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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FUTURE PLANT DESIGNS SUBCOMMITTEE

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THURSDAY

SEPTEMBER 24, 2015

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Michael L. Corradini, Chairman, presiding.

COMMITTEE MEMBERS:

MICHAEL L. CORRADINI, Chairman of the Subcommittee

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

DANA A. POWERS, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:

MAITRI BANERJEE

ALSO PRESENT:

GREGORY CRANSTON, NRO

JEAN CLAUDE DEHMEL, NRO

ROBERT FITZPATRICK, NRR

JENNY GALLO, NRO

ZACH GRAN, NRO

JAKE ZIMMERMAN, NRR

T-A-B-L-E O-F C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

8:30 a.m.

CHAIRMAN CORRADINI: This meeting will come to order. This is a meeting of the Future Plant Design Subcommittee of the Advisory Committee on Reactor Safeguards. My name is Mike Corradini. I'm acting chairman of this Subcommittee.

ACRS members in attendance today are Dennis Bley, Dana Powers, Ron Ballinger, Steve Schultz, Dick Skillman and Ms. Maitri Banerjee is the designated federal official for this meeting.

Today we have members of the staff to brief the Subcommittee on the staff's development of the NRC's Design Specific Review Standard, or DSRS, for the NuScale small modular reactor. This document is being developed in anticipation of the NuScale design certification application for their integrated PWR technology.

The discussion topics on today's agenda include several sections of the DSRS, in particular 11.1 on coolant source terms and Chapter 8 on electrical systems.

The rules for participation in today's meeting were announced in the *Federal Register* on

September 21st, 2015. The meeting was announced as open to the public, but no request for making a statement to the Subcommittee has been received from the public.

We have one bridge line established. The bridge number and password were published in the agenda posted on the NRC public web site. To minimize disturbances the public line will be kept in the listen-in only mode and the public will have an opportunity to make a statement or provide its comments at a designated time towards the end of this meeting.

Dr. Rempe, who's in Paris, has a conflict of interest in the area of NuScale severe accident considerations because of her prior work that she completed for NuScale in this area, and Dr. Rempe will recuse herself from discussions in this particular area.

I'll start with Mr. Greg Cranston, the NRO project manager, who will introduce the presenters and to start off our briefing. Greg?

MR. CRANSTON: Thank you. My name is Greg Cranston. I'm the senior project manager for the NuScale project. As mentioned this morning, we're going to be talking about source term and the

electrical sessions associated with the Design Specific Review Standard for NuScale.

Mr. Zach Gran will be presenting the source term and Mr. Bob Fitzpatrick will be presenting the electrical DSRS sections this morning.

This is the third in a series on selected DSRS sections to present to the Committee. As mentioned before, we do have the comments. They are being processed and sent out to the respective branches so that they can start reviewing them and decide which ones would be incorporated.

CHAIRMAN CORRADINI: A number comes from NuScale, but did you get any substantial comments from other groups?

MR. CRANSTON: I would say from the standpoint of comments specifically on DSRS sections. We did get about five general comments from NEI, not specifically related to a DSRS. One of their main comments was they thought maybe there were too many DSRSs that could have remained as standard review plans.

CHAIRMAN CORRADINI: Okay.

MR. CRANSTON: We did receive a couple of comments from the general public which were

totally unrelated to DSRSs, but just provided an opportunity for them to state their beliefs about nuclear power.

CHAIRMAN CORRADINI: Okay.

MS. BANERJEE: Can I ask a question, please? Did you figure out which DSRS could go back to the SRPs?

MR. CRANSTON: No, we are taking that comment under advisement. And we'd also been starting to look at that ourselves based on comments that we did get back. And we're in the process now of formulating a guidance document to go back to the branch chiefs for them to decide if they want to continue with a DSRS for a particular section or if, based on their knowledge of the NuScale systems at this time and looking at the comments, it doesn't make sense to just revert back to the standard review plan.

CHAIRMAN CORRADINI: And that decision will be made sometime in the next couple months?

MR. CRANSTON: Yes.

CHAIRMAN CORRADINI: Okay.

MR. CRANSTON: Definitely, yes. In fact, hopefully we get that done within a month.

CHAIRMAN CORRADINI: Okay.

MR. CRANSTON: Because we need to proceed with the processing the DSRSs to get the finals issued at least six months prior to the submittal of the design certification application from NuScale.

CHAIRMAN CORRADINI: And I'm sure you said this and I just don't remember. When are you expecting that?

MR. CRANSTON: They say as early as October of next year, but they said it's more likely the end of next year.

