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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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NUSCALE SUBCOMMITTEE

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TUESDAY

JULY 9, 2019

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B10, 11545 Rockville Pike, at 1:00 p.m., Joy Rempe, Chair, presiding.

COMMITTEE MEMBERS:

JOY L. REMPE, Member

CHARLES H. BROWN, JR. Member

DENNIS BLEY, Member

MICHAEL L. CORRADINI, Member

VESNA B. DIMITRIJEVIC, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

PETER RICCARDELLA, Member

GORDON R. SKILLMAN, Member

MATTHEW SUNSERI, Member

ACRS CONSULTANT:

STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

CHRISTOPHER BROWN

MICHAEL SNODDERLY

ALSO PRESENT:

CLINTON ASHLEY, NRO

PETER BAMFORD, NRR

TOM BERGMAN, NuScale

KEVIN COYNE, NRO

RAUL HERNANDEZ, NRO

NADJA JOERGENSEN, NuScale

REBECCA KARAS, NRO

CHRIS MAXWELL, NuScale

RYAN NOLAN, NRO

OMID TABATABAI, NRO

DINESH TANEJA, NRR

ANDREA VEIL, ACRS

ROBERT VETTORI, NRO

SCOTT WEBER, NuScale*

ROBERT WEISMAN, OGC

*Present via telephone

A G E N D A

P R O C E E D I N G S

1:05 p.m.

CHAIR REMPE: This meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards NuScale Subcommittee. I'm Joy Rempe, Chair of the NuScale Subcommittee.

Members in attendance today include Vesna Dimitrijevic, Dennis Bley, Jose March-Leuba, Charlie Brown, Walt Kirchner, Pete Riccardella, Mike Corradini, Dick Skillman. We also have our consultant, Steven Schultz here with us today.

The purpose of today's meeting is for the Subcommittee to receive a briefing on staff evaluations of Chapter 20, mitigating strategies for beyond design basis external events in the NuScale design certification application. Today, we have members of the staff and NuScale to brief the Subcommittee.

Before I continue with our standard ACRS subcommittee opening remarks, I want to make some comments here. The ACRS review of this topic's going to be a bit different than we originally planned. A couple of weeks ago, NuScale notified our designated federal officials that they'd like to present this material at the July full committee meeting.

And the DFOs checked with the staff, and they'll also be presenting tomorrow. So there's the potential that we may complete our review of this topic and write a letter this week.

And in fact, I have prepared a very draft letter with some background information regarding this topic, essentially what topics are addressed by NuScale in the Chapter 20. And how their strategies for beyond design basis events differ from other applications we reviewed and the staff review findings, and some preliminary thoughts that we may want to discuss today. But I'm going to need your help on this.

So at the end of this meeting, I'd like to request your thoughts on two items. First, shall we try and write a letter on this topic this month? And we can recommend and at the beginning of the full committee meeting that the letter would be completed in September.

And then if we do decide to go forward with the letter this month or even in September, I'd like your input for my draft letter on what should be included in this topic. And it would help if you'd send it tonight sometime, okay.

So let's go back to the standard

information that I'm supposed to say at the beginning of Subcommittee meetings. The ACRS was established by statute and it's governed by the Federal Advisory Committee Act, or FACA. That means that the committee can only speak through its published letter reports. And we hold meetings to gather information to support our deliberations.

Interested parties who wish to provide comments can contact our office requesting time. And that said, we also set aside ten minutes for comments from members of the public attending or listening to our meetings. And written comments are also welcome. The meeting agenda for today was published on the NRC's public meeting notice website, as well as our ACRS meeting website.

And on the agenda for this meeting, as well as on the meeting, the ACRS website, instructions on how the public can participate. It's my understanding, unless Kathy tells me differently, that there's been no requests for making a public statement from the public at this meeting.

And we may close this meeting after the open portion to discuss proprietary material, and presenters can defer questions that should not be answered in the public session to that time. And if

we start asking things we shouldn't, please speak up and tell us to hold off, okay.

A transcript of the meeting is being kept and will be made available on our website. And therefore we do request that participants in this meeting use the microphones located throughout the meeting room in addressing the Subcommittee, and the participants should first identify themselves and speak with sufficient clarity and volume that they can be readily heard.

We have a bridge line established for the public to listen to this meeting, and to minimize disturbance, the public line will be kept in a listen-in only mode. And to avoid disturbance, I request that attendees, especially members, put their electronic devices, such as cellphones, in the off or noise-free mode.

And now we're going to begin with the meeting. Does the NRC staff have any introductory remarks that they wish to make?

MR. COYNE: Kevin Coyne, NRO. We can make it just part of the staff presentation after the break.

CHAIR REMPE: Okay, so then I'm going to ask NuScale to begin today's presentations.

MS. JOERGENSEN: Thank you. We're here today to present NuScale SR Chapter 20, which is the mitigation of beyond design basis events. With me here I have Chris Maxwell, Senior Reactor Operator, and myself, Nadja Joergensen. I'm a Licensing Specialist.

MR. MAXWELL: Good afternoon. The new rule, 10 CFR 50.155, is separated into a requirements section for mitigational strategies for beyond design basis external events, which is covered under paragraph B1, and into requirements specific for spent fuel pool level indication, which is addressed by paragraph E. And we're going to start today's discussion with the mitigation strategies.

The new rule is written to consider a damaged state that results in an extended loss of AC power and ELAP concurrent with a loss of normal access to the ultimate heat sink, or for a passive design such as NuScale's, a loss of normal access to the normal heat sink.

The objective of the rule is to establish sufficient coping capabilities to prevent fuel damage in both the reactors and the spent fuel pool, and to maintain the containment function by using installed plant equipment and supplemental mitigating equipment.

As such, the three key safety functions of core cooling, containment, and spent fuel pool cooling are required to be established and maintained indefinitely, or until sufficient site functional capabilities can be maintained without the need for mitigational strategies.

That phrase indefinitely or until sufficient site functional capabilities can be maintained without the need for mitigation strategies is described to mean that the licensee needs to plan for obtaining sufficient resources to maintain the three key safety functions until an alternate means of heat removal is established.

Additionally, the new rule allows for new reactors to establish different approaches from those of operating reactors, including using only installed plant equipment for both the initial and the long-term response. Therefore it follows that the phrase alternate means of removing heat may be provided by installed plant equipment.

To evaluate the NuScale power plant coping capability, it's necessary to establish what a minimum installed coping duration is. NuScale considers a coping period of 14 days using only installed plant equipment to be sufficient time to establish the

alternate means of removing heat.

The basis for this duration is the operating experience of the Fukushima event, where, without the benefit of a pre-planned strategy or a hardened pool makeup line, the access to the site limited by the earthquake and tsunami, personnel were able to begin injecting to the spent fuel pool after nine days using offsite resources and injecting the spent fuel pool using installed plant equipment at 14 days.

Beyond that point, beyond the minimum installed equipment coping period, the continued use of installed plant equipment, as well as ad hoc resources and repairs to plant equipment, can be used to continue coping indefinitely.

MEMBER BLEY: Can I ask you a question?

MR. MAXWELL: Yes, sir.

MEMBER BLEY: Much of the arguments I've read in the FSAR show how your built-in capabilities are adequate for most of these requirements. So it doesn't look like you're recommending to a future COL applicant that they participate in SAFER because it doesn't sound like you think it'd be necessary.

Are you providing those standard hook-ups that say for uses, so if you need to get equipment

from, you might get it from another nearby plant, so it would be easy to hook it up?

MR. MAXWELL: Yes, sir, we are. What we have, beyond what we'll be talking about today, we have the standard equipment you would see as far as we backup diesel generators, two of them independent from one another that can provide power to our battery chargers and our highly reliable DC power system and to our instrumentation.

We have temporary or temporary connections to those same busses provided by the diesel generators for an offsite generator that's --

MEMBER BLEY: And that's the connections I was asking about. Are they going to be the standard ones that are --

MR. MAXWELL: Yeah, they're --

MEMBER BLEY: All the other plants are using now?

MR. MAXWELL: That's correct. We can bring a portable, the design includes connections for portable generators.

MEMBER BLEY: Okay.

MR. MAXWELL: It also includes a hardened vent, seismically qualified, assured makeup line to the ultimate heat sink for, a gravity feed to the

spent fuel pool. While all those capabilities are provided to meet the requirements, they're not required.

MR. SCHULTZ: So excuse me, so what does that mean in terms of what Dr. Bley was discussing in terms of the guidance that you anticipate providing to the COL applicant?

MR. MAXWELL: Well, there's -- the COL and the operator are going to have requirements to perform task analysis on their systems and develop procedures associated with it. There won't be a requirement specifically for procedures for mitigating beyond design basis event, because no operator actions are required specifically to mitigate the event.

You still, you know, I like to think of this as two separate items. There is the responding to the event itself, the ELAP and the current loss of access to the ultimate, to the normal heat sink, and the plant response to that through installed safety-related plant equipment.

Then there's what the operators are going to be doing. And the benefit of the plant responding to the strategy or to the event and maintaining the three key safety functions is that the operators have been freed up to use the exiting procedures to try to

restart their backup diesel generators or to hook up a temporary generator if necessary to respond to the initiating event itself, rather than to be focused on establishing and maintaining the three key safety functions.

So they will use their processes as required for operations to develop their procedures for hooking up that equipment and repowering the busses. Items like starting the backup diesel generators is not unique to mitigating a beyond design basis event. It's a procedure that will exist, a standard operating procedure or an abnormal procedure that will exist for the plant that it would use in the situation.

MR. SCHULTZ: But let's presume that there is a fleet of these facilities. Then you would anticipate that there'd be some common direction given so that the fleet of NuScale facilities are going to be following the same process and procedure. And if there is, if there is a safer type of an approach, or a common approach taken, that in fact it is a common approach.

MR. MAXWELL: Yes, sir, and --

MR. SCHULTZ: For the NuScale industry, whatever you want to call that.

MR. MAXWELL: Right, and again, I'm back to the separation of whatever the initiating event is, it's a loss of all power, all AC power, they're safe. There will be a procedure to respond to the loss of all AC power. So it's not specific to a mitigating beyond design basis event, it's specific to the initiator.

So there will be a procedure that is an abnormal procedure to respond to that that directs the action, such as starting up backup diesel generators or getting our auxiliary AC power source available to provide site power.

If it's a seismic event, there'll be an abnormal procedure to respond to seismic events. If it's flooding, you would expect a abnormal procedure to respond to a flooding event. So again, the operators are freed up to address those initiating events and respond to them and to restore power, rather than to focus on the key safety functions.

And there's not a need for specific procedures dedicated to that. There's not a, in the days of old were called FLEX procedures. There's not a need for that because the installed plant equipment responds to establish and maintain the three key safety functions.

MR. SCHULTZ: Okay, thank you.

MR. MAXWELL: Sure. So now I'd like to discuss the evaluation of the NuScale design coping capability and to describe those capabilities.

As you're aware, the NuScale power plant design was informed by the Fukushima accident and sought to provide coping during an ELAP without AC or DC electrical power, without a need for inventory addition or supplemental onside equipment, without the use of offsite resources, and without any operator actions and therefore any required operator monitoring.

In short, the design provides extended coping by establishing and maintaining three key safety functions by the automatic response of installed plant equipment alone. As I just alluded to, the strategy provides a significant advantage of permitting the plant staff to focus on addressing the initiating events, rather than focusing on deploying supplemental equipment or procedures, to maintain just the three key safety functions.

To evaluate the power plant's baseline coping capability, it's necessary to establish some coping criteria as well as the initial conditions, assumptions, and the boundary conditions. For this,

NuScale used existing industry guidance as previously endorsed by the NRC.

And they include that plant equipment that is designed to be robust with respect to design basis external events is assumed to be fully available, while plant equipment that's not robust is assumed to be unavailable.

The procedures and equipment relied upon should ensure the satisfactory performance of necessary fuel cooling and containment functions are maintained and that the fuel in, both the modules and the spent fuel pool is required to remain covered at all times.

CHAIR REMPE: So I'd like to stop you for a minute. You keep referring to the insights from Daiichi. And if you read some of the operator interviews, they make the comment because they didn't have instrumentation due to the loss of power, it was like flying an airplane blind.

And now you're talking about monitoring the plant, that things are going as planned, and you actually have in Rev. 1 of this technical report you submitted saying that the ECCS components, including instrumentation, are environmentally qualified for the moisture chemistry and radioactivity of expected

environments, and it goes on about that.

And if I look at the table you provided, you do have the water level, so I have a question about the radioactivity levels. Are you going to do fluence? Again, we, and I can say radar-based water levels since they're here because we've established now that's in the open literature. But I'm not sure of the details of it.

But some of them actually if you have some types of monitors, they tried to do this in the past, they suffer from darkening from fluence levels. And I'm not sure if that's going to be in your design or not, but that's something I'm concerned about.

And then if I were an operator I'd, since you're kind of putting the water back and forth between the reactor vessel and the containment, I really would like to know what the containment water level is to make sure things are going as planned, and that's not one of the key components that's in the table about the containment. You just have other components in the containment.

So I'm curious on why you didn't include the containment water level too as a key component. Because I think I would want to know as much as possible of what's going on, especially if you had

some sort of event where you went back and got re-critical again and you're going to flood up your containment. It seems like that.

So I have questions about why didn't you include the water level for the containment, and then the radioactivity levels and how you're going to qualify it. Because again, this is kind of going out to the future, and it's going to be I guess an ITAAC or something about this first of a kind application for water level measurements.

And I want to know if it's going to be looking at not just the heat, the neutron flux, but also the total fluence. Are you going to go for, sometimes I see 30 days or something like that? Or how long are you going to qualify this for, and is that going to be specified somewhere?

MR. MAXWELL: I'll ask if Brian Gardes is on the line from NuScale. I don't have Brian now, but I will.

CHAIR REMPE: They were supposed to be open, but.

MEMBER CORRADINI: Can the NuScale folks in Corvalis speak up that your line's open?

(Off mic comments.)

MR. MAXWELL: Okay, thank you. So as,

we're going to see if Brian can speak to the level instrument specifically. The discussions on the technical report about instrumentation are just some discussions of the instrumentations that would be available to the operators. Containment level will be available for 72 hours to the operators.

CHAIR REMPE: It's not in the list of the critical, like there's a table it's going to take me a while to bring it up. But there's a table for what's in the reactor vessel versus what's in the containment. And the containment does not have water level on that table.

MR. MAXWELL: Understood, and so what I want to say is that none of those indications are necessary, because installed plant equipment alone, without operator action, without operator monitoring, establishes and maintains the three key safety functions.

MEMBER MARCH-LEUBA: ECCS valves open on high water level in the containment.

MR. MAXWELL: Not in this event they do not.

MEMBER MARCH-LEUBA: Well, then you have to consider, this is available.

MR. MAXWELL: ECCS at 24 hours in this

event, the next slide here talks about our boundary conditions. For an ELAP condition, there's a box that's established and some assumptions that are made about the plant response.

MEMBER MARCH-LEUBA: But to be able to say with a straight face that you do not rely on AC or DC power, you have to run every combination of AC power on, AC power off, the other way around, DC power going to five holes. You have to run all those combinations.

MR. MAXWELL: Absolutely.

MEMBER MARCH-LEUBA: And you're relying on DC power to open the ECCS valves.

MR. MAXWELL: In 20 -- actually, the module protection system in this event, at 24 hours into the event, de-energizes the --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: If you lose AC power.

MR. MAXWELL: This event is a loss of AC power.

MEMBER MARCH-LEUBA: You rely, for successful completion, you are relying on losing AC power. What if you keep --

MR. MAXWELL: I keep AC power?

MEMBER MARCH-LEUBA: Yeah.

MR. MAXWELL: The event is a loss of AC power. It is the defining --

MEMBER CORRADINI: Yeah, I think what, I want to make sure you guys are communicating. I think what Chris is saying is they have a set of going in state assumptions that they have to follow. Am I understanding this correctly?

MR. MAXWELL: Yes, sir, that's exactly correct. The event itself is defined as an extended loss of AC power concurrent with loss of normal access to the normal heat sink.

And then there's a set of boundary conditions that were established, again, established in industry guidance and endorsed by the NRC, that are the baseline assumptions. Then you start your evaluation of our coping capability with those assumptions.

CHAIR REMPE: So I'm going to go back to Section 5.3.2, and it has here, The key safety function of containments is established and maintained for greater than 50 days without operator action. However, the parameters listed in table 5.2 or 5-2, are available to assure the control room operators that the safety-related systems have performed as designed.

And it has the CIV positions and the wide range containment pressure and the spent fuel pool level. There is nothing in here about containment water level.

MR. MAXWELL: I understand that, and what I'm trying to convey is none of those indications are necessary to establish and maintain. However, just for the containment, just addressing the containment function, containment water level is not a key parameter.

When that list was developed, it said if I'm just looking at of the three key safety functions, if I'm just evaluating the containment function, what I need to know is a containment pressure. If I'm an operator and I'm, which of course this is not going to happen that the operators just sit back and observe.

But if that's what they were doing, then what they would have observed is at the 24-hour mark, when the ECCS valves open, that's when you would reach the peak pressure in containment. So containment pressure is one aspect of containment integrity that they would want to monitor.

Early within the first minute, there's a containment isolation. So containment isolation valve position is a key parameter for them to verify that

the safety-related components have performed as designed.

CHAIR REMPE: So your point is just that you don't worry about overpressure of the containment, but if I were also trying to worry about the reactor going re-critical, that's not a concern. It's just, okay, you've still got the water level in the reactor vessel and yeah, something's going on with the water going back and forth, but you're not going to worry about trying to flood up the containment or something like that if the reactor --

MR. MAXWELL: We will not flood up the containment. Within the boundaries of this event, the containment isolates, all safety-related components operate as designed. There's, of the inventory necessary to maintain core cooling is preserved within the containment.

CHAIR REMPE: And you don't worry about any sort of re-criticality occurring for this event. But what if it did occur, you just, that's not part of the scope and you don't have to worry about it.

MR. MAXWELL: That's right, the boundary conditions, one of the boundary conditions is that there's no current ATWS, no anticipated transient without scram. All rods insert.

CHAIR REMPE: Okay.

MEMBER MARCH-LEUBA: A single rod fails?

MR. MAXWELL: That's correct. But you remember the scope here, we're talking about a beyond design basis event. So we're in a, like other events where you're not required to stack failures, like a control room evacuation doesn't assume a concurrent LOCA or an ATWS. Similarly, and in the operating fleet and our assumptions is that there isn't a concurrent ATWS with the extended loss of AC power.

MEMBER MARCH-LEUBA: It's not an ATWS, it's one rod has too much friction can come in after the earthquake.

MR. MAXWELL: We assume all rods insert in this event. The assumption of boundary condition.

MEMBER MARCH-LEUBA: Yeah, and I can assume, you can assume a lot of things.

MEMBER CORRADINI: But I think what, I'm not taking sides, I just want to make sure we're communicating. Is that they're been given a set of assumed, going in statuses of the various systems, which they then must analyze. Am I understanding this correctly?

MR. MAXWELL: Yes, sir.

MEMBER RICCARDELLA: And are those the

same assumptions that the operating fleet uses?

MR. MAXWELL: Yeah. We extracted these directly from the existing fleet guidance.

CHAIR REMPE: So I'll give you that one for a while I guess. But then what about the fact here for the core cooling parameters when they have 50 days and they have the table, the parameters in table 5-1, and they have water level as a parameter here?

So somehow or other you're going to give us confidence that you don't have any sort of issues for the entire fluence, not just at the radiation levels, as it indicated in the other quote I read earlier. But you're going to also do the fluence on the RPV water level sensors to make sure they're qualified?

MR. MAXWELL: I believe I don't have that table in front of me, but if you look, I believe it's broken into two sections, and the first is the verification portion, where the instruments that are used to verify that those conditions have been established.

And then the extended duration, what indication the operators could use to verify that the key safety function core cooling is maintained. I'd also say that that's an old revision of the technical

report as well.

