed.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.12 ASME BPV Code Class 1, 2, and 3 Piping Systems and Associated Support Design
  - There are no significant differences between NuScale DCA FSAR and SDAA FSAR.
  - SDAA SE conclusion is the same as DCA SE conclusion.

NuScale SDAA FSAR Chapter 3 Review

(Except for Sections 3.7, 3.8, 3.9.2)

- **NuScale DCA FSAR Chapter 3 (Rev. 5) vs SDAA FSAR Chapter 3 (Rev. 1):**
- Sections 3.13 Threaded Fasteners—ASME BPV Code Class 1, 2, and 3
  - Significant differences between NuScale DCA FSAR and SDAA FSAR:
    - The RVVs and RRVs were changed to be bolted directly to the reactor vessel nozzle
      - These four bolted flange connections were classified as break exclusion areas
    - Added augmented examination requirements for ASME Class 1 threaded inserts and seal welds
  - NuScale provided:
    - Engineering study of stresses of the bolted flange connections that adequately show that the probability of gross rupture of the ECCS valves bolted connections is extremely low
  - SDAA SE conclusion is the same as DCA SE conclusion.
    - Sampling plan and expansion criteria for the steam and feedwater plenum that can be credited for RVV and RRV break exclusion locations.

NuScale SDAA FSAR Chapter 3 Review
(Except for Sections 3.7, 3.8, 3.9.2)

Conclusion

- While there are some differences between the DCA and the SDAA, the staff found that the applicant provided sufficient information to support the staff's safety finding.
- The staff found that all applicable regulatory requirements were adequately addressed.

Presentation to the ACRS Subcommittee
Staff Review of NuScale SDAA FSAR, Revision 1

Chapter 8 “Electric Power"

November 5, 2024
(Open Session)

NuScale SDAA FSAR Chapter 8 Review

Overview

- NuScale submitted Chapter 8, Auxiliary Systems, Revision 0 of the NuScale SDAA FSAR on December 31, 2022, and Revision 1 on October 31, 2023
- NRC regulatory audit of Chapter 8 was performed from March 2023 to August 2023, generating 24 audit issues
- 14 audit issues were resolved in the audit
- 14 audit issues resulted in NuScale submitting supplemental information to address questions raised during the audit. 10 issues were retracted as a result of information presented.
- No RAIs were issued
- Staff completed Chapter 8 review and issued an advanced safety evaluation to support today's ACRS Subcommittee meeting

NuScale SDAA FSAR Chapter 8 Review

Contributors

- **Technical Reviewers**
  - Sheila Ray, NRR/DEX/EEEB
  - Liliana Ramadan, NRR/DEX/ELTB
- **Project Managers**
  - Ricky Vivanco, PM, NRR/DNRL/NRLB
  - Getachew Tesfaye, Lead PM, NRR/DNRL/NRLB

NuScale SDAA FSAR Chapter 8 Review

Sections

- 8.1 – Electric Power - Introduction
- 8.2 – Offsite Power System
- 8.3 – Onsite Power System
- 8.4 – Station Blackout

NuScale SDAA FSAR Chapter 8 Review

Augmented DC Power System (EDAS)

- EDAS is the Augmented DC power system of the NuScale US 460 design
- Consistent with the SRM-SECY-19-0036, a risk-informed, graded approach commensurate with the design type and features that acknowledges the mitigative measures available to ensure reasonable confidence of public health and safety is acceptable.
- This holistic approach considers realistic conditions, plant behaviors, and operator responses in conjunction with the agency's deterministic assumptions and analyses to provide context and perspective to making risk-informed decisions.
- The staff used a risk-informed, graded approach to evaluate the augmented quality aspects in FSAR Table 8.3-3 of the EDAS as supported by SRM-SECY-19-0036.
- The staff considers that the description for the augmented design, qualification, and quality assurance provisions in FSAR Table 8.3-3 is adequate.