CHAIRMAN CORRADINI: So sometime December

'16, January '17?

MR. CRANSTON: Correct.

CHAIRMAN CORRADINI: Which means you need to have something out in the public as a final by June?

MR. CRANSTON: Yes, that's what our goal is. Now, they do have the draft comment. They do have the draft DSRSs to use in conjunction with their preparation of their DCA, plus they have seen -- well, they've seen all the comments because all the comments are from them.

CHAIRMAN CORRADINI: Yes. Yes, that I

gather from what you had told us.

MR. CRANSTON: Yes.

CHAIRMAN CORRADINI: Okay.

MR. CRANSTON: And that kind of covers the last bullet there, too, that some DSRS sections may revert back.

Again, this just covers what we mentioned previously as far as what our intent is with respect to making the presentations to ACRS to provide the approach staff took in developing them. Again, the comments were -- closing period was 6/30, or the DSRSs were issued on 6/30 and the comment period closed 8/29, and we're processing them now for inclusion either in the DSRS or if a particular document reverts back to the standard review plan, then those comments will be forwarded to the branch that addresses changes to standard review plans.

CHAIRMAN CORRADINI: Just so I understand the process -- so in the next couple months you guys will decide what reverts back, how you're going to answer those. So your responses will also be part of the record once you've decided what the final layout of this is going to be?

MR. CRANSTON: That's correct. We have developed a comment matrix for all sections. And

each comment that we've received has a comment response block, and we'll be filling that block out as to how we dispositioned that comment.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. CRANSTON: Okay. If there are no further comments at this point or questions, I will turn the presentation over to Mr. Zach Gran who will cover Section 11.1, Source Terms.

MR. GRAN: All right. Thank you. Hello, all. My name is Zach Gran. I have a master's in health physics from U. Mass.-Lowell and I am a qualified technical reviewer in NRO in the Radiation Protection and Accident Consequences Branch. I have five years of experience doing health physics review in NRO and I am here to present the items that are unique to the DSRS Section 11.1.

The current DSRS is based on design information provided to the staff in late 2013. This is the latest information presented to the staff. And the staff also noted that in the recent public comment period there were no comments provided on DSRS Section 11.1.

The DSRS Section 11.1 acknowledges that current PWR GALE is not applicable to the NuScale

design, and accordingly NuScale has stated that they would be developing a version of GALE specific for their design.

CHAIRMAN CORRADINI: Can you at least remind us why it's applicable?

MR. GRAN: There's -- I guess that's -- the whole sense of 11.1 is the source term development to allow -- the assumptions that GALE had before were for the traditional reactors, for the much bigger. So now it's a lot smaller, so different design considerations will be incorporated for the new GALE.

CHAIRMAN CORRADINI: So it's just the scale of the module that makes it not applicable? I'm sorry, I don't know GALE. I'm sure Dr. Powers is going to punch me and tell me about it privately, but can you go a little further there?

MR. GRAN: Sure. I mean, there are aspects of GALE that are applicable, so that the staff will like key in on those when reviewing. So there are certain aspects that we go over in the next slide of the applicability of things from GALE.

CHAIRMAN CORRADINI: Okay. If you're going to get to it, that's fine.

MR. GRAN: And so NuScale will be

submitting a topical report soon. I believe it's the end of the month based off of their independent GALE code analysis. And in this submission the topical report will address radionuclide distributions and concentrations in the primary and secondary coolant based off of the fuel design characteristics, industry data on expected performance, and the activity due to neutron activation of corrosion --

(Simultaneous speaking)

CHAIRMAN CORRADINI: So I'm sorry to -- so GALE estimates the coolant-based source term --

MR. GRAN: Yes.

CHAIRMAN CORRADINI: -- from corrosion and activation?

MR. GRAN: So normally GALE utilizes the ANSI 18.1 standard, which encompasses the operating history of reactors going way back, I guess, and that normally incorporated all of the knowledge that they had, but since it's a different design, different scale, new assumptions will have to be taken.

CHAIRMAN CORRADINI: Okay. All right. I think I get it. All right. Thank you.

MR. GRAN: So while the PWR ALE is not

relevant, elements of its guidance are still relevant for the staff's review of the NuScale design. So first, the use of ORIGEN and SCALE is relevant since common PWR fuel will still be used.

Second, operating experience estimating coolant activity is still relevant, so neutron activation of corrosion wear products are still the same and that there are adjustments made for the use of internal alloys in service areas that are in contact with the reactor coolant.