CHAIR REMPE: I'm actually looking at Rev. 1 and there isn't this, it only has parameters for assuring the functions established and the function. So there's just two columns in the table I'm looking at. Do I need to go back to Rev. 0 to see what you're talking?

MR. MAXWELL: No, that serves the same purpose. As far as establishing the function, if I heard you correctly, that that's the header for that column, is that when the function is established, the instrumentation exists. Or the power for the instrumentation's assured.

CHAIR REMPE: But this has to be for 50 days, according to the text.

MR. MAXWELL: It's established within 24 hours. The Emergency Core Cooling System actuation at 24 hours is the last action, automatic action that occurs during this event. Operators can observe the actuation of ECCS, and with ECCS in service, the natural circulation provided, then that safety function is assured for 50 days.

CHAIR REMPE: Well, the introductory sentence says, The key safety function for coolant is established and maintained for greater than 50 days

without operator action. And so you're trying to tell me then that they only need it for the 24 hours, not the full 50 days.

MR. MAXWELL: The indication, that's correct. Once the ECCS valves open, there's no plausible mechanism for those valves to reposition closed. They're in their safety position, the natural circulation's established. The containment's isolated, so the inventory is contained within the containment vessel.

And operators observe the operation of ECCS. Their continued observance isn't required to assure that the system continues to function.

CHAIR REMPE: So okay, we don't have any water level in the containment, we just have it in the reactor vessel. But we're just going to, the operators will say, okay, the valve opened and I don't care anymore for 50 days, I don't need any instrumentation is the position you're taking?

MR. MAXWELL: I would only characterize that the operators don't care anymore. I would say that when the safety systems actuate and are in service, then within the boundary conditions established event, that the safety function is maintained for a minimum of 50 days.

CHAIR REMPE: I just, as a, I think an operator would want to know what's going on through that 50 days is especially after, again, I know it was a big BWR, but knowing how an operator feels when they don't have any instrumentation, I think you would want to have confidence that it would last.

MEMBER BROWN: But the loss of ultimate heat sink is not, you all stated in your Chapter 20 that that's not plausible, therefore that's really not part of this particular evaluation that you all are doing. The only thing that plays here is the extended loss of AC power.

MR. MAXWELL: The actual, it's a loss of access to the ultimate heat sink that the --

MEMBER BROWN: Well, but you're sitting in the ultimate ==

MR. MAXWELL: That's right.

MEMBER BROWN: You're sitting in the ultimate heat sink. So you haven't, theoretically you can't lose access, and you say that. There is no, the loss of it as defined in the reference is not plausible, no other heat sink is credited for maintaining the key safety functions. So I'm just trying to separate the variables here.

MR. MAXWELL: Right.

MEMBER BROWN: We keep arguing about this and these two primary initiating conditions. One of them is not relevant for this because you're always sitting in the ultimate heat sink. The only thing that plays is the extended loss of AC power, and that plays into whatever other things have to happen, the valves closing and all the other type things that you're talking about.

MR. MAXWELL: That's correct, and for the passive designs, they defined it as an extended loss of AC power with loss of normal access to the normal heat sink. So we don't have the main condensers available.

MEMBER BROWN: Your normal sink's the pool of the water, isn't it?

MR. MAXWELL: No, sir, normally it's the main condenser.

MEMBER SKILLMAN: It's no steam dump. No steam dump.

MEMBER RICCARDELLA: Or load. So that's their normal.

MEMBER BROWN: I've never thought of that as the heat sink because you're sitting in the thing, and.

MEMBER BLEY: Yeah, but that's where the

heat's going.

PARTICIPANT: But only --

MEMBER BROWN: Well, the containment's not, is still evacuated in this circumstance, isn't it?

MR. MAXWELL: It is until 24 hours into the event. At 24 hours into the event, it's when the ports open.

MEMBER BROWN: Okay, all right, I got that.

MEMBER RICCARDELLA: What happens at 24 hours in?

MR. MAXWELL: At 24 hours, the module protection system de-energizes the trip solenoids for the emergency core cooling system, allows those valves to open, and initiates ECCS.

MEMBER RICCARDELLA: And that floats to containment.

MR. MAXWELL: It's DC powered.

MEMBER RICCARDELLA: So, oh, you're on DC, okay, got it.

MEMBER CORRADINI: Just if we all wait two slides, he has a time window that I think will help us.

MEMBER BROWN: Well, I guess what I was

getting confused with, Mike, was the loss of the ultimate heat sink. The point is the containment is evacuated initially for the 24 hour period before it's flooded, and then becomes now you have access, you have access to the heat sink back effectively, once you've flooded it into 24 hours, correct?

MEMBER MARCH-LEUBA: So you have additional access. You always have the DHRS.

MR. MAXWELL: That's right.

MEMBER MARCH-LEUBA: And just satisfy on the record, the special with the level, whether the ECCS valves open or they don't, you will still survive the event perfectly. Actually, if you don't lose DC power, the event will be even better than you describe here, because you will have the DHRS cooling your decay heat nicely.

Opening the ECCS valves is just an additional step to have is because you lost DC power. But you would, it would be a success branch if you kept the DC power on. Outsourced.

MR. MAXWELL: It is a, we load-shed the ECCS solenoids off of the batteries at 24 hours --

MEMBER MARCH-LEUBA: I understand. But if you lost all AC power except the one that fuels the batteries, nothing bad will happen in this event. You

could run that one and it would be a success. But, because you will keep cooling on DHRS high pressure.

MEMBER KIRCHNER: He's saying the DHRS system would successfully take you to a safe --

MR. MAXWELL: It's complicated because the power that powers the chargers is the same power, so the logic --

MEMBER MARCH-LEUBA: Yeah, but if you claim that you'll rely on it --

MR. MAXWELL: Right.

MEMBER MARCH-LEUBA: The rule is, I don't know what rule is for Mike, but for me is you can live with it or without it.

MR. MAXWELL: Absolutely.

MEMBER MARCH-LEUBA: If we have every possible combination. And indeed, you do.

MR. MAXWELL: If we had AC power available on busses, it would not impact this event in a negative way, negative manner. We would still have all of our safety-related systems, module protection system, the containment isolation system, reactor trip system, and DHRS actuation.

MEMBER MARCH-LEUBA: What I'm trying to say is you do not rely on ECCS actuating 24 hours before the successful operation.

MR. MAXWELL: We do not, that's correct.

MEMBER MARCH-LEUBA: If they kept close, you would still survive perfectly.

MR. MAXWELL: We still have DHRS that provides the core cooling initially.

MEMBER MARCH-LEUBA: It's redundant and sufficiently -- so our discussion about the ECCS actuation in this particular transient.

MEMBER DIMITRIJEVIC: For how long can DHRS operate for, you know? How long can DHS remove the heat successfully?

MR. MAXWELL: I have to, I don't know the answer to that question off the top of my head.

MEMBER MARCH-LEUBA: DHRS has a capacity of roughly six percent power?

MEMBER DIMITRIJEVIC: I know, but you need the, you know, the nature of its inflation and all.

MEMBER CORRADINI: Under this stylized accident, though, they have a slide later to show --

MEMBER SKILLMAN: It shows it, it's coming up.

MEMBER DIMITRIJEVIC: My other question is for your ultimate heat sink you need eventually outside cooling, right. What provided, what provides the cooling for your pool? No, no, no, but that pool

needs to be cooler.

MR. MAXWELL: We don't, no boiling, boiling of the ultimate heat sink provides the sufficient cooling for the modules. It eventually, and we have slides that will show this. But eventually we would add inventory, maintain inventory. But --

(Simultaneous speaking.)

MR. MAXWELL: -- temperature control.

MEMBER BROWN: To the reactor pool.

MR. MAXWELL: That's correct. Ultimate heat sink.

MEMBER DIMITRIJEVIC: Well, okay, so you eventually, and what's that eventually when you need to provide inventory to the ultimate heat sink?

MR. MAXWELL: Our analysis, we talk about with 50 days, is based on 45 feet, a 45-foot elevation in the pool. And that's just where the long-term cooling calculation evaluation stopped, at 45 feet. It didn't, it's not because there's a --

MEMBER DIMITRIJEVIC: Twelve units put in decay heat, right?

MR. MAXWELL: With all 12 units, right. We didn't evaluate beyond that point, so it's not significant in that something happens in the ability

to cool core, to remove containment heat. It's just that we went out to 45 feet, and that's where the calculation stopped.

MEMBER MARCH-LEUBA: Those units, were the DHRS, what elevation is DHRS?

MR. MAXWELL: The top of the DHRS passive condenser is just above 45 feet.

MEMBER MARCH-LEUBA: Top 45 feet is the DHRS.

MR. MAXWELL: It's 45 feet just below the top of the passive condenser.

MEMBER MARCH-LEUBA: It will work another foot.

MR. MAXWELL: Still mostly submerged.

MEMBER SKILLMAN: Chris, may I ask you to go back one slide please?

MR. MAXWELL: Yes, sir. Figure out how, yeah, thank you.

MEMBER SKILLMAN: Thank you. Let's see, operator action monitoring. Would you speak more to that please?

MR. MAXWELL: Again, just to --

MEMBER SKILLMAN: This is without AC or DC. Go ahead.

MR. MAXWELL: Yes, sir, just within the

confines of the scope of this event, the, with the design relying only on --

MEMBER SKILLMAN: Oh, these are the game rules for the way this rolls out.

MR. MAXWELL: That's correct.

MEMBER SKILLMAN: Okay, go ahead.

MR. MAXWELL: With that, because it's the automatic response of the installed plant equipment that establishes and maintains the key safety functions, no operator actions are necessary to do so. With the need for monitoring is predicated on the need for operator action. If I don't have any required operator action, then I don't have a requirement for monitoring.

As an operator myself, of course I want to, I'm going to monitor, I'm going to, you know, observe the actuation of all the safety-related equipment. But back inside those boundary conditions, that safety-related equipment performs as designed. So that's the discussion about with no operator action, therefore no monitoring's required.

MEMBER SKILLMAN: And I don't want to be preachy, but just let me make a point or two. I can buy and defend loss of AC and DC. I can defend no inventory. I can defend no supplemental equipment.

I can defend no operator resources. I cannot defend a responsible SRO in charge of the watch for 12 plants not fighting to the death for at least source range instrumentation.

And I base that having been involved in an NBDE like this. The thing we wanted more than anything else at TMI2 was primary instrumentation for neutron count. And we had several instances where we lost it. And there was more excitement, and what I mean by that is the emotion of fright, than anything else.

We began to understand we didn't have pressurizer level. We knew the pumps were vibrating. From the radiation levels we knew we had lost a lot of fuel or clad. But the thing that we were driven by was neutron count rate. I would think that maybe that one issue should be revisited.

If you were in charge of 12 reactors and you've had this event, I think the one thing you would be saying is I know a shutdown, I'm fairly confident it's, I'm fairly confident it's shut down. And I really think it's shut down, but I would really like to have something that confirms it's shut down, 12 times.

So I would just offer I think that's a

blind spot that NuScale should think about, for a lot of reasons. I mean, this whole design is predicated on the robustness of the passive competencies to protect the cores.

But the one parameter that seals the deal in the operator's mind and in the NRC inspector's mind is that we've got a count rate that we believe is accurate. And the neutron count rate has dropped and is not increasing.

Thank you for the monologue.

MEMBER BLEY: I was, just before you did that, Dick, I wanted to go back to where Joy was. And I just wanted to urge you to think about this, because you are an operator. I mean, you meet the requirements, I don't disagree with that. The analysis looks right. But if you're an operator and you can't see what's going on, and there's lots of examples where this has happened.

It's not just Fukushima and TMI. There's lots of other examples. When operators can't see what's going on, they get nervous. They start trying to find ways to see what's going on, and they operate, right. They do, you don't, you know somebody did an analysis and it said you're okay. But am I really okay? I should be okay, am I really okay.

And the idea that with a little pre-planning you could see some of the parameters that are crucial to keeping you from doing wrong. Now, the chapter on human factors engineering says we look at errors of commission. The PRA says we look at errors of commission, but you hardly looked at errors of commission at all.

So what are the bad things somebody could do if you get in this spot and they get nervous, and they start wanting to do something? That didn't show up in the PRA, it probably should have. So just to think about, not that there's anything wrong with this analysis for this purpose. I'm done.

MR. BERGMAN: Can I just say what I did--

PARTICIPANT: Are you going to identify yourself?

MR. BERGMAN: Yeah, Tom Bergman.

PARTICIPANT: Get close to the mic.

MR. BERGMAN: Tom Bergman, NuScale. So I appreciate what you said, yes. The purpose of our application and the purpose of this presentation is to demonstrate that we meet the NRC's regulation. It isn't to say what we or operators will do that goes beyond that regulation. So of course our operators care, of course they will try to maintain as many

instruments as they can.

But in terms of this regulation, thank you for noting, the question is have we met the regulation. If you think the regulation isn't appropriate, those questions need to go to the NRC staff, because we think we've made the case we've met the NRC's regulation.

CHAIR REMPE: Again, I, it extends beyond Chapter 20. But even if you're going to do the water level, I'm curious on how we're going to have it qualified in the reactor vessel if you are going to rely as it -- it's a key parameter they're monitoring, so maybe it doesn't fall under Chapter 20, it's just it's there by the way.

But I am not sure that the qualification for the water level will consider something for those conditions that are considered in Chapter 20 is what I was trying to get to.

The other thing is is that at some point, and I know you slides on it later, but saying that you don't have operator action and this thing about the batteries is a thing I'd like to see you discuss today while you're up here too, because it does seem to imply that your battery runs out after, it could run out after 72 hours.

And so I know you're going to be discussing that, but there is some action required to replace a battery apparently, okay.

MR. MAXWELL: I will address that in spent fuel pool level indication portion.

MEMBER BROWN: Can I ask one, this is a question just to clarify for myself -- somebody answering something? I'm sorry, I didn't mean to interrupt.

CHAIR REMPE: Go ahead, speak up.

MR. WEBER: I just wanted to go over information on -- sorry, this is Scott Weber in the PRA group at NuScale. And I just wanted to add a little bit of information about like containment water levels from the other instruments that we've been talking about. Because we're talking very specifically in the context of Chapter 20.

But obviously for all these dissertations, anything that NuScale has determined to be a close monitoring variable is also subject to equipment qualification and to equipment operability requirements.

And so just because something is not necessarily on, you know, a list of the key functions with specific respect to this event, that does not

mean that it doesn't have equipment qualification requirements, which are generally, you know, for every two hours or beyond some, or up to 30 days or 100 days in that table; and then you have the subpart to that, which I don't have in front of me immediately.

But the equipment qualification program is the -- subject to the same conditions that you would see in the type of events where it is an extended loss of power but it's not a core damage event. It's a primary source for cooling activity. That's all reflected in the equipment qualification program, and so all these instruments are going to be shown expected to be qualified.

And additionally there will be survivability requirements that use a beyond design basis core damage event. So we just want to make sure that that is understood. And that's it, and if there's more questions?

CHAIR REMPE: So the thing was is this a first-of-a-kind application, and it's my understanding when the water level sensors were reviewed, it was not clearly stated that they're going to this first-of-a-kind technology. For example, if you'd used a DP cell, you might not have been worried about a radiation level.

But because the details of this sensor are not well known, it may require some differences in how it's qualified. And I have not seen anything, this is, what you put in Chapter, in the technical report, in Rev. 1 of it, where you said we're going to at least do radiation levels, but then the next question is well, what about fluence.

And so I'm not sure I've seen that anywhere in what I've looked at. But it would be good to give me some sort of reference where I can see that you're thinking about all the variables that might impact this first-of-a-kind sensor.

Go ahead, Charlie.

MEMBER BROWN: I just wanted, and when I read this, I guess I didn't glom onto this. I presume this analysis is assuming you've got 12 modules operating.

MR. MAXWELL: Yes, sir.

MEMBER BROWN: In that circumstance. You switch between DNPM, as opposed to each NuScale NPM. I got lost in the transition, so you've answered my question.

MR. MAXWELL: So the next slide will help a little bit with that. And this is the boundary condition. So again, this is tracking from existing

industry guidance. Boundary conditions for the event are that the beyond design basis event occurs, impacting all modules at the site.

All modules are initially operating at power unless the site has a procedural direction to shut down for the impending event. Each module will successfully shut down when required. All rods are inserted, there is no anticipated transient without scram.

Onsite staff is at site administrative minimum shift staffing levels. No independent concurrent events, for example, no security threat. All personnel onsite are available to support the site response. And spent fuel and dry storage is outside the scope of this event.

MEMBER CORRADINI: I think you're going to discuss this but just to, in anticipation. But what makes you guys unique, I thought you wrote somewhere in chapter is you're, you have a higher probability of something in transition to refueling, and that's going to be a particular mode that you're going to analyze specifically for this.

MR. MAXWELL: And we did, and we took, we considered a --

MEMBER CORRADINI: If you're going to do

it later, you can wait.

MR. MAXWELL: I don't, we don't have a slide specific to that, so I'll just describe it briefly. Here is that what we did is we considered a module that was in transition, so it had been cooled down. In order to achieve the state of transition you cool down the module, you pull it up, and you open the ECCS valves.

So I've got a module now that's on the reactor building crane. It's been moved over to the containment tool, and we've lifted it to its highest point to be set into the pool, into the refueling pool. And that's at that moment that that's when the ELAP occurs.

And we did an evaluation, and it was also if we provided adequate core cooling for beyond 50 days. It was still, it was not bounding compared to the other modules.

Additionally, while we did look at that, we also looked at, well, in transition, you know, you'd say that the initial condition's better off than compared to an operating module that you're already cooled down and flooded.

And so we're looking now specifically at the amount of time that you spend at that elevation

where there's less cooling, depth of cooling to the ultimate heat sink. And something along the lines of .02% of an operating cycle that the module will spin in that state.

MEMBER RICCARDELLA: Crane stops working so it's sitting there for 50 days or something.

MR. MAXWELL: That's correct. And you know, we've kind of jumped into what the operators will be doing. And of course there's design features that allow manual operation to lower the module with the crane, that's correct, manually. But the analysis shows that it wouldn't be required.

MEMBER MARCH-LEUBA: But wouldn't the limiting one when would be if you put in the refueling machine sits there at that unlimited position, and it's not DHRS.

MR. MAXWELL: There's no --

(Simultaneous speaking.)

MR. MAXWELL: Right, but you're submerged. Now you're just in the ultimate heat sink. Now you have the entire capacity of the ultimate heat sink.

MEMBER MARCH-LEUBA: Not when you lower the level past the top of the head. Or did you lower the level past the top of the open head?

MR. MAXWELL: Well we, the modules flooded

up, all the way up to the baffle plates. Now we put it in the C tool, remove the bottom head of the containment. It's still flooded within --

MEMBER MARCH-LEUBA: And the opening is at what elevation? That top opening?

MR. MAXWELL: I don't know that number.

MEMBER MARCH-LEUBA: Is it greater or lower than 45?

MR. MAXWELL: Lower, much, much lower than 45 feet.

MEMBER MARCH-LEUBA: Much lower.

MR. MAXWELL: Yes, sir.

MEMBER MARCH-LEUBA: Okay.

MR. MAXWELL: All right, so now that we've established these boundary conditions, we'll, we took a look. We evaluated to determine if the design met the coping criteria. So I want to describe the NuScale power plant response to an extended loss of AC power concurrent with the loss of normal access to the normal heat sink. And without any operator action and without use of any offsite resources.

So within the first minute of the event, you receive a reactor trip. Decay heat removal system initiation and containment isolation for all 12 modules. That makes all the reactors sub-critical and

places in service the decay heat removal sufficient to establish safe shutdown conditions.

Twenty-four hours into the event, at the 24-hour mark, the module protection system de-energizes the trip solenoids for the ECCS valves, allowing the ECCS valves to open and place ECCS into service.

Yes, sir. It floods it -- it partially transfers reactor system to the containment vessel. So it puts some coolant into the containment and some, while some stays in the reactor above the top fuel.