Non-Proprietary

NuScale SDAA FSAR Chapter 8 Review

Conclusion

- While there are some differences between the DCA and the SDAA, the staff found that the applicant provided sufficient information to support the staff's safety finding.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Presentation to the ACRS Subcommittee
Staff Review of NuScale SDAA FSAR, Revision 1

Chapter 14, “Initial Test Program and Inspections, Tests, Analyses and Acceptance Criteria"

November 5, 2024

(Open Session)

Non-Proprietary

NuScale SDAA FSAR Chapter 14 Review

Overview

- NuScale submitted Chapter 14, "Initial Test Program and Inspections, Tests, Analysis, and Acceptance Criteria," Revision 0 of the SDAA FSAR on December 31, 2022, and Revision 1 on October 31, 2023
- NRC regulatory audit of Chapter 14 performed March 2023 to December 2023, generating 22 audit issues
- 22 audit issues were resolved in the audit
- 4 audit issues resulted in NuScale submitting supplemental information to address questions raised during the audit
- 0 RAIs were issued
- Staff completed Chapter 14 review and issued an advanced safety evaluation to support today's ACRS Subcommittee meeting

NuScale SDAA FSAR Chapter 14 Review

Contributors

- **Technical Reviewers**
  - Charley Peabody, NRR/DSS/SNRB
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NuScale SDAA FSAR Chapter 14 Review

Sections Evaluated

- Section 14.2 – Initial Test Program
- Section 14.3 (SDAA Part 8) – Inspections, Tests, Analyses, and Acceptance Criteria
- The ITP and ITAAC may change to address information needed to make a safety finding in high effort chapters, as needed. The changes will be discussed as part of the high effort chapters presentation.

NuScale SDAA Ch. 14.2 Initial Test Program

Significant Changes from DCA to SDAA

- A comprehensive review of the Initial Test Program (ITP) procedures was performed and compared to the DCA ITP.
  - Reviewers found that design changes between the DCA and the SDAA were appropriately captured in the applicants test program submittal and revisions.
- No significant programmatic changes to the Initial Test Program itself were noted by the staff.
- The staff concluded that the SDAA ITP submittal as revised conforms to the NUREG-0800 Standard Review Plan for Initial Test Programs.

NuScale SDAA FSAR Ch. 14.3 ITAAC Review

NO Significant Changes from DCA to SDA

- A comprehensive review of the ITAAC requirements for the following SER Sections were performed and compared to the corresponding DCA system ITAAC Requirements and no significant changes to the ITAAC program itself were noted by the staff.
  - Section 14.3.2, "Structural and Systems Engineering“
  - Section 14.3.4, "Reactor Systems"
  - Section 14.3.5, "Instrument and Controls Systems"
  - Section 14.3.6, "Electrical Systems"
  - Section 14.3.8, "Radiation Protection"
  - Section 14.3.10, "Emergency Planning"
  - Section 14.3.13, "External Flooding Protection"
- The staff concluded that the SDAA ITAAC submittal for these Sections as revised conforms to the NUREG-0800 Standard Review Plan for Initial Test Programs and ITAAC.

NuScale SDAA FSAR Ch. 14.3 ITAAC Review

Significant Changes from DCA to SDAA
SER Section 14.3.3 Piping Systems and Components ITAAC

- A comprehensive review of the SDAA proposed Piping Systems and Components ITAAC was performed and compared to the corresponding DCA Piping Systems and Components ITAAC.
  - Reviewers found that design changes between the DCA and the SDAA were appropriately captured in the applicant's proposed ITAAC, such as the addition of the ECCS supplemental boron dissolvers and CNV lower mixing tubes.
- The staff concluded that the SDAA proposed Piping Systems and Components ITAAC as revised meets the regulatory requirements for ITAAC, as described in the SER.

NuScale SDAA FSAR Ch. 14.3 ITAAC Review

Significant Changes from DCA to SDAA
SER Section 14.3.7 Plant Systems ITAAC

- A comprehensive review of the Plant Systems ITAAC requirements were performed.
- In comparing the SDAA ITAAC with those proposed in the DCA the staff found changes/modifications were made to the ITAAC for the systems used to perform fuel handling and for systems used to conduct heavy load movements.
  - The ITAAC for the Fuel Handling equipment added ASME NUM 1 to the ITAAC acceptance criteria
  - The ITAAC for the Overhead heavy load handling system added ASME NUM-1 to the acceptance criteria for a TYPE 1A crane
- The staff finds that the SDAA Plant Systems ITAAC submittal, as revised, to be necessary and sufficient to provide reasonable assurance that the facility built has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act as amended, and the Commission's rules and regulations.