At this condition, all 12 modules are in safe shutdown with passive decay heat and containment cooling. And the spent fuel in the spent fuel pool remains passively cooled by the inventory of the ultimate heat sink.

MEMBER MARCH-LEUBA: I mean, your analysis at 24 hours, you remove the DHRS cooling. I mean you drained it.

MR. MAXWELL: It becomes of significantly reduced effectiveness because of ECCS in operation.

MEMBER MARCH-LEUBA: You're only in the steam, DHRS is only in the steam area, it's not condensing.

MR. MAXWELL: That's correct.

MEMBER MARCH-LEUBA: But that's assumed, that is calculated in your modeling?

MR. MAXWELL: Yes. What we did was use the station blackout analysis. The first 72 hours of the station blackout is identical to an ELAP. And we use that analysis to predict the response.

MEMBER MARCH-LEUBA: Because if I remember correctly, the conductivity through the containment is only like .5% nominal power. Certainly less than one percent.

MR. MAXWELL: I don't know the answer to that question.

MEMBER MARCH-LEUBA: That's the number of, actually, 0.6% is the number that sticks to my head and I've heard sometime. And that, it's awfully close to decay heat.

MR. MAXWELL: Well, yeah --

MEMBER MARCH-LEUBA: If you've run the calculation properly.

MR. MAXWELL: That's correct.

MEMBER MARCH-LEUBA: I'm not in the business of arguing with computer codes if you've done it.

MR. MAXWELL: We have a calculation that did consider this. You know, if DHRS is in service

for the first 24 hours, and then transferring over to Emergency Core Cooling System at 24 hours.

Okay, again, like I said now so we're in safe shutdown on the 12 modules and the spent fuel in the spent fuel pool just continues to be passively cooled by the ultimate heat sink inventory. During all this period, the ultimate heat sink is heating up, and it begins to boil after more than five days.

When the pool begins to boil in our analysis we assume that none of the inventory returns back to the pool. Level begins decreasing. Again --

MEMBER MARCH-LEUBA: Well before that you will start evaporating.

MR. MAXWELL: Right.

MEMBER MARCH-LEUBA: Which will mean the containment level building around the pool, and we'll have an environment similar to Florida yesterday. And everything will be condensing, any instrumentation, anything that has -- everything in building survives condensing moisture?

MR. MAXWELL: All the safety-related equipment necessary is qualified to the pool environment that's in that area --

MEMBER MARCH-LEUBA: Is it qualified for 99% humidity and condensing?

MR. MAXWELL: Correct.

MEMBER MARCH-LEUBA: What happens to the steam when you start boiling it? Because that building is closed.

MR. MAXWELL: There are pressure, overpressure reliefs in the reactor building, safety-related overpressure reliefs.

MEMBER MARCH-LEUBA: Like a safety relief valve? Cooling down service, same function.

MR. MAXWELL: That's correct. Like again, after more than five days the pool begins to boil and it just, again to point out, so you know operator action. The level in the pool would begin to decrease, and it would reach 45 feet, which we said earlier was just below the top of the DHRS passive condensers, after more than 50 days.

MEMBER CORRADINI: So can I ask a question? Jose asked it, and maybe I misunderstood. So there is pressure relief from the building to the environment?

MR. MAXWELL: That's correct.

MEMBER CORRADINI: If I then go through a change of conditions where there's a negative pressure, is there pressure relief from the environment back into the containment -- into the

reactor building?

MR. MAXWELL: I don't know the answer to that, I'll have to take --

MEMBER CORRADINI: Does somebody know that in the design? Does it go, does it swing both ways? In other words, if I have an overpressure does that go out? If it starts breathing, will it allow it to come back in if I start condensing steam too much? Because I'm going to essentially flush all the air out of the system, right?

MR. MAXWELL: Right.

MEMBER CORRADINI: As I approach boiling, the partial pressure of steam is going to essentially take over. So I'm curious if I then get a lower pressure, will there be an inflow?

MR. MAXWELL: I understand the question, unfortunately I don't know the answer to that.

MEMBER CORRADINI: Can you take it down and get back to us?

MR. MAXWELL: Yes, we can.

MEMBER CORRADINI: Thank you.

MEMBER BLEY: My memory from work that was done on cylindrical containments --

MEMBER CORRADINI: Well, this is a building, it's not a cylindrical --

MEMBER BLEY: No, if you get into that condition though so that you've got a few inches of reverse pressure. You aren't built for that kind of strength.

MEMBER CORRADINI: Well, but --

MEMBER BLEY: Weird things can happen.

MEMBER CORRADINI: But as long as they've got a, I expect you're going to tell me they had a damper, like a door. The door opens, the door closes, it swings both ways.

MR. MAXWELL: I think we're going to find this more along the lines of a rupture.

MEMBER CORRADINI: Because where I'm going with this essentially is -- I'm in -- well, I'll stop.

MR. MAXWELL: I'll get the official answer for you.

MEMBER CORRADINI: That's fine, that's fine. Okay, thank you.

MR. MAXWELL: So now we've got, like I said, the pool level has dropped down to 45 feet. Again, that takes more than 50 days for that to occur. During that period, passive core cooling and containment cooling are assured.

And just, again, I'm pointing out that the 45 feet is not significant in any regard to the

ability to cool the fuel or containment. It's just where the long-term cooling calculation analysis terminated.

Regarding the spent fuel pool cooling safety function itself, it continues to be maintained, even if the level in the ultimate heat sink is allowed to lower. And after more than four months, the ultimate heat sink level would reach the bottom of the opening in the weir wall that separates the spent fuel pool from the rest of the ultimate heat sink pools.

And that level's significant. Before that point, pools are in communication with one another and the reactor pool and the refuel pool act as a makeup source to the spent fuel pool for that period. And once the walls, once the pools are separated and we're just looking at the spent fuel pool for cooling of the spent fuel, it still requires another month, up to five months before the level would reach the top of the spent fuel rack.

CHAIR REMPE: This is my ignorance of the regulations, but the fact that you've separated out the fact that operators have, some plant person has to replace the battery, it's not included in the requirements to meet this particular aspect.

MR. MAXWELL: That's correct.

CHAIR REMPE: So your subtitle about plant response without operator action or offsite resources applies for this particular criterion. But later with the spent fuel and then is where you hit up about the batteries might have to be replaced.

MR. MAXWELL: Right, this condition would still exist, because this isn't level monitoring, it's just the pool passively lowering and the safety functions continuing to be maintained during this period. Then yes, you're right that we separate. Then there's the paragraph E requirement specific to spent fuel pool level indication.

CHAIR REMPE: Okay. Well, I go further. Then the staff though has applied broadly. We're not going to do anything beyond 72 hours in the response that they, what they have in their draft SE. And they went ahead and because they don't have analysis beyond 72 hours is why they stopped on this, when it wasn't because they needed an operator action or anything like that?

Is there a primary reason plus, or is that your understanding of why they stopped on 72 hours for this?

MR. MAXWELL: Let, they would like to speak to that.

CHAIR REMPE: Okay, well, I'll let them speak to it later. Are you still strong that you want 50 days or whatever? Or that's your, the NuScale stance here still?

MR. BERGMAN: Hi, Tom Bergman, NuScale, again. Yes, we would like to have the coping period of 14 days approved and the recognition that 14 days represents indefinite given the resources required at that point. So we're calculating it to 14 days. The 50 days shows we have plenty of margin for 14 days.

PARTICIPANT: Yeah, I think the 50 days is just a calculation.

MR. MAXWELL: Right, that's what we, you know --

CHAIR REMPE: And you believe you have adequate documentation to support that with what you've provided with this Rev. 1 technical report.

MR. BERGMAN: Correct. It was also -- I can't remember the day but it was a March 2019 letter to NRO where we laid out the rationale for what we're doing as well.

The DCA has now been brought in, the technical reports have been brought up to date. That letter, which is referenced in the Staff SECY paper, provides that basis for the 14 days.

CHAIR REMPE: Okay, thank you.

MR. MAXWELL: So, now with the pipe response being covered, we're going to remove two of the individual key safety functions, beginning with core cooling.

The success criteria we looked at and the criteria are for the equipment relied upon to provide satisfactory fuel cooling performance and to maintain the fuel covered at all times.

With the containment isolation that occurs in that first minute, within the first minute of the event initiation, the reactor coolant system inventory required to meet these criteria is preserved for the duration of the event.

The core cooling itself is provided as we've established in the first 24 hours by the decay heat removal system and then the remainder of the ELAP via the emergency core cooling system.

Also essential for core cooling is the ultimate heat sink inventory.

Core cooling, again, occurs initially through transfer of heat to the ultimate heat sink to the DHRS passive condensers, which are submerged in the ultimate heat sink and then transfers to heat transfer from the containment vessel with ECCS in

operation.

The passive heat removal to the ultimate heat sink is capable of maintaining core cooling for more than 50 days without pull inventory makeup or operator action.

Next safety function is containment. The containment function is provided by the containment isolation valves and the containment vessel.

As we just mentioned, there's containment isolation that occurs within the first minute of the event by a module protection system automatic response.

The containment vessel temperature and pressure are passively controlled by heat removal of the ultimate heat sink.

And the parameters reach their peak value during ELAP immediately following opening of the ECCS valves, again, which happens after DHRS has been in operation for 24 hours, reducing RCS temperature.

And pressure over that period and the opening of the ECCS valves itself does not represent a challenge to the containment integrity.

So, with the ultimate heat sink inventory -- without any addition or any other operator actions, the containment cooling is maintained for more than 50

days.

The third key safety function is spent fuel pool cooling.

Just a couple minutes ago we discussed the pools of the ultimate heat sink and in this figure we can see the rear wall itself that separates the spent fuel pool from the refuel pool and the opening in the wall, the weir that allows the movement of fuel between the two pools using the refuel machine.

And that opening is significant because it's what allows the spent fuel pool to communicate with the other pools and initially causes the ultimate heat sink to respond as a single volume to the event until level lowers below or to that point.

And again, as described earlier, at that point it's just the inventory in the spent fuel pool that's providing cooling to spent fuel. It still would require more than 150 days for the level to passively boil down to the top of the spent fuel rack.

The last topic I'll talk about, with respect to again just to the mitigation strategy and monitoring and with respect to that, just to the mitigation strategy, pipe monitoring is not necessary because there are no operator actions to establish and maintain the three key safety functions for more than

50 days following the initiation of an ELAP.

However, the instrumentation is instrumentation DC electrical power provided in the design that allows the control room operators to observe the response of the installed plant equipment to verify the conditions necessary for coping had been established.

These indications remain available for a minimum of 72 hours.

MEMBER MARCH-LEUBA: You're saying that the batteries share the load, drop an unnecessary load but keep the control room alive for 72 hours?

MR. MAXWELL: That's correct.

MEMBER MARCH-LEUBA: Is that what you're saying?

MR. MAXWELL: Yes.

MEMBER CORRADINI: So, you said something earlier and I wanted to kind of return back to it.

So, as you said, the philosophy is that this essentially is, to put it in terms, is a hands-off response where the operators are free to then address the initiators and cure or reestablish.

So, what would be in the emergency operating procedure realm, not this realm, to

reestablish battery charging to get the batteries so they'd go beyond 72 hours? Can you remind me what that is?

MR. MAXWELL: They're not --

MEMBER CORRADINI: I assume it's EOPs that they would be following?

MR. MAXWELL: Right, and forgive me, it's not my area of expertise. I can't remember the name of --

MEMBER CORRADINI: It's not mine either so just take us down the path.

MR. MAXWELL: If you look at the displays for the operator, it's the three key safety functions that they evaluate.

And I'm a visual thinker, I'm looking at the panel in my head here, but there's the three key safety functions and then, essentially, they're the backup functions. So, once the three key safety functions are established and maintained, here are the other areas that you need to address.

And one of them is electrical distribution and entering that procedure will direct the operators to restore power, to start the backup diesel generators, to get the auxiliary AC power source running and ready for electrical loading.

So, there are procedures for those defense-in-depth components, if you will, that will direct the operators to take those actions.

MEMBER CORRADINI: And those would, based on EOPs and even with the stylized accent, those would occur simultaneously?

MR. MAXWELL: That's correct.

MEMBER CORRADINI: Thank you.

MEMBER RICCARDELLA: So, going back to your picture with the rear wall?

MR. MAXWELL: Yes, sir.

MEMBER RICCARDELLA: There's nothing that causes circulation, natural or otherwise, between the main side and -- so one could get considerably warmer than the other.

It's just that if it boils off, the level will stay the same, right?

MR. MAXWELL: That's exactly right. The heat load in the spent fuel pool -- the pool boil-off calculation was very conservative. It assumes 18 years' worth of spent fuel in the pool including a fresh full-core offload.

So, the heat load being more significant than the reactor and refuel pool and the volume being smaller, the spent fuel pool boils off faster. And

again, the refuel pool make up, essentially acts as a makeup source.

MEMBER RICCARDELLA: It's like the hot tub in a swimming pool?

MR. MAXWELL: That's correct. So, now with the discussion of the mitigation strategies complete, we move into the spent fuel pool monitoring portion of the rule, which is covered by Paragraph Echo.

The objective of this part of the rule is to provide a reliable means to remotely monitor wide-range spent fuel pool water level until five years have elapsed since all of the fuel within the spent fuel pool was last used in the reactor vessel for power operation.

And the intent is that the operators have the information necessary to prioritize event response. The NuScale ultimate heat sink system includes remote level indication for the following.

It's got reactor pool, refuel pool, and two dedicated indicators for the spent fuel pool.

These indicators are seismically qualified as well as qualified for the environment of the pool area during an ELAP, and are normally powered by our highly reliable DC power system via the plant

protection system.

MEMBER MARCH-LEUBA: Would you go back to the cartoon and show where the refueling pool is?

MR. MAXWELL: Yes, sir.

MEMBER MARCH-LEUBA: Where is the third pool? Because I only see two.

MR. MAXWELL: What this isn't showing you in this mimic is that the elevation of this floor is below the reactor pool.

MEMBER MARCH-LEUBA: It's a continuous mass of water?

MR. MAXWELL: It is.

MEMBER MARCH-LEUBA: There is no rear wall there?

MR. MAXWELL: That's correct, no wall. The difference is just the --

(Simultaneous speaking.)

MEMBER MARCH-LEUBA: It's still the pool, you just call it Section A, Section B?

MR. MAXWELL: That's correct. It could be thought of another way as two indications for spent fuel pool level indication on this side of the rear wall and two indicators for pool level on the other side of the rear wall.

In addition to the 72 hours of battery

power from the highly reliable DC power system, the design would include for these level indicators a replaceable battery power source that's independent from the plant AC and DC power systems.

And those batteries will have a minimum capacity of 14 days.

MEMBER MARCH-LEUBA: Capacity to provide what?

MR. MAXWELL: To provide indication for these spent fuel pool level indicators.

MEMBER MARCH-LEUBA: It will power the instrumentation? Where is the display, the control room?

MR. MAXWELL: The location of the display, final location, hasn't been determined but what is required is that it's remote from the pool area.

MEMBER MARCH-LEUBA: It has to be in an accessible location.

MR. MAXWELL: That's correct.

MEMBER MARCH-LEUBA: The USS is not accessible.

MR. MAXWELL: That's exactly right.

MEMBER BLEY: What keeps this replaceable battery from supplying power to other things?

MR. MAXWELL: It's divorced, it's capable

of being completely divorced from the AC and DC power system. It's independent of and divorced from the AC and DC distribution system.

MEMBER BLEY: I don't remember seeing details of this. Are they available somewhere?

MR. MAXWELL: The final instrument hasn't been selected, just we're implementing the requirement for --

MEMBER BLEY: The electrical side isn't laid out anywhere.

MR. MAXWELL: No, sir, not at this time. I just want to point out that it's specific to the instrument.

This is not part of our electrical distribution system at all, it's going to be specific to the spent fuel pool level instrument.

MEMBER BLEY: So, you would have to disconnect a normal power source and then insert this replaceable battery source?

MR. MAXWELL: Again, we haven't selected our --

MEMBER BLEY: You don't know exactly?

MR. MAXWELL: I can tell you that at my old plant ours divorced itself and a loss of power relay dropped out and just put the replaceable battery

in service.

MEMBER BLEY: So, there will be one there permanently?

MR. MAXWELL: That's correct, a permanent install.

MEMBER BLEY: And it will be charged permanently but it will somehow disconnect when you get to this point?

MR. MAXWELL: That's correct.

MEMBER BLEY: And when you say replaceable, is there the intent that at some point when it starts running down, you could stick a new one in there so you'll keep these instruments?

MR. MAXWELL: That's the intent. Again, without having selected the permanent design, I can tell you that there's designs that are capable of the batteries.

MEMBER BLEY: It will be for all of these level instruments, not just one?

MR. MAXWELL: All four.

MEMBER BLEY: Have you done that for any other instruments that you know of?

MR. MAXWELL: Not that I'm aware of.

MR. SCHULTZ: Chris, is this then the system that is time-limiting in terms of the 14 days?

In other words, you're putting this into place so that you can support a 14-day timeframe?

MR. MAXWELL: I would say that the mitigation strategy, again, keeping it separate from the spent fuel pool level indication, worked on require spent fuel pool level indication to mitigate the beyond-design-basis event.

So, this is separate, the 14-day battery is separate, to the spent fuel pool level indication requirement, Paragraph Echo, not to the B1 requirements.

Because we don't credit or need the spent fuel pool level indicators as part of our mitigation strategy.

MR. SCHULTZ: But you're putting the replaceable battery power source in place so that you can support 14 days as it relates to this requirement?

MR. MAXWELL: Correct, Paragraph Echo requirement.

MR. SHULTZ: Okay.

MEMBER RICCARDELLA: But if they're constantly charging during normal operation, wouldn't you expect them to last 14 days?

MR. MAXWELL: I expect them to last 17 days because the first 3 days they'll be supplied by

the highly reliable DC power system.

I'd actually expect it to be 20 days, frankly, but once the EVS batteries are no longer available, that's when these batteries would be placed into service.

And their allowance is made in the rule for intermittent operation but we haven't finalized what instrument we're going to use.

MEMBER BLEY: That would be something you do by procedure or it might even --

MR. MAXWELL: That's correct.

So, to summarize, the two different portions with regards to the pipe mitigation strategy, the NuScale strategy, is to rely on the automatic response of the permanently installed safety-related plant equipment to establish and maintain the three key safety functions and to provide extended coping capabilities of greater than 14 days.

And again, this strategy doesn't require any AC or DC power, or any inventory addition, or any operator action to be placed into service or to be maintained.

And regarding the spent fuel pool level indication strategy, they rely on the installed instrumentation I've just described. And included in

that is a 14-day battery backup power supply.

MR. SCHULTZ: But you don't really need that to satisfy the condition of the fuel? The fuel is fine for 50 days, 50-plus days?

MR. MAXWELL: That's correct.

MR. SCHULTZ: So, you don't need to spend this money, you could spend it on something else if you didn't have to meet this requirement?

MR. MAXWELL: That's correct.

MR. SCHULTZ: But you can do it and do so. Okay, thanks.

MR. MAXWELL: That's the end of the Chapter 20 presentation if there's questions.

CHAIR REMPE: I'm going to delve a little bit more about what I tried to ask earlier about what would be required to get the Staff to go to a 14-day approval.

If they were to decide to do this, they probably would ask for a lot more analyses to be submitted, which would require a lot more review on their part as well as they'll be RAIs and all that stuff.

And there's always pressure about oh, it costs so much for a design certification but you guys are willing to step up and say whatever it takes that

the Staff think they need, you're willing to provide it.

It does cost money to have this additional work done, right?

MR. MAXWELL: I'll defer to the licensee for the response.

MR. BERGMAN: Tom Bergman, NuScale. We believe we've already done the work to provide that information in our latest submittals.

CHAIR REMPE: I heard that earlier but you realize there will be RAIs. The Staff had not intended to do more than 72 hours. Is there a response back?

And if they come back and say, okay, well, you guys want it, we'll do it, and they start asking a lot of RAIs and ask for additional analyses?

MR. BERGMAN: Then we can revisit our decision but Chapter 20 is written as a substantial investment. We'd like to get the maximum return on that investment.

CHAIR REMPE: Sure, I bet. Okay, just exploring the boundaries here. We're scheduled for a break now, are there any other questions?

MEMBER SKILLMAN: I had one. Chris, I'm in your mitigation strategy in your Section 522

reactivity control and just let me make two points.

I'm going to read from your document so you understand why I'm saying what I'm saying. For Boundary Condition 3 in Section 313, when reactor trip occurs in the ELAP event, all control rods fully insert.

This action achieves initial subcriticality, however, depending on the time and core life, for some currently licensed designs the control rods alone may not provide sufficient negative reactivity to compensate for the positive reactivity added as the core cools.

I'm interpreting that as a rhetorical reference to other plant designs, not the NuScale design. Then you say to account for this the NuScale plant design includes a unique core design limit.

I'm assuming that unique in that context means it's unique to the way the NuScale license is written.

MR. MAXWELL: Unique in that it's not typical of designs.

MEMBER SKILLMAN: Okay, so it's back to the former, more general discussion. Unique meaning all those other PWRs out there and not necessarily ours?

MR. MAXWELL: Correct.

MEMBER SKILLMAN: Okay, because what you go on to say then or what this document then says is the hot full-power critical boron concentration is such that a cold zero power with all rods inserted K effective is less than one.

I've operated a 508 percent, a 2791 cooler, a 24-month fuel cycle and I've been out 690 days at 18 PPM. And we push the scram button, it goes subcritical.

So, I think that the limit that you're talking about is at the end of core life with a 508 percent core, 690, because you're in a 24-month fuel cycle, you're out 690, 700 days.

And even at that very low boron concentration, whether it's 10 or 30, at least the way you're writing your license, you will be 5 percent subcritical or 1 percent subcritical, you're simply saying you're subcritical.

MR. MAXWELL: Unfortunately, I don't know that I'm smart enough to answer your question fully.

MEMBER SKILLMAN: I think you're saying the end of life, no matter what the boron concentration is, it shuts down.

MR. MAXWELL: That's correct. We operate

with sufficient boron concentration with all rods in to be subcritical.

MEMBER SKILLMAN: And even as it cools from there, you still remain subcritical?

MR. MAXWELL: That's correct.

MEMBER SKILLMAN: Gotcha. Thank you.

CHAIR REMPE: Mike, did you have a question?

MEMBER CORRADINI: I'm good.

CHAIR REMPE: So, if there aren't any other questions --

MS. JOERGENSEN: I'd like to make a comment. There was a question on the negative pressure in the building, whether the vents would allow it to relieve overpressure and also allow air to come back into the building.

So, the answer is the reactor building ventilation system maintains a negative pressure by design. If boiling occurs, the overprotection is a ruptured disc and steam goes out.

It would not reclose and if there is a later negative differential due to steam condensation, air would be pulled back in.

MEMBER CORRADINI: Thank you.

CHAIR REMPE: So, since we are now

scheduled for our break, let's take it and come back until 2:40 p.m. by this clock, okay? Thank you.

(Whereupon, the above-entitled matter went off the record at 2:24 p.m. and resumed at 2:41 p.m.)

MR. TABATABAI: Okay, good afternoon, everyone. My name is Omid Tabatabai, I'm a Senior Project Manager in the Office of New Reactors.

And we're here to present the Staff's evaluation of NuScale's Chapter 20 safety evaluation application and the design certification application.

But before we get started, I would like for Kevin Coyne who's here and he's the Director of our Division of Safety Assessment, Risk Analysis, and Engineering.

So, Kevin will be making some introductory remarks on behalf of the Staff. Kevin?

MR. COYNE: Thanks, Omid. Kevin Coyne, Acting Director, Division of Engineering, Safety Systems, and Risk Assessment. And thank you for the opportunity to greet the Subcommittee today.

Needless to say, the ACRS reviews are very valuable to the Staff and provide good feedback that we then incorporate into our reviews. And in particular, thank you for the flexibility and scheduling of a full Committee Meeting tomorrow.

I know that's unusual but it was important to NuScale, important to the Staff to try to get to the full committee as soon as we could.

So, the mitigation of beyond-design-basis event review that the Staff has been doing has evolved since NuScale first submitted their application.

It's worth noting that the MBDBE orders and the rule are not applicable to a design certification.

But to the extent an Applicant chooses to describe certain design aspects of the SSCs used to provide the mitigation strategies in their FSAR, the Staff can review that and provide some level of finality based on that review.

Looking to our OGC, I just wanted to make sure I got that part right. So, legitimate to review but it's not required for the design cert.

NuScale has asked for the reviews so the Staff is going through the review. We've briefed ACRS on our MBDBE reviews and the past HMP was obviously the most recent one.

That review criteria was against the orders that were issued after the accident at Fukushima Daiichi. Since that time, the Commission has approved the new rule, 5150(5).

So that was another driver for the evolution of how the review is going to proceed in this case. So, the Staff will brief on the SE that we've generated but it should note that that SE is largely based on Rev 2 of the FSAR.

Subsequent to us receiving Rev 2 to Chapter 20, NuScale has significantly changed the approach for their mitigation and beyond-design-basis event strategies and has submitted a markup to the Staff describing those changes.

So, we expect our SE to change based on our review of the markup, however, we will describe today the review criteria that we intend to use to apply to the NuScale review.

So, I just wanted to let everyone know it's a bit of a review in motion here. We will go through the review criteria that we intend to use and then answer any questions you guys have on that.

MEMBER RICCARDELLA: But the presentation material that we just saw, was that per the markup or per the original Rev 2?

MR. COYNE: I believe that reflects NuScale's current position on their compliance with --

MEMBER RICCARDELLA: Which is what you referred as the markup.

MR. TABATABAI: Yes.

MEMBER CORRADINI: So, is the markup then connected with the Revision 1 of the technical report that supports the chapter?

MR. COYNE: Yes.

CHAIR REMPE: My understanding is the Staff will not be doing anything to reflect the revised information that we saw today and the Rev 1 of the technical report.

You're going to issue the SE pretty much as is without accommodating this additional information.

What we're trying to get to is, is this the right time for us to be writing a letter or should we wait if you're going to do an update in the next --

MR. COYNE: so, that's not a question I can answer but I can tell you that we have different phases in the review. So, what you have is the Phase 2 SE. It is what it is.

We will generate a Phase 4 SE, we have a milestone date of mid-December to make that publicly available.

And so that Phase 4 SE would definitely reflect the current NuScale approach and our review approach for that information.

MEMBER RICCARDELLA: But if we were to write a letter now we could comment on the criteria that you're going to use for that evaluation. So, that's what you said you're going to present today, correct?

MR. COYNE: Correct. So, we will cover the criteria that we intend to apply to the review today.

MEMBER CORRADINI: Okay, maybe we'll just ask the questions at the end instead of the beginning because we'll take you on all sort of what-ifs.

So, once we see the criteria -- but the criteria are not going to be any different than what you would have applied to any other -- they're design-specific for the NuScale design.

MR. COYNE: Ryan will cover that.

MEMBER CORRADINI: Okay, fine.

CHAIR REMPE: I'd like to also point out that the SECY paper is not public yet but it will be within a few weeks.

But I know one Member has already approached me and said they'd like to have a closed session to discuss this a little bit more.

And so we might want to also have some of these questions after we get through the public

portion of today's meeting. Okay?

MR. NOLAN: It should be publicly released Friday.

CHAIR REMPE: Unfortunately, we've got to do this now but yes, we'll discuss it a little bit more.

MEMBER RICCARDELLA: If we're going to write a letter it will be written by Friday.

CHAIR REMPE: Go ahead.

MR. TABATABAI: Thank you, Kevin. This afternoon, we will be talking about some background information.

As Kevin mentioned, this review has been kind of dynamic in terms of information that we have received and also the regulations that have been operated and issued lately.

We will describe the Staff's review approach and we will share with you some of the preliminary findings that we have made in terms of our evaluations.

The word preliminary here is because as you know, these findings are based on kind of an older version of information and review criteria. So, we will be updating those in Phase 4.

We will describe our review of NuScale's

mitigating strategy and that is basically the topic of the SECY paper that you mentioned. And Ryan will be talking in detail about that.

And then we will describe our Phase 4 review strategy and plans. Before starting our presentation, I'd like to recognize our team of reviewers.

As you see, we have quite a few reviewers who contributed to this review and preparing the SER from various offices, NRR, NSER, and NRO. This slide basically summarizes what Kevin mentioned during his introductory remarks.

We received Rev 2 of Chapter 20 or design certification application in October 2018. In January the Commission approved the final MBDBE rule which will be codified in 10 CFR Part 50S 50.155.

NuScale informed the Commission, the NRC Staff, in March of 2019 that now that the rule has been finalized they will revise their Chapter 20 to make confirming changes to the information.

We received NuScale's Revision 3 or draft Revision 3 markups on June 10th of this year and then on June 14th, we received Revision 1 to the ELAP topical report, extended loss of AC power.

One June 26th the Staff issued their SECY

paper which kind of describes how we plan to complete the review of NuScale's Chapter 20 and the title of the SECY paper is Staff Review of NuScale Power's Mitigation Strategy for Beyond-design-basis External Events.

And we are expecting for the rule to be publicly available around September 2019.

MEMBER BLEY: I'm sorry, say that again?

MR. TABATABAI: In 2019 10 CFR 50.155 will be published in the Federal Register.

MEMBER BLEY: Okay.

MR. NOLAN: Yes, it will be published and final at that point.

MEMBER BLEY: So back in March -- Rev 2 of Chapter 20 is up on your public website?

MR. TABATABAI: That's correct.

MEMBER BLEY: Did you say you now have Rev 3?

MR. TABATABAI: Yes, it was submitted on June 10th.

MEMBER BLEY: You haven't really looked at that yet or have you?

MR. TABATABAI: It is a markup, it is not part of an entire DCA package. The entire DCA package will arrived late August.

MEMBER BLEY: Okay.

MR. TABATABAI: But it is publicly available.

MEMBER BLEY: Oh, it is?

MR. TABATABAI: It is.

MEMBER BLEY: Okay, are there substantial changes?

MR. TABATABAI: Yes.

MEMBER BLEY: From 2 to 3?

MR. TABATABAI: Yes.

MEMBER BLEY: There are. And they're consistent with Rev 1 of the tech report?

MR. TABATABAI: I will have to -- these documents have been submitted very recently. We have not completed detailed --

MR. NOLAN: Yes, but I think they were revised together. So, Rev 3 of the FSAR and I think Rev 2 of the tech report will be consistent.

MR. TABATABAI: NuScale wants ELAP to support Revision 3 but, again, from the Staff's perspective, we have not reviewed --

(Simultaneous speaking.)

MEMBER CORRADINI: Sure, but I think Ryan said something I want to make sure of. So what is in theory consistent? Rev 3 and TR-1? Or Rev 2 and

TR-1?

MR. TABATABAI: Rev 3 and TR-1.

CHAIR REMPE: Is Rev 3 on the NRC's website? Where is it?

MR. NOLAN: We've received a draft markup and then when the entire FSAR is submitted as part of Rev 3, which is expected at the end of August timeframe.

CHAIR REMPE: So we cannot see Rev 3 right now?

MR. TABATABAI: I can provide the ML number. You can search it. It is not on the website but it is in ADAMS, publicly available.

MEMBER BLEY: Well, if you can give us the ML that would be good. Thank you.

CHAIR REMPE: While we're asking for things, I saw that the SECY does refer to this March, whatever, 19 letter that was mentioned earlier today.

And it's a publicly available ML number or do I have to go to the private one?

MR. TABATABAI: No, it's publicly available.

Staff's Phase 2 review approach, as I mentioned, because of the timing of different submittals and availability of Staff's review

guidance, the latest final rule is not reflected in that.

Although, it's part of SRM SECY which was issued in January. That's the latest publicly available guidance document that we have.

But most of our, I mean all of our, evaluation findings in the SER are based on Revision 2 of the NuScale DCA.

These are the lists of all of the regulatory documents or guidance documents that we used to evaluate NuScale's DCA Rev 2.

And based on the documented information, our findings currently are only for the first 72 hours after initiation of a beyond-design-basis event.

MEMBER CORRADINI: I want to make sure, so the SECY gives the rationale as to why you're stopping at three days?

MR. TABATABAI: That's correct. The SECY is not public yet but --

MEMBER CORRADINI: I understand. When it is, the reasoning for that bullet is there?

MR. TABATABAI: That's correct. The last part of the SECY discusses why the Staff is going only up to 72 hours.

MEMBER CORRADINI: Okay.

MR. NOLAN: And we'll touch on it.

MEMBER BLEY: It talks about how you're doing the review as well, which you can tell us now?

MR. TABATABAI: Yes.

MEMBER BLEY: Go ahead.

MEMBER SKILLMAN: Omid, on that slide, please, you identify it as NEI 1206 Rev 2 but in the safety evaluation you identify that the key safety functions are identified in NEI 0612 Subsection 423.

You also communicate it's NEI 0612 Revision 3. So, is there a disconnect between this slide and what is in your safety evaluation?

MR. TABATABAI: No, there were actually different revisions. It depends whether or not the NRC proved or endorsed any of those NEI guidance documents.

I think in the SER for different subsections in Chapter 20, you might notice various NEI revisions or various guidance. But on this slide I have kind of listed those major recurring themes that you see in the SER.

It doesn't really include every single revision of the NEI or 1206 or 1202. It doesn't list all of that. This is what the main, basically the main, guidance documents that we have used.

MEMBER SKILLMAN: Well, then I mean confused because it seems that this is referring to -- it's on Page 34 of the PDF.

It is technical evaluation 20.2.4 and this sets out what the Staff has identified as the key safety functions. So, this is the heart of your review.

MR. TABATABAI: Right. Under LOLA --

MR. ASHLEY: Hi, this is Clint Ashley from the Staff. I think the confusion is these numbers are NEI 1206 and NEI 60612.

One of them, the first one, is for mitigation strategies. The second one is for loss of large areas. And so that's why you'll see those two numbers in the safety evaluation, because Chapter 20 of NuScale covers both topics.

MEMBER SKILLMAN: Fair enough, thank you.

MR. TABATABAI: Next slide. So, on this slide we have summarized our preliminary findings of NuScale Chapter 20 information.

There are four subsections in Chapter 20. Section 20.1 talks about mitigation strategies. This is basically what NuScale presented to the Members before us and that is the subject of Ryan's presentation later on during this presentation.

We also reviewed Subsection 20.2, which is LOLA, loss of large area, and 20.3, emergency procedures, and 20.4, enhanced emergency response capabilities.

With respect to loss of large area, the Staff used SRP guidance in Section 19.4 and that section basically talks about how to review to make sure information or design complies with regulatory requirements in 50.54 HH2.

In that section, the Staff specifically looked at five different criteria with respect to RCS reactor cooling system inventory or RCS heat removal, containment isolation and containment integrity, and released mitigation.

I just don't want to get into details of the review but we looked at the SRP guidance and looked at the information that NuScale had provided.

And we confirmed that the information in the design meets the regulation. We have no open items on this topic, we won't have any issues.

MEMBER BLEY: Something still isn't completely clear to me. I thought when I read their Chapter 20, NuScale's Chapter 20, that they based it on the draft mitigation beyond-design-basis event rule.

Is that true, number one? And then number two, the final rule you said will come out later in the year and the revision will essentially be against that.

Are those two statements both correct?

MR. TABATABAI: Yes.

MEMBER BLEY: Okay, thank you.

MEMBER DIMITRIJEVIC: Well, I have one really basic question. I'm not sure, how did you take out considering damage to ultimate heat sink?

Because ultimate heat sink is always part of the beyond-design-basis events and here something says, okay, they have this big pool and this is not any, I mean, I don't know, seismic size or whatever, sink opening like in CAD, the damage done.

MR. NOLAN: Yes, so the 5150(5) rule techs addresses this specifically for passive plants and that is loss of access to the normal heat sink, not the ultimate heat sink for passive designs.

MEMBER DIMITRIJEVIC: So, it does specifically say that?

MR. NOLAN: Yes.

MEMBER DIMITRIJEVIC: Interesting, based on what?

MEMBER CORRADINI: I think you're

connecting what Charlie asked and what we were talking about actually at break, which is they're using the same terminology, whether it be an active plant or a passive plant.

MEMBER DIMITRIJEVIC: I understand the difference in terminology. I'm just sort of surprised that damage to this big pool through the big seismic event, was not considered.

That's what I am sort of -- it's not a part of beyond-design-basis events, that's why I'm surprised.

MR. NOLAN: So, if it's being relied on for mitigation strategies of the beyond-design-basis external event, it would still need to be reasonably protected.

And the NEI guidance steps through -- I think they use the phrase robustly protected. And so we would still ensure that any SSC that's relied on for the mitigation strategies is appropriately protected for that event.

MEMBER DIMITRIJEVIC: For which event?

MR. NOLAN: Beyond-design-basis external event.

MEMBER DIMITRIJEVIC: Yes, but that can be anything. A seismic event in magnitude, right?

MR. NOLAN: So, the guidance specifies it's designed to the design basis SSC.

MEMBER DIMITRIJEVIC: Of the design basis?

MR. NOLAN: Yes.

MEMBER DIMITRIJEVIC: But this is beyond-design-basis?

MR. NOLAN: That's correct.

MEMBER RICCARDELLA: Yes, but as I understand it that's no different than the operating plants with their FLEX equipment, right? Their FLEX equipment is not designed for a beyond-design-basis earthquake.

(Simultaneous speaking.)

MEMBER BLEY: That is true, Pete.

MEMBER RICCARDELLA: That is true. But again, considering seismic, what it's designed for is different, I think, than what it's ultimate capacity really is.

So, it's designed for maybe -- the SSC is like a ten to the minus four event but the containment or any of this equipment could probably survive a ten to the minus six event without actually failing.

Because there's margins and safety factors in the design. As we've seen this morning, we've seen plants survive earthquakes that are significantly

above their SSC.

MEMBER BLEY: But you can't assume that it's --

MEMBER RICCARDELLA: No, you can't assume.

(Simultaneous speaking.)

MEMBER BLEY: -- the magnitude. I think the one thing you can say is all the cases where people have really looked hard, it's not a cliff.

If you go a little bit beyond, you aren't all of the sudden in trouble. It drops off.

MEMBER RICCARDELLA: Well, I guess the key is that should probably be part of the seismic PRA for this plant.

MEMBER BLEY: It certainly should be, yes.

MEMBER DIMITRIJEVIC: This is a different situation.

I mean this is beyond-design-basis event and in this case if we consider just damage, let's say, leak or spillover or something due to a seismic event, they have to prove they have makeup capability within the timeframe, right?

Which is not part of the discussion.

MR. NOLAN: So, for the purposes of this discussion, we are just implementing the rule as written.

And so if you take a look at the rule text, I think it's 5150(5)(C)(2), it says that the equipment must be reasonably protected from the effects of natural phenomena that are equivalent in magnitude to the phenomena assumed for developing the design basis of the facility.

So, that's what the rule specifies.

MEMBER BROWN: I want to understand just one more time here.

The extended loss of all AC and the loss of the ultimate heat sink issue is fundamentally assumed that 24 hours later the ECCS comes on?

Whenever it's triggered, it assumes that the reactor pool remains intact through all of this?

MR. NOLAN: That's correct.

MEMBER BROWN: So, seismic event reactor pool, that's really the loss of the ultimate heat sink and that's assumed not to happen? The ultimate --

(Simultaneous speaking.)

MR. NOLAN: Right, that assumption goes beyond what the rule specifies.

(Simultaneous speaking.)

MEMBER BROWN: Whether it's realistic or not, it's beyond the point. That's what the rule says.