NuScale SDAA FSAR Ch. 14.3 ITAAC Review

Significant Changes from DCA to SDAA
SER Section 14.3.9 Human Factors Engineering ITAAC

- A comprehensive review of the HFE ITAAC requirements was performed
- Some Human Factors Engineering activities for the NuScale SDAA are still ongoing
  - For the DCA, the staff reviewed results from the applicant's Integrated Systems Validation (ISV) activities before finalizing their SER
  - For the SDAA, ISV results were not available for the staff during their safety review
  - The SDAA includes an ITAAC for completion of an ISV test in accordance with the human factors verification and validation implementation plan
- The staff concluded that the SDAA HFE ITAAC submittal as revised conforms with the NUREG-0800 Standard Review Plan for HFE

NuScale SDAA FSAR Ch. 14.3 ITAAC Review

Significant Changes from DCA to SDA
SER Section 14.3.11 Containment Systems ITAAC

- The staff reviewed the containment systems ITAAC requirements.
- Significant changes resulted from staff concerns raised during the review of Ch 6:
  - Section 6.2.1.1, NuScale proposed a one-time ITAAC for the first module built to verify the as-built CNV free volume bounds the minimum value used in the containment design-basis analyses.
  - Section 6.2.5, NuScale is proposing three ITAAC In response to staff RAIs for the passive autocatalytic recombiner (PAR):
    - An inspection to confirm the PAR is installed in accordance with the associated installation specification
    - A report to confirm the PAR has sufficient capacity for required oxygen recombination to maintain the CNV atmosphere inert during DBEs
    - Environmental qualification of PAR
- The staff finds that the SDAA Containment Systems ITAAC submittal as revised conforms with the NUREG-0800 Standard Review Plan for Initial Test Programs.

NuScale SDAA FSAR Chapter 14 Review

Conclusion

- While there are some differences between the DCA and SDAA, the staff found that the applicant provided sufficient information to support the staff's safety findings.
- The staff found that all applicable regulatory requirements were adequately addressed for the design.
- COL items are provided for programs and site-specific aspects, similar to the DC application.

Meeting title	**Open Session NuScale Subcommittee Meeting on Staff's Evaluation of Chapters 3, 8 and 14**

Participants

Michael Snodderly	ACRS (DFO)
Thomas Dashiell	
Sandra Walker	
Omer Erbay	NuScale
Tammy Skov	
Larry Burkhart	
Allegra Chilstrom	Court Reporter
Dennis Bley	
Eric Lantz	NuScale
Charlie Brown	
Vesna B Dimitrijevic	
Chris Nighbert	NuScale
Stephen Schultz	
Augi Cardillo	NuScale
Bradley Drake	NuScale
Joe Remic	NuScale
Emily Larsen	NuScale
Meghan McCloskey	NuScale
Kevin Fischer	NuScale
Rob Morrow	NuScale
Wendy Reid	NuScale
Aaron Pierce	
David Benson	NuScale
Vicki Bier	
Hank Pratte	
Addison Hall	
Edward Stutzcage	NRC
Erwin Laureano	NuScale
Stacy Joseph	
Jeff Ehlers	NuScale
Matthew Martineau	NuScale
Renee Martin	
Derek Widmayer	
Dan Lassiter	NuScale
Michael Valleau	NuScale
Thomas Griffith	NuScale
Jim Osborn	NuScale
Robert Martin	
Paul Guinn	NuScale
Rim Nayal	NuScale
Kenneth Armstrong	
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Carlen Donahue	NuScale
Charley Peabody	

Isaac Wang	
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Tim Polich	
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Kris Cummings	NuScale
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Peter Shaw	NuScale
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Andrea Mota	NuScale
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John Honcharik	NRC
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Ken Mott	NRC
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