MEMBER RICCARDELLA: But Charlie I mean has I think cracked the ultimate sink is probably something that's not a big deal. Total destruction would be a big deal.

MEMBER BROWN: I agree with you. If it starts leaking, when do they start adding water back in? 30 days when they statute replenishing? Or if they have to from the boil, 45 days? 50 days?

Whatever it was, there was some number of days when they would have to start making up inventory in the reactor pool. So, if it cracks you're going to lose some, I presume, 50 days.

Even if they could start doing at 30 days, it's based on all the risks so it would probably be okay. I'm being too generous right now.

All right, you answered my question, thank you.

MR. TABATABAI: Okay, the last point I'd like to make on this slide is that we understand that Revision 3 to Chapter 20 will not have these Sections 20.3 and 20.4.

In the SER, because there are some COL action items listed under 20.3 and 20.4 and we're defining the findings on those COL items to the COL application stage, not during the design certification

stage, but according to -- the new rule doesn't require them and NuScale we understand will not list any COL action items for these items, emergency procedures or enhanced emergency response.

CHAIR REMPE: I know you said it clearly but I just want to make sure because the current version that I reviewed basically just says there's a COL action and they're just going to have nothing on those two sections.

MEMBER CORRADINI: Per the new rule?

MR. TABATABAI: Yes.

CHAIR REMPE: Because the new rule says not to do that? Which hasn't been issued yet, the new rule, because it's not coming out until September of 2019.

MR. TABATABAI: The Rev 3 to design certification application comes in August, last August, and that will be available publicly. But the rule will be published in September some time.

CHAIR REMPE: Interesting.

MR. SCHULTZ: Right now it's really just a placeholder for these and they're going to take out the placeholders?

MR. TABATABAI: That's correct.

MR. SCHULTZ: And you're going to accept

that these items can be discussed at the COL stage and that review will be done in detail then?

MR. TABATABAI: That's correct.

And I think when Ryan goes through his presentation, one of the reasons we're talking about 72 hours is responsibility of COL Applicants versus design certification.

So, with that, my portion of the presentation is finished and I'll turn it over to Ryan.

MR. NOLAN: All right, thanks Omid. The first few bullets here is kind of an overview.

We've discussed a lot of this already but from a regulatory framework perspective the recently approved regulation, 5150(5), for mitigation for beyond-design-basis events does not apply to Applicants for design certification.

So, it would be applicable to the COL but not to the design certification Applicant. And as was stated previously, NuScale is voluntarily seeking the NRC to approve the use of its installed design features for the mitigation strategies.

As many of you are already aware, the NuScale design incorporates several unique design features that provide enhanced coping capability for

extended losses --

MEMBER BLEY: I've been trying to parse your opening statement and I thought I understood that it does not apply to Applicants for a design cert. I thought it had COL up there.

But you said it will apply to COL?

MR. NOLAN: It does apply to the COL.

MEMBER BLEY: Okay.

MR. NOLAN: And so NuScale is seeking finality to the extent -- yes.

CHAIR REMPE: I know this kind of goes between both of you but earlier today we heard, well, other Applicants have done something like KHMP did.

Did they do more than just the mitigation and beyond-design-basis events? Did they also do the LOLA?

And I know I participated in the letter, I'm just trying to remember did they do the thing about emergency procedures and integration of procedures and emergency response?

Or did they focus just on LOLL and mitigation of beyond-design-basis events?

MR. NOLAN: I can't recall the specifics.

Is there anyone out there who can speak to the procedure side of -- from a LOLA perspective, they

address the design features, which is typical of what most design cert Applicants have done.

So, they've addressed the design feature piece of the LOLA requirements.

CHAIR REMPE: Do they have to do it?

MR. NOLAN: No.

CHAIR REMPE: It's a --

(Simultaneous speaking.)

MR. NOLAN: Yes, 5054(h)(h)(2) is similar in that it's only applicable to the licensee. In this case it would be the COL.

MR. TABATABAI: Bob Vettori is our lead reviewer for that area.

MR. VETTORI: Okay, for LOLA all the operational stuff's going to go in the COL. That's what KHMP did also.

CHAIR REMPE: Okay. You have to say who you are, I'm sorry.

MR. VETTORI: I'm sorry, Bob Vettori, NRO.

MR. NOLAN: And I guess since we were talking about LOLA just now, I'll just make the point that the 5054(h)(h)requirements are getting absorbed into 5150(5).

And so once 5150(5) is published, 50549(h)(h) will kind of transfer over.

You can go to the next slide. I just put this up here for reference since it's probably been a little while since some of you have seen the rule text. Maybe it's new to a lot of you as well.

And these are just the pertinent portions of 5150(5) just for your reference.

MR. SCHULTZ: Ryan, I don't see 72 hours mentioned anywhere here. You've got lots of dot-dot-dots. I didn't think it was.

MR. NOLAN: Yes, it actually says indefinitely, the rule says indefinitely.

And I'll talk a little bit more about the criteria we're using but the main goal is to remain consistent with what was done for the operating fleet as well as the previous design cert Applicants.

MR. SCHULTZ: Thank you.

MR. NOLAN: So, as a brief overview, NuScale already went over a lot of this, but their approach, because of the uniqueness of their design, they rely mostly on safety-related SSCs, their AC and DC independent systems.

And I think many of you have seen what that event progression looks like. They're requesting a minimum coping duration of 14 days with the justification that 14 days provides sufficient time

for a licensee to establish an alternate means of heat removal.

And then the last point here is the position that there's no reliance on monitoring for mitigation strategies.

And there was a few notes in their March 28th letter and I think in the technical report, I haven't looked at the FSAR too closely, but there's a couple points that say instrumentation is expected to be available in the near term and that monitoring is there as a supplementary capability.

CHAIR REMPE: So, I know it's in a later slide but it has your plans to document that it's not relied on unless but it's expected. And I think that's in the SE also.

How are you planning to make sure your expectations are met with respect to qualification of the instrumentation?

MR. NOLAN: Sure, I think we looked at it from a robustness, to make sure that it's robustly protected.

It's designed for the SSC, it's located inside protected areas, not susceptible to wind or flooding hazards. It's protected to the external event.

CHAIR REMPE: So, protection from external events is your way of making sure that -- you've heard me whine about I want to make sure that it will be qualified for the fluence levels it may experience.

And is that going to be codified somehow, like in the ITAC, for qualifying the instrumentation?

MR. TABATABAI: I believe it's already a design commitment. Dinesh Taneja is walking to the microphone to explain it.

MR. TANEJA: This is Dinesh from NRO, NRC Technical Reviewer. So, a lot of these instruments that are relied on upon are part of their normal instrumentation.

If you look at Chapter 3, your EQ requirements, for example, containment level, right now is required to be operational for 100 days, to qualify for 100 days of operation. So, that is a design commitment.

Seismic, radiation, and temperature so the EQ qualifications.

CHAIR REMPE: And the radiation will be for the flux levels or fluence that it experiences?

MR. TANEJA: 100 days post-accident. So, whatever that total integrated dose is, that's what needs to be qualified.

CHAIR REMPE: And that's actually in Chapter 3?

MEMBER DIMITRIJEVIC: Chapter 3, 3.10. 2.10. There's a table for the instruments and what the requirements are.

CHAIR REMPE: Okay, I'll check again. Thank you for reminding me.

MEMBER BLEY: I know you guys have used robust a lot and it jumped off the page at me reading their Chapter 20, Robust Makeup Line with External Connection Point.

I take it robust is defined in one of the NEI documents or both of them, and is it defined in a qualitative way? And can you explain that?

Or is it defined in some kind of quantitative way?

MR. NOLAN: I don't have that information in front of me right now.

MEMBER BLEY: Whoever's decided you agree that these things are robust, what does that mean?

MR. HERNANDEZ: Hello, my name is Raul Hernandez from Bottle Supply. You're talking about the makeup line to the spent fuel pool?

MEMBER BLEY: That was the one that jumped off the page at me but it's used over and over and

over again and I heard it referenced that it's the NEI document that requires all of these things to be robust.

And I want to know what that means, either from your interpretation of the NEI document or how you guys used it, not just for that line but for all of these cases.

MEMBER RICCARDELLA: I want to echo Dennis's question because the Applicant uses that. And so the Staff have an agreement on what the definition is.

MEMBER BLEY: Somebody told us earlier it's as defined in one of the NEI documents, I forget which one. But if you can tell us what it means --

(Simultaneous speaking.)

MR. HERNANDEZ: For the level instruments of --

MEMBER BLEY: And why is that true? How did you decide that or did you just --

MR. HERNANDEZ: It is described in Section 9.1.3, spent fuel pool design. It discloses the makeup line and the NEI documents, if I'm not mistaken, is 1206.

MEMBER BLEY: It's in 06?

MR. HERNANDEZ: That's for the level

instrument, that's the one that I'm responsible for.

MEMBER BLEY: So, it's not defined in a general way?

MR. NOLAN: I think from a qualitative sense it's protected to the applicable hazard, right? And so it needs to be protected to wind and missiles, to snow and ice, to the seismic event.

MEMBER BLEY: So you think that's the way it's --

MR. NOLAN: Yes, so if it's being relied on for mitigation strategy it needs to be protected to those hazards.

MEMBER BLEY: In a qualitative sense it converts to a quantitative sense in specific examples.

MR. TABATABAI: Dr. Bley, Peter Bamford is from the Japan Lessons Learned so he can probably --

MR. BAMFORD: Peter Bamford, NRR. I worked on a lot of the operating plant reviews. Robust is defined in NEI 1206, there's a definition of this action and it's defined there.

Specifically, what it means is you can be robust in a couple of different ways. One is if it's safety-related protected to all the plants, external hazards, that would generally qualify as robust.

Because safety-related, it meets all the

seismic, tornado, flooding, any of the postulated external events.

In addition, a licensee could show by analysis, let's just say they had a piece of equipment that was not necessarily safety-related but they could show by either analysis or test it would likely be available after the postulated external events.

Those would be considered as robust also and all that is encompassed in the definition in NEI 1206. I hope that helps.

MEMBER BLEY: That helps a lot, thank you.

MR. SCHULTZ: And NuScale puts those prescriptions associated with the external events, they list the conditions from Chapter 3 I believe it is, that defines what the equipment will survive for each of the events.

Cold, heat, seismic, and so forth.

MR. NOLAN: Right, and so it's short-hand up here but most of the SSCs that NuScale's relying on are safety-related.

One exception is the EDSS, the batteries, however, they have unlimited quality, they are designed to the SSC as specified in Chapter 3 as well as those other requirements imposed on the battery system.

MEMBER BROWN: The 14 days for alternative heat removal, that means your ability to put water into the spent fuel pool or into the reactor pool? Which one is it?

(Simultaneous speaking.)

It's not totally the same thing. Don't you have to overflow? I thought there was something you had to overflow from the spent fuel pool to get into the --

MR. NOLAN: Yes, the connection is to the spent fuel pool.

MEMBER BROWN: I thought I read something about something had to overflow into something, from one part to -- I forgot which way it went.

MEMBER RICCARDELLA: Spent fuel over the weir to the --

MEMBER BROWN: To the reactor pool. So, if the reactor pool boiled up, you'd fill the spent fuel and it would spill over into the reactor. My memory is not as bad as I thought, thank you.

MR. NOLAN: And if you're only at decay heat levels, I wouldn't expect the water level to be below the weir within 14 days.

MEMBER BROWN: No, that's why based on the other discussions I was assuming that boil-off would

occur almost two times that much but I don't remember the exact numbers.

PARTICIPANT: It looks like the weir is uncovered at 130-something days.

PARTICIPANT: 150.

MEMBER BROWN: No, the top of the fuel, not the weir.

PARTICIPANT: The weir comes before that.

MEMBER BROWN: That's right.

PARTICIPANT: It's ten feet above.

MEMBER BROWN: Thank you.

MR. NOLAN: Okay, so the next few slides I'm going to go over the Staff's review approach.

MR. SCHULTZ: Ryan, before you leave that slide, that's the last time you mentioned 14 days.

MR. NOLAN: Right, that's what NuScale is proposing.

MR. SCHULTZ: That's what they've proposed?

MR. NOLAN: Correct.

MR. SCHULTZ: Let's wait until you're finished then.

MR. NOLAN: So, like I mentioned before, one of the most important things for our review approach is to maintain consistent with what we've

done for the operating plants as well as previous design certifications.

We've received several SRMs from the Commission reiterating consistency with the operating reactors and implementing this rule.

MEMBER CORRADINI: So, by saying it that way, can I translate that?

MR. NOLAN: Sure.

MEMBER CORRADINI: So, you don't feel that you have the ability to go beyond three days to make a judgment because it's not in the regulation or what?

MR. NOLAN: It's not necessary.

MEMBER CORRADINI: Not necessary?

MR. NOLAN: To go beyond 72 hours.

MEMBER CORRADINI: Because technically --

MR. NOLAN: At the design cert level. And so for the operating plants what we did is -- the focus of the staff's review is on the initial response.

This is where the most critical and time-sensitive actions are projected to occur. And there wasn't a lot of review that was performed once you get our far in time.

MEMBER CORRADINI: So, this is the one part I guess I and to investigate for me at least.

So, the 72 hours in some sense is the equivalent of Phase 3 of the current plants in terms of Phase 1 install, Phase 2 FLEX, Phase 3 beyond FLEX to safer?

Approximately.

MR. NOLAN: There's variations, yes.

MEMBER CORRADINI: Okay, so I'm still trying to understand the technical reason.

The technical reason you're saying is because all the crucial stuff occurs in the first three days and after that things should be stable and therefore there's no need to look at it?

MR. NOLAN: At the design certification level.

MEMBER CORRADINI: So, because NuScale is going beyond that to help the potential owner/operator, Staff doesn't feel compelled to analyze it yet?

MR. NOLAN: Right, we'll take a look at the post-72-hour strategy during the COL review. That's discussed on the next slide.

MEMBER CORRADINI: Okay, all right, but I'm trying to formulate this correctly. If it's obvious that they can make it past 72 days, you don't feel compelled to note that in the design

certification analysis?

MR. SCHULTZ: That's what I was going to get to later, that question.

MEMBER CORRADINI: Sorry.

MR. SCHULTZ: No, that's fine.

MR. NOLAN: We don't feel it's necessary for us to make a regulatory finding beyond the 72 hours. It's not required for us to make any regulatory finding.

This rule is not applicable to the design cert Applicant, right? It's applicable to the COL. And so right now where we are with the review, we can make a 72-hour reasonable finding and then beyond that, it will be the responsibility of the COL.

And like I said, it's consistent with what we did for the operating reactors. That's where the focus of the Staff review was, was there.

We did not spend a lot of resources looking out two weeks, three weeks, four weeks. But it's consistent with what we did for --

MR. SCHULTZ: But the operating reactors have invested a lot to demonstrate what would happen at 72 hours and beyond. That's the industry response that's associated with it.

I don't want to speak for NuScale but I

thought they were trying to get some understanding that the design of this facility is such that one would not have to do something at 72 hours.

And if we could get some determination that 14 days is a reasonable time to paint the picture of what needs to be done when, rather than 72 hours, it would make the COL, the potential COL Applicants, more excited about this design than hearing that it's a 72-hour stopping point where they've got to do something more, including analysis or whatever else it might be.

So, they're asking for 14 days as opposed to 72 hours, getting an agreement up above but you don't necessarily have to make a determination as part of your design cert agreement, right?

MR. NOLAN: Yes.

MR. SCHULTZ: Have you decided not to give them that or are you --

MEMBER BROWN: That's what the SECY's all about.

MEMBER BLEY: And that part of it I think isn't a public discussion at this time. We can have a session later.

MEMBER BROWN: It isn't, you're probably right. I didn't think about that.

CHAIR REMPE: But in the public discussion, though, you can say that -- do you have enough information? Do they give enough out?

Or have you just not looked at anything beyond three days? Do you think there's enough information or you think it would -- they're going to have to --

MR. NOLAN: It would require more work most likely on both sides.

CHAIR REMPE: You've looked at it enough to say this is going to take a lot more?

MR. NOLAN: Right, so as you're aware, during the Chapter 15 presentation there's a few transient phenomena that we're evaluating and we expect to resolve that for the 72-hour timeframe.

But it would probably take a closer look to make findings that go beyond 72 hours.

CHAIR REMPE: Such as recriticality?

MR. NOLAN: Correct.

MEMBER CORRADINI: But I thought criticality doesn't apply to this event? It applies when you're missing a rod.

(Simultaneous speaking.)

MR. NOLAN: It doesn't apply to this.

MEMBER DIMITRIJEVIC: It doesn't apply to

this event. Actually, you don't have any difference.

(Simultaneous speaking.)

MR. SCHULTZ: Based on the stylized assumptions, it doesn't apply.

MR. NOLAN: Well, it depends on what event and phenomena you're talking about. If you're talking about boron redistribution, that's just a transient phenomena that is potentially going to occur.

The difference here is we would assume all rods in so that buys a lot of margin. In Chapter 15 we would assume one rod out.

MEMBER CORRADINI: I know we're not allowing you to go down your normal path but such is life.

In the draft SE, the identification of boron dilution is one of the things that is renumbered as an open item but is unresolved in this regard?

MR. NOLAN: Right, and so following this approach that we're laying out here, we would not expect that to be an issue for Chapter 20 review.

We would take another look at that during the COL and as part of the COL review we would look to make sure there isn't any credible transient phenomena that can affect recriticality or anything else for

that matter.

MEMBER CORRADINI: You got me there because I thought you were going to say something different. So, what I read in the draft SE, in essence, doesn't apply now because of the 72-hour consideration?

MR. NOLAN: That's with the assumption that Chapter 15 will resolve the issue.

MEMBER CORRADINI: Ah, okay, sorry. It's still tied back to 50?

MR. NOLAN: Yes.

MEMBER CORRADINI: Okay, excuse me, sorry, I misunderstood. Thank you.

MEMBER DIMITRIJEVIC: I don't see the real logic here. I don't see why -- why when you pass 24 hours would this analyze this? Everything is the same up to -- I mean, there is not any reason for you to stop at 72.

Even in the earlier discussion, this rule doesn't apply for this situation. You don't really have any reason to stop at 72 logically. If you give them 72, the 14 days are completely the same.

So, I don't really see. I heard your discussion about this Chapter 15 72 hours but that doesn't apply. You have rules which are applicable

here.

MR. SCHULTZ: I took it from the Applicant's response to the question about the spent fuel pool instrumentation and the DC power required for that, that that is their conclusion.

That if they can provide that power for that instrumentation, then 72 hours and 14 days are the same, if you will. That was the only piece that they see is required to demonstrate 14 days.

MR. COYNE: Kevin Coyne, NRO.

So, in Ryan's next slide he's going to talk a little bit more about the expectations for the COL relative to some of the discussion.

But going beyond 72 hours, one of the considerations the Staff had is given NuScale's unique features and enhanced capability to deal with the damaged state that's assumed in 5150(5), we didn't want to create a de facto, more restrictive standard for the review than what we applied to the operating reactors.

And so having to make a regulatory finding after 14 days for NuScale could be viewed as imposing a more restrictive criteria for the review for Chapter 20 than what we would apply to the operating fleet.

CHAIR REMPE: Could you elaborate why you

think it's going to be more restrictive?

Yes, you went two more hours but what's going to be more restrictive than for the operating reactors, other than you're going to be doing something more in depth for a longer period of time?

MR. COYNE: So, I think just that, that we would be doing a more in-depth review for a longer time period.

MEMBER RICCARDELLA: But I thought I heard someone say you will be doing that at the COL stage? Did I hear that?

MR. NOLAN: And I'll talk about that on the next slide. The last point I'd like to make on this slide is that what we're reviewing are the design aspects.

It's the installed SSCs, that's what, if granted, the Commission would be providing finality on. The operational aspects or procedures training, that's all deferred to the COL, which is typically what we'd expect for procedural development.

MEMBER CORRADINI: So, let me say it a different way just so I'm clear.

So, the 72 hours at this stage, even though it's not necessary for the DCD, going beyond 72 hours could set up a precedent for going in the past

and I assume into the future?

MR. NOLAN: Right, yes, it's not necessary for us to make a finding beyond 72 hours.

MEMBER CORRADINI: And the SECY is informational, it's not a vote?

MR. NOLAN: Correct.

MEMBER CORRADINI: Yet.

MR. NOLAN: Correct.

MEMBER BLEY: Procedural question since Mike brought that up.

I remember vaguely that when you send up an information paper, if there's no voter, no SRM, at some point in time it's assumed the Commission agrees with you. Is that not true?

And what is that point in time?

(Simultaneous speaking.)

MR. NOLAN: That's a great question. I'm not sure I want to be the one to step up to answer it.

MR. COYNE: Kevin Coyne, NRO. I don't think that's a question that NRO can answer. We can do a little research for you and try to get back to you.

MEMBER BLEY: Okay, somebody's told you about that in the past and I was just trying to get that fixed. But, yes, do a little research and let us

know.

CHAIR REMPE: So, at the beginning of this meeting today we discussed about how we might have a letter this week, we might have a letter in September.

Any feelers or senses that the Commission is going to act on this before September that you'd be willing to put on the record?

MR. TABATABAI: I think consistent with the other Chapters that you have written letters, your letters are preliminary I think, or interim reports?

PARTICIPANT: Interim letters.

MR. TABATABAI: I think interim reports is appropriate in this case. I think so. I think during Phase 5 you might have the final letter.

CHAIR REMPE: For example, if the Commission decided to do more than just take the information, if they did decide to respond back, no one has given you any clues that's going to come before September?

MR. TABATABAI: No, we can't predict that. We can't stop the review either.

MR. NOLAN: So, like I mentioned on the previous slide, what the Staff is reviewing for the design certification is the capabilities and capacities of the installed SSCs to basically satisfy

the required safety functions.

For the COL review, if there is no transient phenomena that's identified or applicable, then no additional information would be needed. There would be nothing else needed from a COL at that point.

And the basis here, well, I guess the second bullet is level of detail that we expect from the COL would be commensurate with the time available to implement.

What that means is we would have to understand the site, where it's located, and any required operator actions.

And so if there's a required action to refill the spent fuel pool, we wouldn't expect to have detailed contracts in place to acquire that inventory but we would expect to see some plan of where it's coming from, what the general procedure would be.

MR. SCHULTZ: Are you expecting that a COL is going to somehow come up with a design feature that has got a spent fuel pool requirement there that's not 50 or 60 hours?

But rather somewhere between 72 hours and 14 days? I don't know if that example fits, the example you just gave.

MR. NOLAN: Well, I mean right now we know

that water will have to be added into the pool eventually. The requirement is indefinite coping and so eventually water will have to be added.

We just have a long time constant here to take those actions. And so because there's a lot of time to take the action, we wouldn't expect contracts in place for this design.

But we would expect to see some plan on where's that water coming from.

MR. SCHULTZ: Okay, I was probably just quibbling with the selection of spent fuel pool level for that but I could understand it for other applications perhaps.

I got your concept so thank you.

MR. NOLAN: And with respect to instrumentation, our plan is to document that their instrumentation is not relied on to support the mitigation strategies, that instrumentation is not needed to take operator action.

However, it is expected to be available and meets the robust protection requirements, and it's just an added assurance.

MR. SCHULTZ: Again, this is all aligned to demonstrate that the design under the design certification process meets the requirements of the

new rule?

MR. NOLAN: That's correct.

MR. TABATABAI: That concludes Ryan's presentation. So, where do we go from here?

Our plan for completing the review is to follow what we have outlined in SECY 19-0066 to complete the review of NuScale application when we receive Revision 3 of Chapter 20 to make sure information meets the requirements in 10 CFR 5150(5).

As I mentioned earlier, we are expecting Revision 3 to be submitted in late August of this year.

And last but not least, our full committee presentation is scheduled for tomorrow and we would like to receive your feedback as to what your expectations are for us to present to you tomorrow.

If there are any specific areas that you'd like us to focus on or you would like to repeat the same information to the full committee, Just please let us know.

MEMBER CORRADINI: For a practice nature you're going to have one more attendee I think, unless I did my math wrong. And so I think that's probably the only difference in the audience.

But I guess I have questions I'm still

struggling with. The SECY is a process SECY, that is shall I or shall I not ask the Applicant for more information at this juncture to decide if I go beyond 72 hours.

And the essence of the Staff's suggestion not to go beyond 72 hours is a precedent-setting reason as far as I can tell. Correct me if I'm wrong but the way I heard the discussion was it's a precedent.

Past plants, we looked at 72 hours, future plants, you might not want to look beyond 72 hours so there's no reason to do this one beyond 72 hours. That's the essence of what I'm hearing.

Is that an appropriate --

MR. NOLAN: Consistency.

MEMBER CORRADINI: Okay, fine.

MR. SCHULTZ: Is there more analysis, evaluation that the Staff needs to do to support a finding of 72 hours?

MEMBER RICCARDELLA: 72 or 14 days?

MEMBER CORRADINI: No, 72 hours.

MR. TABATABAI: I think for us to make a finding for up to 72 hours based on Revision 3 information and the SECY approach, I think the review will not require a lot more requests for additional

information or interactions with --

(Simultaneous speaking.)

MEMBER RICCARDELLA: A lot more or any?

MR. NOLAN: We would not expect any more information from NuScale.

MR. TABATABAI: For clarification.

MEMBER CORRADINI: But if I take Steve's question a little bit further, that would imply, though, the assumption -- the but is but the connected open items in Chapter 15 have to be resolved?

MR. NOLAN: Yes.

MEMBER CORRADINI: In Phase whatever? Okay.

MR. NOLAN: Soon.

MEMBER DIMITRIJEVIC: What benefit would it be if you approve 14 days for COL Applicant?

Because if they have to go infinite, it's much easier for them to start in 14 days, right, instead of 3?

MR. NOLAN: If there's no operator action needed --

MEMBER DIMITRIJEVIC: Why is NuScale asking for 14 days? What is the benefit?

(Simultaneous speaking.)

MR. TABATABAI: I think Tom Bergman

explained that it's more time for the --

PARTICIPANT: Pardon me?

MR. TABATABAI: I guess marketing.

MEMBER RICCARDELLA: Well, then the natural question is, following up to Steve, how much more effort would be required to approve it for 14 days?

MEMBER DIMITRIJEVIC: None because it's the same.

MR. NOLAN: Yes, I don't want to speculate too much here but we're working these transient phenomena issues in Chapter 15.

There's thermohydraulic analyses that NuScale's performed that ends at 72 hours, it doesn't go beyond that.

We would have to take a closer look at what would actually be needed to go beyond that.

MR. SCHULTZ: But Chapter 15 has a different set of assumptions.

MR. NOLAN: That's certainly true, this is definitely unique here.

MR. SCHULTZ: You're talking about certain phenomena that you would like to understand better given the NuScale design, is that stated about right?

MR. NOLAN: And the reason I'm pointing to

Chapter 15 for a lot of it is because of the uniqueness of the design in that a loss of all AC is basically a design basis event. And so there's a lot of reliance on that existing analysis.

You certainly don't have to rely on Chapter 15 assumptions here but when we start looking at boron redistribution and other phenomena, that's where those issues are being looked at and addressed.

MEMBER DIMITRIJEVIC: Why I ask how much work is required because in this part of the transformation process, you're now hanging to the old rule, 72 hours.

If you can do something with minimal work, say, in 14 days that will save you a lot of review and time and process. For a future COL Applicant, it makes perfect sense to do that.

Why we are hanging to this old rules? We don't have to hang to old rules all the time. They are not applicable for every case, you know?

MR. NOLAN: So, yes, going back to my points on what we would review during the COLA phase, if the phenomena that we're looking at as part of Chapter 15, if that turns out to not be an issue, there wouldn't be any additional review work needed because we've already reviewed the capabilities and

capacities of those systems to perform under the currently realistic assumptions.

MEMBER DIMITRIJEVIC: But you said in COLA they have to prove it to infinite period, right? In the COLA phase they have to prove, that's what you said, right?

MR. NOLAN: Well, they wouldn't have to perform an analysis out that far. They have to have a strategy to address the safety functions.

MEMBER DIMITRIJEVIC: Infinite, right?

MR. NOLAN: Yes, or until sufficient site capabilities have been restored.

MEMBER DIMITRIJEVIC: But this is a difference in they can bring some equipment after 14 days is different than after 3 days. That's what I want to say.

So, from that point of view, it would be more complicated reviews if this is stopped at 3. That's how I --

MR. COYNE: Kevin Coyne, NRO. So, just to be clear, there's nothing magic about 14 days either.

As Ryan pointed out, the 5150(5) wording is indefinite and so the 72 hours is predicated on what we need to do to review the design aspects of the SSCs that were added in for the mitigating strategies

that NuScale described in the FSAR.

And so it's not necessary for us to go beyond 72 hours for that review provided there's no credible transient phenomenon that we would have to disposition at the COL stage.

There's also a thought that some of this would be potentially site-specific and so at the design cert stage we don't have site-specific information obviously.

And so from a practically consideration, 72 hours is as far as we need to go to make the finding that we need to make for the design cert given that NuScale has asked for the review. That's what establishes the criteria.

But there's nothing special about 14 days either from NuScale since the criteria would ultimately be indefinite or until sufficient site capability exists.

MEMBER MARCH-LEUBA: So, from a technical point of view, the only difference I see is the boron redistribution, concentration of boron. Once you open ECCS, you're boiling water and condensing the steel.

So boron is not uniformly. So maybe you can make an argument for 72 hours that it has not been enough cause a problem but when you go for five months

in that condition, you need to resolve that in Chapter 15.

MEMBER CORRADINI: I agree with what Jose is saying but I think the stylized accident they work under here is different than in 15.

MR. NOLAN: Well, you have more margin to work with because we assume all rods in.

MEMBER MARCH-LEUBA: Correct.

MR. NOLAN: But that's the only difference.

MEMBER CORRADINI: That's a big difference.

MR. NOLAN: It has a lot of margin.

MEMBER MARCH-LEUBA: If you are distilling water, concentrated boron is somewhere, hopefully in the core, somewhere else maybe.

Just what they need to resolve in Chapter 15, if you are in the process where you are distilling water and changing the concentration, the longer you are in that condition, the worse you are.

MEMBER CORRADINI: But the assumption is one case is the worst rod is stuck out and the other assumption is all rods in.

MEMBER MARCH-LEUBA: With the worst rod stuck out you don't need to dilute boron. You go

critical.

MEMBER CORRADINI: But the boron dilution --

MEMBER MARCH-LEUBA: Boron dilution helps you when you have all rods in.

MEMBER CORRADINI: Right, but in the Chapter 15 analysis the worst rod stuck out was part of the assumptions of the boron dilution question.

MEMBER MARCH-LEUBA: No, it was --

MEMBER CORRADINI: I'm looking at the Staff, I'm sure that's the case.

MEMBER MARCH-LEUBA: Worst rod is stuck out, you go critical without diluting boron.

MS. KARAS: This is Becky Karas from Reactor Systems. We are looking at all those scenarios, you're right.

In Chapter 15 you would assume the worst rod is stuck out and then we're looking at both end of cycle with no boron conditions.

We're also looking to see if it's potentially more limiting for a beginning-of-cycle or minimal cycle condition with boron redistribution and one rod stock out.

But as Ryan's explained, those are all to

72 hours at this point, right? So, when you take an all rods in condition and you want to go out for extended periods of time, that hasn't been looked at yet.

And you would get a lot of margin with the one rod and you're using things like more nominal assumptions, but that's one of the hurdles that we're talking about.

MEMBER CORRADINI: But that's what I thought Ryan was suggesting is requiring more analysis potentially on both parts, on both sides.

MR. NOLAN: Yes, we would have to take a closer look to go beyond 72 hours.

MEMBER BLEY: And no one's willing to say how much effort that is without looking at it.

MEMBER MARCH-LEUBA: To me the biggest argument of what the Staff is saying is you don't want to create a precedent that will then backfit all the plans and they have to take longer.

MEMBER BLEY: You're already setting a bit of a precedent in that you're analyzing something that's not required at this stage.

MR. NOLAN: Yes, so let me add that I believe every PWR has mitigating strategies for reactivity control for adding borated water.

So this is one of the first PWRs we're seeing that does not have a strategy to do so, which is why we're discussing the issue.

CHAIR REMPE: So, if I think about it, they have a lot of NuScale-specific things but there's also the fact that there's a philosophy about that if you go to 14 days you don't have to have onsite FLEX, which is more generic and hasn't really been discussed very much.

Have you thought much about that part? Because if you do that Phase 1, Phase 2, Phase 3, that's what they're going for, they're going to still have the safer stuff maybe with the COL Applicant. But is that cast in concrete or what's your thoughts on that?

MR. NOLAN: I guess for the operating reactors it was more of a Phase 1 plus Phase 2 should be at least 24 hours, right? And then the assumption is Phase 3, you'd get the offsite resources at 24 hours.

And so if your Phase 1 strategy is sufficiently long, you don't need onsite portable equipment. I think South Texas is a good example of the three and four.

It doesn't have necessarily Phase 2

equipment.

(Simultaneous speaking.)

CHAIR REMPE: Okay, so --

MR. NOLAN: But Phase 1 is sufficiently long enough.

CHAIR REMPE: Okay, so basically this isn't that unique that they're saying no flux on site.

MR. NOLAN: It would certainly be unique for operating plants. It's probably more common than not for new reactors.

MEMBER BLEY: I'm still stewing over your precedent issue. I mean the whole Chapter 20 is something that, as you said, isn't required for a design cert.

The Applicant's asked you to review it and you have. The Applicant's asked you to review it beyond 72 hours, which doesn't seem any more precedent-setting than coming into do it for 72 hours when you don't need to.

So, that argument seems a little fuzzy to me. Think it over tonight and tell us more tomorrow.

MR. COYNE: Kevin Coyne, NRO. One thought is we review against the regulatory requirement, not against the criteria that an Applicant is giving us to review against.

So, we reviewed at 72 hours because we believe that's what's necessary to meet the regulatory requirement for the design features that are described for the SSCs in the FSAR or will be.

So, going beyond that isn't necessary to support the regulatory finding we need to make against 5150(5) for those portions that would get finality with the design certification.

MEMBER CORRADINI: But what I heard you say, Kevin, then is you were willing to take the first step but the second step goes outside of the regulatory requirements as stated.

That's what I'm -- in other words, you reviewed what you eventually would have to review anyway, you just did it earlier in the phasing.

But to go beyond 72 hours goes beyond what the regulation requires.

MR. NOLAN: Goes beyond what we believe is needed to satisfy the review that the design aspects satisfy the regulation.

And reviewing a design cert application to 72 hours is not precedent-setting, it's what we did for APR 1400.

MEMBER BLEY: But at the time we thought you'd need to do it.

MEMBER KIRCHNER: I'll just point out that the advanced reactor policy statement expects better performance out of these advanced plants.

So, you could actually use the Commission's policy as a justification for looking out further.

MEMBER BLEY: Let me just ask you where you're headed. You've set the SECY up.

If the SECY doesn't generate an SRM or it's what I was saying earlier, at some point it's by default considered accepted, then that would agree with your interpretation on the 72 hours.

If the Commission finds that you ought to look beyond that, they would issue an SRM I suppose. So, you've kind of left it in the Commission's lap as far as I understand what you've done with the SECY.

MEMBER KIRCHNER: That's a possibility.

CHAIR REMPE: Steve, did you want to say something? We kept interrupting you.

MR. SCHULTZ: No, I got my question and statements in, thank you.

CHAIR REMPE: Okay, so we may have a closed meeting still. You don't want to talk anymore in private?

Okay, so do any Members have any

statements? But not your final ones. I'll go to public comments unless you guys have any more questions.

MEMBER BLEY: We just went around and around on this but there's only, essentially, one open item, right in your SER?

You didn't specifically talk open items but I think there's only one and that has to do with the boron dilution.

MEMBER CORRADINI: There is another one formally which is the SECY.

CHAIR REMPE: The SECY is what I was thinking of.

MEMBER CORRADINI: There's a process open item

MEMBER BLEY: Yes, it does have it in there. You're right, it's there.

CHAIR REMPE: Okay, so with that, could you get the phone lines open and I'll ask if there are any public comments in the audience while we're waiting for the phone lines to be opened?

Seeing no one trying to talk on the mic, we'll just wait. I heard a beep that implies to me the phone lines are open.

Is anyone out there that could confirm

that? I know we're not supposed to have to do that anymore but it seems prudent.

Not hearing any comments and I'll wait for Mike.

MEMBER CORRADINI: Is anyone out on the open line, please?

CHAIR REMPE: Yes, but wait until after we get through this line thing. Let's worked for Mike to come back just to make sure I don't preclude someone from the public wanting to --

MEMBER CORRADINI: If somebody's on the public line could you please speak up?

CHAIR REMPE: I think I heard a voice so I'm going to assume that there are no comments from anyone on the phone line and we'll let the phone line get back closed.

And I think I saw somebody who decided they wanted to talk. Please state your name and provide your comment.

MR. BERGMAN: Tom Bergman with NuScale.

So, I wasn't sure I was really considered a member of the public but listening to the Staff's discussion, I do agree they've taken an approach that is sort of very efficient at getting to a finding.

As far as the 14 days, we would have

preferred this paper, hearing that it's an info paper, that it would be an actual vote paper because the Commission stopped doing negative consent papers like decades ago.

And whether or not it needs Commission engagement is a Staff decision, but to me this is unlike what we did with 5054(M), the licensed operators rule, which only applies to licensees but we chose to address it in the DC.

And we addressed it in a very different way than it's done. And that has gone very well. Obviously nothing's approved.

So we think they can go beyond 14 days but the policy issue, potential policy issue, we saw is if you can get to 14 days, that constitutes the word indefinite.

That's what we are really proposing based on the resources we need at 14 days, which we don't need at 14 days, we really need much later, is a gravity feedwater supply in the spent fuel pool.

But that's the hard question we're asking, is if we can show we can get to 14 days, does that constitute indefinite under the definition of a rule?

That's what we were seeking from the Staff, not just a 14-day capacity because we show 50

days. And the other question is why 14 days? And we debated.

You want a technically defensible number, right, you just don't want to pick 30 days or whatever because why did you pick 30 days? And there were two obvious technically defensible numbers to us.

One was 14 days which was based on the ability for ad hoc response at Fukushima that grossly exceeds what we need in our plant, and then 50 days.

The problem with 50 days is that sets a very high bar for everybody else trying to come in. And 50 days really wouldn't leave us any margin because you always erode margin during construction in operation.

But those were the two sort of technically defensible days and we felt 14 represented a reasonable number, not just for us but potentially for other advanced reactors coming down the road.

MEMBER BLEY: Tom, would you restate -- if we can get to 14 days, does that constitute --

(Simultaneous speaking.)

MR. BERGMAN: Basically indefinite coping.

MEMBER BLEY: Indefinite coping, right.

MR. BERGMAN: In terms of indefinite means you're confident you can get supplies from off site to

keep the plant in a safe condition indefinitely. Because if you don't pick a day, then indefinite means forever.

CHAIR REMPE: So, before I go around the table, I want Mike to confirm the lines were open and he closed them, right?

We heard someone mumble something but there weren't any comments, but I'll give the public one more time here on the phone line.

So, again I'll ask does anyone on the phone line that's a member of the public want to make a comment? And this time I'm still not hearing everything.

I'm going to ask you to go ahead and close them and we're going to go around the table and I'd like the Members and our consultant to chime in about their thoughts again to confirm they're comfortable with trying to have a letter discussed this month at the full Committee Meeting.

Again, our schedule, we've got a lot of other letters that are in the queue so it may not happen but my workload in the next couple of days will depend on your response back.

And then if you have some comments you'd like to have emphasized, state them here and then I

probably will say send me an email with them written down too.

Because I'm trying to update a very drafty letter. And I'm going to start with Steve, our consultant, and then I'll go around the table, okay?

MR. SCHULTZ: I appreciate all the comments in the discussions that we had today from both the Applicant and the Staff.

My understanding has gone back and forth even through the discussion period here.

I feel that based on the comments, based on all the work that the Staff has done to prepare the SECY as well as the documentation associated with staging what I think their findings will be, I think we have enough, I think the Committee has enough, to write an interim letter.

I'm not sure what the final thoughts will be from the Committee but I think based on what we've heard today we can formulate a statement of where the progress stands and where we expect it to go forward.

I think I got the timeframe right, the next six months, associated with the Chapter 15 evaluations and so forth that need to be completed.

It's got to be interim because of the need to determine whether the findings for Chapter 15 are

going to influence this.

CHAIR REMPE: I think definitely the Chapter 15 findings are important.

I guess the other thing is if there's anything during our discussions today that ACRS identified that the Staff has not already identified, those are that kind of points too that I'd really like to have.

I can I hope summarize the status of things but if there's some gaps in what they're reviewing that are not being adequately addressed, let me know or send me some thoughts, okay?

MR. SCHULTZ: I think based on what we're doing on this topic, the difficulty is this topic has got constraints that are different from the Chapter 15 analysis and constraints.

But the Staff has spoken to that today so that needs to be done. But given the combination of letters that are going to be written for this meeting, I think we have several positions to put forward.

CHAIR REMPE: Thank you. Dick?

MEMBER SKILLMAN: I think we can write a letter that agrees with NuScale and the Staff that the concept of 14 days is sufficient to be described as indefinite. I'm comfortable with that.

There are some features of the NuScale design that I'm not comfortable with but on this particular one, I can concur that 14 days is a timespan that can be defended as indefinite.

Just two things based on the Fukushima experience, like the team that presented. After about 9, 10, 11 days in spite of the horrible infrastructure challenges, the teams at Fukushima were able to add water and do a lot of things.

14 days after TMI-2 would have put that event in April 11th of '79. By that time we were cooling down. We had a mess but the containment was intact, we were adding water, we were steaming using bypasses on the feedwater isolation valves.

Clearly we were in the middle of a catastrophe. The aggregate intellect and ingenuity of the team, even without procedures and no emergency planning, pulled it together.

This design is so much more advanced with so much more defense in depth, I think we can say yes, 14 days constitutes the front end of indefinite and after that they can keep on going.

So, I'm comfortable with that.

CHAIR REMPE: You're basically also then implying you think the Staff should go a bit further

in their review than 72 hours.

MEMBER SKILLMAN: Yes.

CHAIR REMPE: Okay, that kind of input is also helpful on how I write this letter since it's a group letter and I don't want to have a minority opinion when I present.

Mike, go ahead?

MEMBER CORRADINI: So, I guess I agree with Dick and I think Steve but I'm going to go a little bit further. It seems to me we've got to take a holistic approach to this.

So, if we're going to go beyond three days, then I need some action after three days to settle other issues that I'm worried about. And that issue is that I want to make sure that I'm subcritical after a few days.

So, I'm going to pretend that I'm in charge. If I were in charge and I would say NuScale, I'll grant you 14 days but at 3 days I want you to go make sure you're subcritical somehow -- I don't care how, you figure it out -- that's got to be in the letter.

Otherwise we stop at 72 hours. That's it.

CHAIR REMPE: Matt? Okay.

MEMBER SUNSERI: I don't have anything

else to add technically and I would support an interim letter.

CHAIR REMPE: Pete?

MEMBER RICCARDELLA: Ditto exactly what Matt said.

CHAIR REMPE: Okay, Walt?

MEMBER KIRCHNER: Again, I'll just repeat myself. There is an advanced reactor policy statement and the expectation is that these advanced designs do have significant margin beyond the current fleet.

So, going back and just falling back on the existing fleet, I'm in the camp of both Dick and Mike. Yes, you need to look at assurances about the subcriticality, so that gets into boron kind of issues.

But that aside, when you think of the Chapter 15 analysis and the complexity of doing that versus just looking at this massive heat sink, I'm pretty confident this is like a first law of thermodynamics calculation.

This is not a dynamic complicated systems code kind of analysis of a LOCA or something very difficult and challenging. So, I'm pretty confident that they can go out to 14 days with what information we've seen.

And the caveat would, again, be in my mind whether we have too many to control.

So, thank you.

MEMBER SKILLMAN: Can I just take my note back? I'm so glad Walt used that word.

I'm surprised at critical safety function, and this goes back to NEI 0612, why reactivity control isn't one of the critical safety functions.

Why isn't reactivity control one of the critical safety functions? That's the reservation I had and Mike nipped it in the bud.

I just don't understand why those words don't show up. They're kind of the fundamental law we all hang onto for respecting the technology.

You can really shut one of these things down and keep it down.

CHAIR REMPE: And as you pointed out earlier, you need some instrumentation to assure that. Go ahead, Jose.

MEMBER MARCH-LEUBA: I was going to say I agree with Mike that reactivity control is a key issue because the very difficult problem that we still have to solve is the boron call it dilution or redistribution.

Once you open ECCS, you will distill. You

are distilling water and filling up the containment with cold, unborated water, which eventually makes it into the downcomer and the downcomer is going to be cold, unborated water.

Because technically the boron inside the core or maybe on the rise and you're feeding cold, unborated water through the bottom of the vessel.

Now, the probability that that happens and goes critical is 10 to the minus 25 because something would happen that would prevent it. But you have to analyze it and you have to ensure that does happen.

And one thing is doing a normal ECCS actuation after an accident where you will be in that operation for two or three hours and then you flag the containment.

And another thing is, well, I want to stay five months in this condition. It's stealing my boron away and this obsession with passive operation and hands-off is leading us into the wrong direction.

I think we should be reviewing emergency operating guidelines, not the procedures, but guidelines that direct the operators to flood the containment with 2000 PPM water and then nothing happens.

But this obsession, and every time I talk

to an operator or an engineer from NuScale it's nothing would happen, nothing would happen, that cannot happen. And it's going into the same direction.

You guys should be thinking what could possibly go wrong? And I don't see the NuScale Staff thinking what could possibly go wrong. What can my operators do to make it better?

Instead of, yes, obsession with passive thinking is marketing. But it's not safe. The only thing saving us is that this is an extremely safe reactor.

CHAIR REMPE: Okay, thank you. Dennis?

MEMBER BLEY: I think we can write a letter. I think I'd like to us to have a little private time to talk about the 14 days, although I don't see any problem with it.

But I think we want to hash that out because I think the Commission will -- that will be the main thing they look at in this letter.

CHAIR REMPE: Let me explore, you mean today? You'd like to have us stay and talk a bit more?

MEMBER BLEY: We can go into letter writing but a closed session first to talk about that.

CHAIR REMPE: That can be worked on. Vesna?

MEMBER DIMITRIJEVIC: I express the same sentiment. We should be look at those 14 days and does that mean indefinite? And that's it basically.

I think we should write the letter, maybe we can even have a private session now because we're finishing.

CHAIR REMPE: Okay, so I agree with what everyone said but I'd like to still elaborate both with this thing about criticality as well as the guides for the operators requires assurance that the instrumentation is there.

And that really is the only thing I could add to what's been said. I was going to suggest and I was trying to draft this letter up, half of it is the standard boilerplate that you put on every single NuScale letter, Mike.

And so why don't we just stick the stuff on Chapter 20 in with the other parts of this NuScale we're going to be reviewing and writing on this month. I know Mike's saying no, he still wants it separate.

If we have to have the separate session, Dennis, then that would be a reason to having the separate letter.

But I'd also, because I'm trying to draft the thing, I sure would like to have that session today and have us discuss it before we go to the full Committee just so that I'll have more time to digest it.

And so I think that I would like to request the Members to stay here after we close.

MEMBER MARCH-LEUBA: Can we go around the table and see if anybody wants a closed session?

CHAIR REMPE: For right now?

MR. SNODDERLY: This is Mike Snodderly from ACRS Staff. So, please recall our letter-writing we want to have in open session.

I think the basis we have for going closed is the OUO aspect of the SECY paper and the fact that it is not being released publicly until July 12th.

So, what I would suggest is that we do go into a closed session here at this time to discuss the OUO aspect, the aspect that was set. And any deliberations you want to have concerning that and possible response to that.

CHAIR REMPE: Okay, so if we do that, again, I'm not ready to do that because there's one other thing I want to talk -- before we go to closed session, I just want to answer something with the

Staff.

MR. SNODDERLY: That's if we're going to closed for the letter-writing.

CHAIR REMPE: Okay, and then we would not have the transcriber stay or they should stay and record it? What should happen on that?

MR. SNODDERLY: If you do it and the transcriber's here we should go closed and it should be transcribed. If you don't want to do it today then, yes, we can do it tomorrow.

CHAIR REMPE: Okay, so we'll do that. The other thing that the Staff brought up is what do you want us to talk about?

And there will be limited time and I think it might be good for us to comment on that too. I think the Staff's slides I didn't see any big changes but clearly, NuScale will not have time to go through as much depth tomorrow as they've done today.

MEMBER CORRADINI: Well, I mean my opinion is given the fact that we can educate our lone Member, they can essentially shrink it down but we'll get to the key points.

We've now asked them everything we can so if we're quiet, they can get through it in 15 minutes in both cases.

CHAIR REMPE: Okay, so they have, what is it, 25, 28 slides? They still need to reduce it a bit.

MEMBER CORRADINI: But they're smart, they can figure it out. I think we clarified a whole bunch of things today that we won't necessarily need to reclarify tomorrow, assuming we can remember.

That's my way of looking at it.

CHAIR REMPE: From my viewpoint, I think our letter will be focusing on the mitigation of beyond-design-basis rule and how it's being met.

The LOLA is of less controversial -- I don't think it's a big deal other than it's there right now. Frankly, the other two sections are going to be going away so I don't see any reason for us to comment much on those too.

So, they could clearly focus on that too and eliminate the other discussion. So, with that, we're going to go into closed session. You want to take a break too? Let's say for ten minutes. Okay, thank you.

(Whereupon, the above-entitled matter went off the record at 4:00 p.m.)

July 3, 2019 Docket No. 52-048

U.S. Nuclear Regulatory Commission
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Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Submittal of Presentation Materials Entitled "ACRS Subcommittee Presentation, NuScale FSAR Chapter 20, Mitigation of Beyond-Design-Basis Events," PM-0719-66189, Revision 0

The purpose of this submittal is to provide presentation materials for use during the upcoming Advisory Committee on Reactor Safeguards (ACRS) NuScale Subcommittee meeting on July 9, 2019. The materials support NuScale's presentation of Chapter 20, "Mitigation of Beyond-Design-Basis Events," of the NuScale Design Certification Application.

The enclosure to this letter is the nonproprietary presentation entitled "ACRS Subcommittee Presentation, NuScale FSAR Chapter 20, Mitigation of Beyond-Design-Basis Events," PM-0719-66189, Revision 0.

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

If you have any questions, please contact Nadja Joergensen at 541-452-7338 or at njoergensen@nuscalepower.com.

Sincerely,

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Enclosure: "ACRS Subcommittee Presentation, NuScale FSAR Chapter 20, Mitigation of Beyond-Design-Basis Events," PM-0719-66189, Revision 0

Enclosure:

"ACRS Subcommittee Presentation, NuScale FSAR Chapter 20, Mitigation of Beyond-Design-Basis Events," PM-0719-66189, Revision 0

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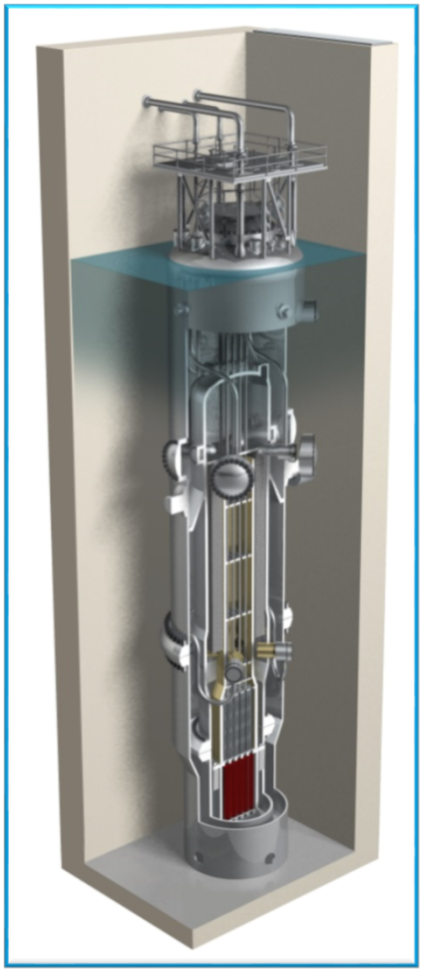
ACRS Subcommittee Presentation



NuScale FSAR Chapter 20

Mitigation of Beyond-Design-Basis Events

July 9, 2019

PM-0719-66189
Revision: 0

Template #: 0000-21727-F01 R5

Presenters

Chris Maxwell
Senior Reactor Operator

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Licensing Specialist

Mitigation Strategies for Beyond-Design-Basis External Events 10 CFR 50.155(b)(1)

Objective of MBDBE Rule

- Establish coping capabilities to prevent damage to fuel in any NPM and the SFP, and to maintain containment function by using plant and mitigating equipment during an extended loss of AC power (ELAP) concurrent with a loss of normal access to the normal heat sink (LUHS).

- Key safety functions (core cooling, containment, spent fuel pool cooling) are established and maintained indefinitely, or until sufficient site functional capabilities can be maintained without the need for mitigation strategies.

Indefinite Coping

- "…indefinitely, or until sufficient site functional capabilities can be maintained without the need for mitigation strategies"
  - Means to plan for obtaining sufficient resources to maintain the three key safety functions until an alternate means of removing heat is established
  - Allows new reactors to "establish different approaches from those of operating reactors" including using only "installed plant equipment for both the initial and long-term response"
- "Alternate means of removing heat" may be provided by installed plant equipment.

Indefinite Coping

- NuScale considers a minimum coping period of 14 days using only installed plant equipment to be sufficient time to establish “alternate means of removing heat.”
  - In the Fukushima Daiichi accident, without pre-planning or a hardened pool makeup connection, and with limited access to off-site resources, personnel began
    - adding water to the Unit 4 SFP with fire and concrete pump trucks after 9 days; and
    - injecting water via the fuel pool cooling system at 14 days.
- Beyond minimum installed equipment coping period, the continued use of installed plant equipment, ad hoc resources, and equipment repairs can be used to continue coping indefinitely.

NuScale Coping Capability

NuScale Power Plant Design

- The NuScale Power Plant was designed to provide coping during an ELAP concurrent with a LUHS without:
  - AC or DC electrical power
  - Inventory addition
  - Supplemental equipment
  - Off-site resources
  - Operator action (monitoring)
- Extended coping duration is provided by the automatic response of installed plant equipment alone.
- This strategy permits plant staff to focus on addressing the initiating event and restoring normal functional capabilities.

Baseline Coping Capability Criteria, Conditions, and Assumptions

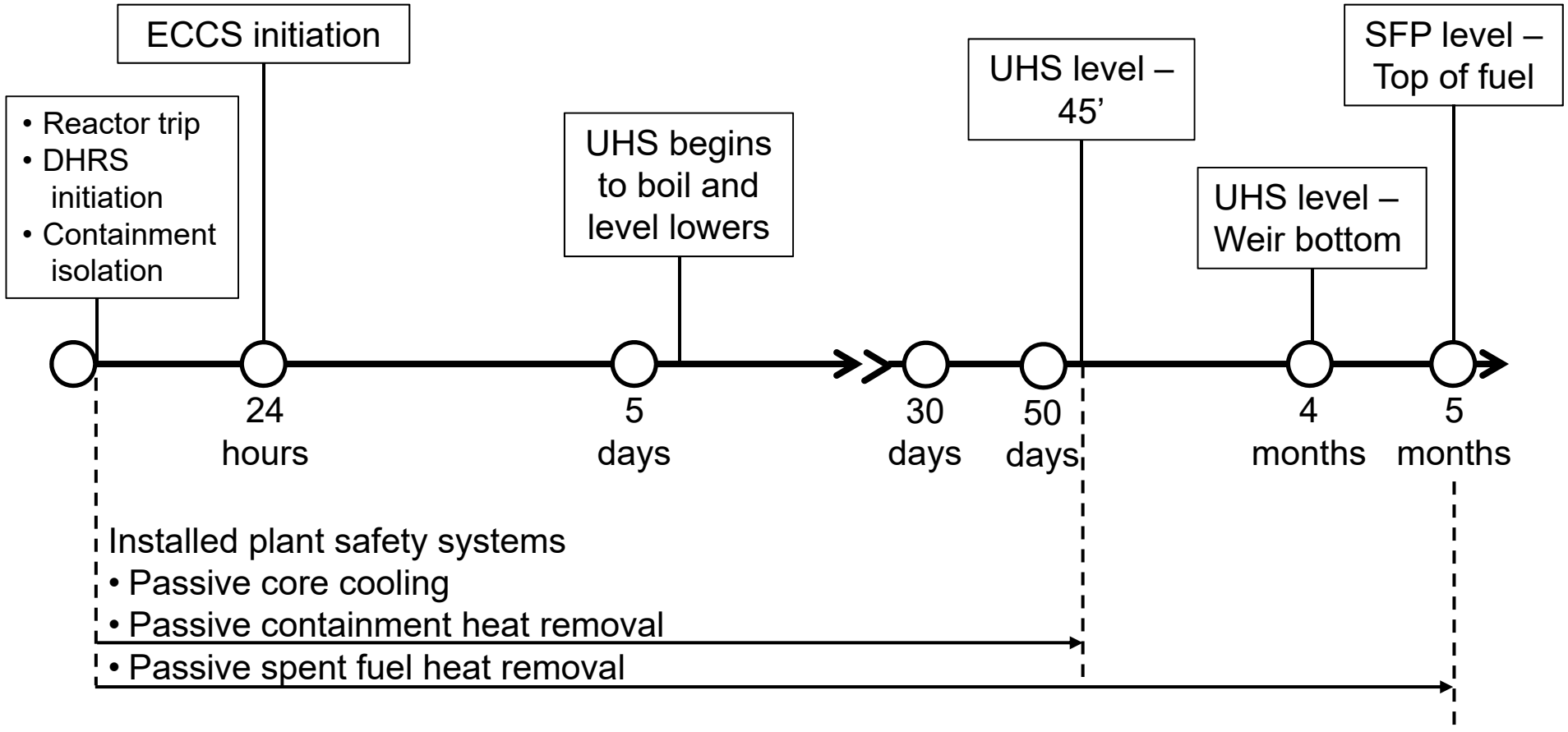
1. Plant equipment that is designed to be robust with respect to design basis external events is assumed to be fully available.
2. Plant equipment that is not robust is assumed to be unavailable.
3. Procedures and equipment relied upon should ensure that satisfactory performance of necessary fuel cooling and containment functions are maintained.
4. The fuel in the modules is required to remain covered at all times.
5. The fuel in the SFP is required to remain covered at all times.

Boundary Conditions

1. Beyond-design-basis external event occurs impacting all modules at the site.
2. All modules on-site initially operating at power, unless site has procedural direction to shut down due to the impending event.
3. Each module is successfully shut down when required (i.e., all rods inserted, no anticipated transient without scram).
4. On-site staff is at site administrative minimum shift staffing levels.
5. No independent, concurrent events, e.g., no active security threat.
6. All personnel on-site are available to support site response.
7. Spent fuel in dry storage is outside the scope of the event.

NuScale Power Plant Response

Plant response without operator action or off-site resources



PM-0719-66189
Revision: 0

Core Cooling

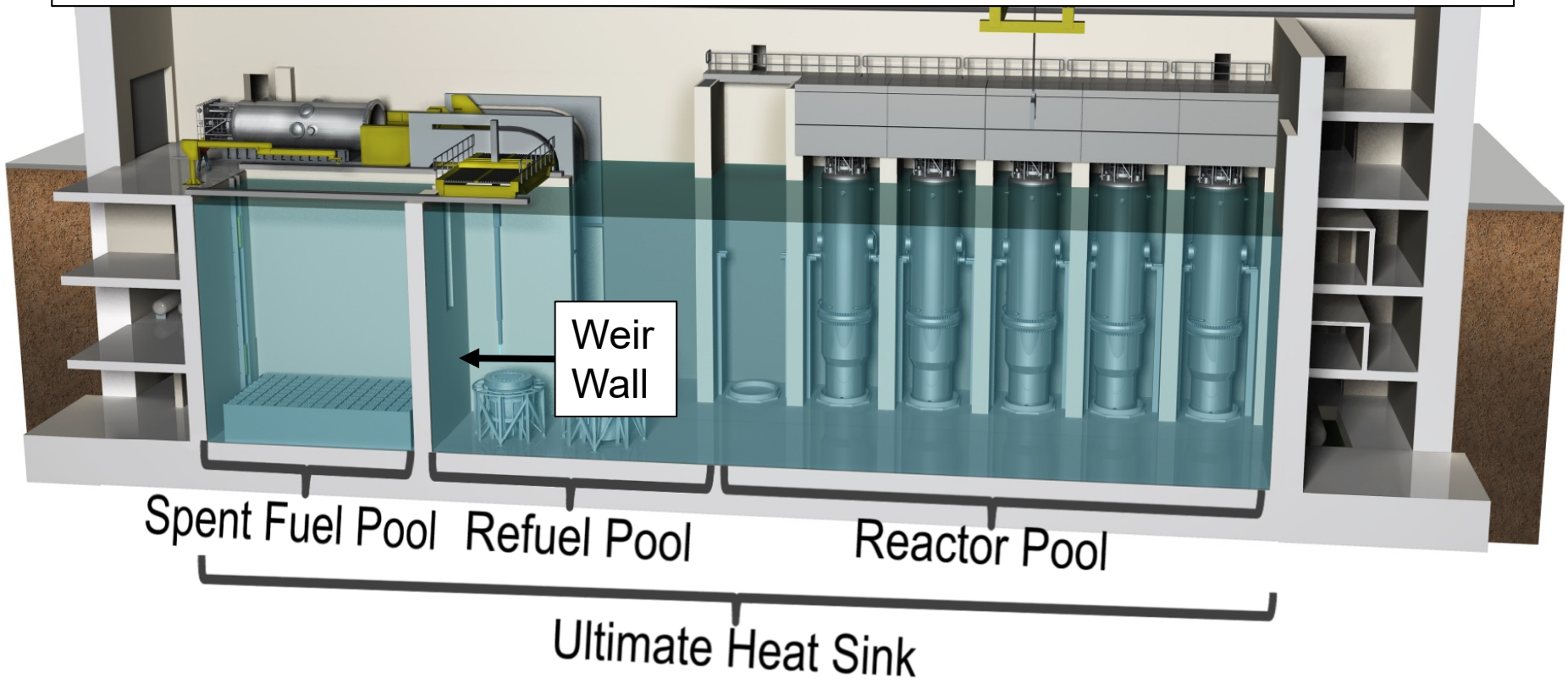
- Reactor coolant system inventory is preserved by containment isolation.
- DHRS passively removes decay heat for the first 24 hours.
- The ECCS cools the core for the remainder of an ELAP.
- Modules are partially immersed in the reactor pool, which is part of the UHS.
- Passive heat removal to the UHS maintains core cooling for more than 50 days without pool inventory makeup or operator action.

Containment

- Containment isolation valves (CIVs) and the CNV provide passive containment function. Without operator action or electrical power, the safety-related CIVs close to isolate the CNV.
- Heat removal to the UHS passively controls temperature and pressure to ensure containment integrity. Peak pressure and temperature conditions for the CNV occur early in the event when the ECCS valves open and do not challenge containment integrity.
- Containment cooling is maintained for more than 50 days without pool inventory makeup or operator action.

Spent Fuel Pool Cooling

- The Spent Fuel Pool is part of the UHS.
- The Spent Fuel Pool is partially separated from the Refuel and Reactor Pools by the Weir Wall.



Spent Fuel Pool Cooling

- The SFP, as part of the UHS, communicates with the refueling pool and reactor pool above the SFP weir wall. As such, the pools respond as a single volume during an ELAP until UHS level lowers below the opening in the weir wall.

- The UHS inventory maintains passive cooling of the spent fuel in the SFP for more than 150 days following initiation of an ELAP without pool inventory makeup or operator action.

Monitoring

- No operator action is required to establish or maintain the required safety functions for more than 50 days following the onset of an ELAP. Therefore, no instrumentation is necessary to support operator actions.

- However, instrumentation and DC electrical power are provided to allow the Control Room Operators to observe the response of installed plant equipment and verify the conditions necessary for coping have been established.

- Indications remain available for a minimum of 72 hours.

Spent Fuel Pool Monitoring
10 CFR 50.155(e)

Objective of SFPLI Rule

- Provide a reliable means to remotely monitor wide-range SFP water level until 5 years have elapsed since all of the fuel within that SFP was last used in a reactor vessel for power operation.

Spent Fuel Pool Level Indication

- The UHS system includes remote level indication for the following:
  - Reactor Pool
  - Refueling Pool
  - Spent Fuel Pool (2)
- Normally powered by the highly reliable DC power system via the plant protection system.
- Include a replaceable battery power source, independent from the plant AC and DC power systems, with a minimum capacity of 14 days.

Conclusion

- NuScale Power Plant Mitigation Strategy
  - Rely on the automatic response of permanently installed, safety-related plant equipment to establish and maintain the three key safety functions and provide extended coping capabilities of greater than 14 days.
- The NuScale Power Plant mitigation strategy does not require:
  - AC or DC electrical power
  - Inventory addition
  - Operator action
- NuScale SFPLI Strategy
  - Installed instrumentation with 14 day battery backup power supply.

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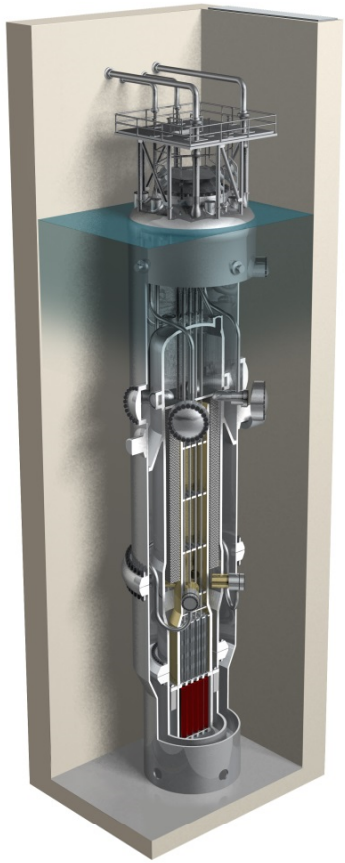

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Supplemental Slides

(Description of slide 10)

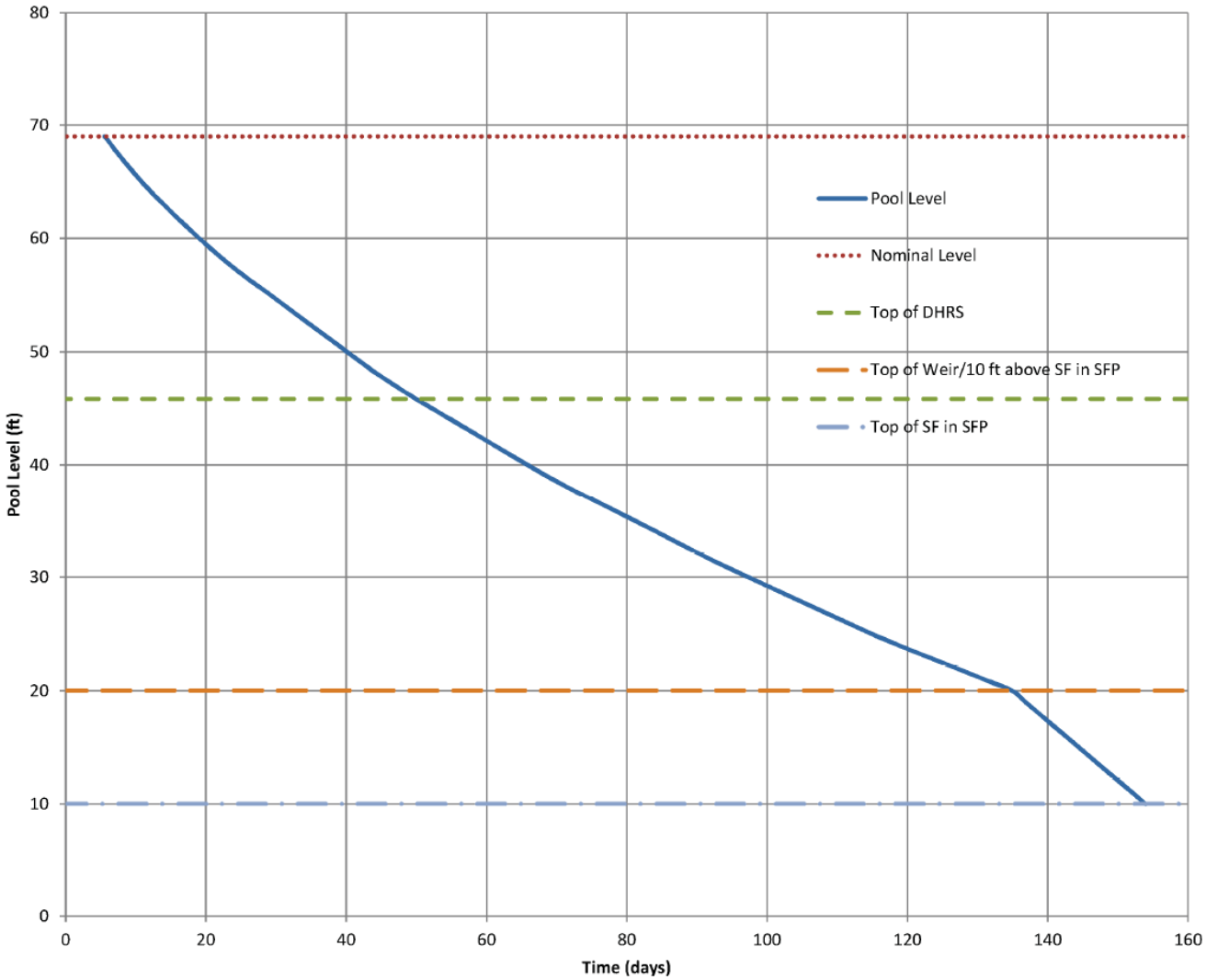
NuScale Power Plant Response

- NuScale Power Module response within the first minute of the loss of all AC power and without operator action:
  - Reactor trip
  - Decay Heat Removal System initiation
  - Containment isolation
- ECCS automatically initiates after 24 hours.
- With the reactor shutdown and passive decay heat removal established, safe shutdown conditions are established.
- Decay heat passively transferred to the UHS.

NuScale Power Plant Response

- After more than 5 days, the UHS begins to boil and SFP level begins to lower.
- With UHS level greater than or equal to 45’, core cooling and the containment function are maintained. It requires more than 50 days for UHS level to lower to this point.
- Without any addition of inventory, Spent Fuel Pool level would:
  - Fall below the UHS weir after more than **4 months**.
  - Reach the top of spent fuel after more than **5 months**.

NuScale Power Plant Response



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Revision: 0

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United States Nuclear Regulatory Commission

Protecting People and the Environment

Preliminary Safety Evaluation with Open Items: Chapter 20, "Mitigation of Beyond-Design-Basis Events"

NuScale Design Certification Application

ACRS Subcommittee Meeting
July 9, 2019

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Agenda

- NRC Staff Review Team
- Background
- Staff's Review Approach
- Summary of the Staff's (Preliminary) Findings
- Staff Review of NuScale's MBDBE strategy
- Phase 4 Review Plan
- Abbreviations

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NRC Staff Review Team

- Key Technical Reviewers
  - Clint Ashley, NRO
  - Robert Vettori, NRO
  - Ryan Nolan, NRO
  - Michelle Hart, NRO
  - Nan (Danny) Chien, NRO
  - Nick Hansing, NRO
  - Raul Hernandez, NRO
  - John Budzynski, NRO
  - Chang Li, NRO
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  - Don Palmrose, NRO
  - Matt McConnell, NRR
  - Sheila Ray, NRR
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  - Joe Ashcraft, NRR
  - Amanda Marshall, NSIR
  - Dan Barss, NSIR
- Project Management
  - Omid Tabatabai, NRO

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Background

- 10/30/2018: NuScale submitted its DCA, Rev 2
- 01/24/2019: NRC approved Final MBDBE Rule (10 CFR 50.155)
- 03/28/2019: NuScale informed the staff that it was revising its Ch. 20
- 06/10/2019: NuScale submitted revised Ch. 20
- 06/14/2019: NuScale submitted Rev. 1 to ELAP Technical Report
- 06/26/2019: NRC issued Information SECY 19-0066[1]
- 07/12/2019: SECY 19-0066 will be publicly available (ML19148A443)
- September 2019: 10 CFR 50.155 is expected to be publicly available

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[1] *SECY 19-0066: "Staff Review of NuScale Power's Mitigation Strategy for Beyond-Design-Basis External Events"*

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Staff's Phase 2 Review Approach

- Staff's (preliminary) Phase 2 SER for Chapter 20 is based on Rev. 2 of NuScale's DCA
- Staff's regulatory bases for the review consisted of:
  - Commission Orders EA-12-049 and EA-12-051
  - JLD-ISG-2012-01, Rev. 1
  - NEI 12-02, Rev. 1,
  - NEI 12-06, Rev. 2
  - SRM-SECY-12-0025
  - SRM-SECY-16-0142
- Based on the docketed information, the Staff's findings in Phase 2 SER are limited to the first 72 hours after initiation of a BDBE.

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Summary of the Staff's (Preliminary) Findings

- 20.1: Mitigation Strategies for BDBE – detailed discussions in the upcoming slides
- 20.2: Loss of Large Area (LOLA)
  - Staff used SRP Section 19.4 as the guidance document
  - Use of NEI 06-12 acceptable to staff to show compliance with 50.54(hh)(2)
  - Key safety functions for evaluation:
    - RCS inventory/heat removal
    - Containment isolation/integrity
    - Release mitigation
  - Staff finds NuScale design meets requirements of 50.54(hh)(2)
- 20.3: Emergency Procedures
  - This Section will be reviewed during a combined license application review
- 20.4: Enhanced Emergency response capabilities for BDBE
  - This Section will be reviewed during a combined license application review

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Staff Review of NuScale's MBDBE strategy

Regulatory Framework

- The recently approved regulation, 10 CFR 50.155, for mitigation of beyond-design-basis events (MBDBE) does not apply to applicants for a design certification.
- NuScale is voluntarily seeking the NRC's approval of its proposal to use installed design features to mitigate beyond-design-basis external events.
- NuScale design incorporates several design features that provide enhanced capabilities for mitigating an extended loss of ac power compared to currently operating reactors.

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Regulatory Framework (Cont'd)

TEXT OF 10 C.F.R. § 50.155(b), (c), and (e) APPROVED BY THE COMMISSION

(b) Strategies and guidelines. Each applicant or licensee shall develop, implement, and maintain:

(1) Mitigation strategies for beyond-design-basis external events. Strategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that are developed assuming a loss of all ac power concurrent with either a loss of normal access to the ultimate heat sink or, for passive reactor designs, a loss of normal access to the normal heat sink. These strategies and guidelines must be capable of being implemented site-wide and must include the following:

(i) Maintaining or restoring core cooling, containment, and spent fuel pool cooling capabilities; and

(ii) The acquisition and use of offsite assistance and resources to support the functions required by paragraph (b)(1)(i) of this section indefinitely, or until sufficient site functional capabilities can be maintained without the need for the mitigation strategies.

. . . .

(c) Equipment. (1) The equipment relied on for the mitigation strategies and guidelines required by paragraph (b)(1) of this section must have sufficient capacity and capability to perform the functions required by paragraph (b)(1) of this section.

(2) The equipment relied on for the mitigation strategies and guidelines required by paragraph (b)(1) of this section must be reasonably protected from the effects of natural phenomena that are equivalent in magnitude to the phenomena assumed for developing the design basis of the facility.

. . . .

(e) Spent fuel pool monitoring. In order to support effective prioritization of event mitigation and recovery actions, each licensee shall provide reliable means to remotely monitor wide-range water level for each spent fuel pool at its site until 5 years have elapsed since all of the fuel within that spent fuel pool was last used in a reactor vessel for power generation.

SRM-M190124A, Enclosure 1, Federal Register Notice at 140-41.

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Staff's Review of NuScale MBDBE Approach (Cont'd)

NuScale MBDBE Approach

- Core cooling, containment, and spent fuel pool cooling is maintained by permanently installed SSCs
  - MPS, DHRS, EDSS, ECCS, CNV, UHS, etc.
- Minimum coping duration of 14 days
  - Provides sufficient time for the licensee to establish an alternate means of removing heat
- No reliance on monitoring for the mitigation strategies
  - Although instrumentation powered by the EDSS is expected to remain available in the near-term, module and reactor pool monitoring is a supplementary capability.

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Staff's Review of NuScale MBDBE Approach (Cont'd)

Staff's Review Approach

- Maintain consistency with scope of review performed for operating reactors and other design certifications.
  - Focus on the initial response coping period (first 72 hours) where the most critical and time-sensitive actions are projected to occur.
- Verify the design capabilities and capacities of the permanently installed SSCs satisfy the required safety functions, including the effects of credible transient phenomena, for 72 hours following initiating event.
  - Review will focus on design aspects of SSCs as described in the FSAR.
  - Operational aspects (e.g., procedures, training) deferred to COL stage.

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Staff's Review Approach (Cont'd)

- COL applicant would need to describe how mitigating strategies (or sufficient site functional capabilities) are maintained for an indefinite time period.
  - SSC design aspects would only need to be addressed if there are credible transient phenomena (e.g., return to power) that could challenge core cooling, containment, or SFP cooling beyond 72 hours
  - Level of detail expected is commensurate with time available to implement actions.
- Staff plans to document that instrumentation is not relied on to support the mitigation strategies; however:
  - Instrumentation is expected to be available for the initial 72 hours,
  - Pool level instrumentation is provided with batteries, for an additional 72 hours of level monitoring, and
  - Provides additional assurance that systems have responded as designed.

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Phase 4 Review Plan

- The staff will follow its plans, as described in SECY 19-0066, to complete its review of NuScale's Ch. 20 in Phase 4 of the DCA review.
- The Staff will evaluate NuScale's DCA, Rev. 3, information for compliance with the requirements of 10 CFR 50.155
- NuScale DCA, Rev. 3, is expected to be submitted in late August 2019
- Staff's ACRS Full Committee presentation is scheduled for July 10, 2019.

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Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
CFR	Code of Federal Regulations
CNV	Containment Vessel
COL	Combined License
BDBA	Beyond-Design-Basis Accident
CNV	Containment Vessel
DCA	Design Certification Application
DHRS	Decay Heat Removal System
ECCS	Emergency Core Cooling System
EDSS	Highly Reliable Electrical System
ELAP	Extended Loss of AC Power
FSAR	Final Safety Analysis Report
JLD	NRC Japan Lessons Learned Directorate
MBDBE	Mitigation of Beyond-Design-Basis Events
MPS	Module Protection System
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NRR	NRC Office of Nuclear Reactor Regulation
NSIR	NRC Office of Nuclear Security and Incident Response
NRO	NRC Office of New Reactors
SER	Safety Evaluation Report
SRM	Staff Requirement Memorandum
UHS	Ultimate Heat Sink