Third, operating history in characterizing the fuel performance is still relevant. The fuel failure rates and failure mechanisms are still useful for informing the assumptions that may be taken by NuScale.

And last, the reliance of the current waste processing --

MEMBER POWERS: How do they know what inventories of corrosion products and the like to use?

MR. GRAN: I'm sorry?

MEMBER POWERS: How do they know what inventories of corrosion products and the like to use for the calculations?

MR. GRAN: That I guess will kind of be

part of the topical report, because I guess they'll have to make a very good presentation to us. We were asking for them to just kind of prevent everything, because they were basing a lot of it off of the operating history. So the same type of metals and I guess in a sense some of the same systems instead

of --

MEMBER POWERS: Different temperatures, different exposure pathways. Geometry is all different.

MR. GRAN: So it's --

CHAIRMAN CORRADINI: I was guessing the biggest effect is surface area to volume. It's a small module, so that would probably be the biggest scaling different and --

(Simultaneous speaking)

MEMBER POWERS: -- goes up, but I think we'd get saturation --

MR. GRAN: Right.

MEMBER POWERS: Okay. But I just don't know how they get --

MR. GRAN: Yes, because there's I guess the issue with trying to -- I guess making the case that some secondary systems are being activated and

generating different types of source terms that we're used to as well.

MEMBER POWERS: What do they do about iodine spiking in all this?

MR. GRAN: I'm not sure.

CHAIRMAN CORRADINI: You're going to find out?

MR. GRAN: Yes.

CHAIRMAN CORRADINI: And this is the next topical report you're expecting from the applicant?

MR. GRAN: Yes, the one at the end of this month, or soon after.

MEMBER BLEY: And will this DSRS be used as a guide for reviewing that topical?

MR. GRAN: Yes, so the DSRS points out aspects of the design that we'll be looking for source terms, so it pointed out like the neutron activation of secondary components like feedwater intake valves or the nozzles and pointing out some of the ideas that additional source terms may be generated because it's a smaller design now, but whether or not there's going to be neutron activation outside -- in like the pool coolant or some of the secondary systems is identified in the

DSRS, and we'll be looking for that stuff within the topical report.

MEMBER SCHULTZ: Zach, could you explain further the statement that operating history in characterizing fuel performance is still relevant? Is that when you say -- what operating history are you referring to?

MR. GRAN: So I'm referring to like the activation rights of certain materials where can say the stainless steel or the production of corrosion products. They might use those assumptions for developing their best estimates for saying this is what we expect to see, because we're still using all -- I believe that they're still using all the same materials, so they try and make the same assumptions for corrosion products. I'm sure there will be some sort of scaling since there's a lot less --

(Simultaneous speaking)

MEMBER SCHULTZ: So that goes to the second bullet, the operating experience --

(Simultaneous speaking)

MR. GRAN: Yes, they're largely connected, yes.

MEMBER SCHULTZ: So the fuel performance is what I'm thinking about. I understand it's the

same --

MR. GRAN: Type of fuel, but it's just smaller, or shorter.

MEMBER SCHULTZ: Shorter. And --

MR. GRAN: But this mainly --

MEMBER SCHULTZ: But are you talking about experience associated with fuel failure or are you talking about --

MR. GRAN: Yes. Experience associated with the fuel failure rates, yes.

MEMBER SCHULTZ: Okay.

MR. GRAN: Since it will still -- it's our understanding that it's the same exact fuel, it's just the shorter versions of it.

CHAIRMAN CORRADINI: So let's go back to history. So I've got the La Crosse boiling water reactor. I've got Rock -- I can't remember the name, all of the small reactors. But there must be a historical record of what their coolant inventory -- their coolant source term inventory was that staff can look back and see, because this is not really a PWR and it's not really a BWR. It's kind of like a quasi-B since they're so close to boiling at the top of their -- at their pressurizer and pressurized is part of all this. So can you look at

the old plants? I'm trying to think. Was it -- Big Rock Point, Humboldt Bay and La Crosse are all very small reactors. So I would assume the surface area to volume scale -- and then questions like Dana had because lower flow, etcetera, etcetera might be relevant. Has the staff got information on those they can go back and look for some empirical anchoring of whatever is proposed?

MR. GRAN: I don't believe that we have that information available.

CHAIRMAN CORRADINI: Well, I know it's out there. The people aren't dead. No, I -- the former plant manager for La Crosse is trying to still dispose of his fuel, so he's still around. So my only point is that there is actually empirical data on the small reactors.

MR. GRAN: So I guess we'll take a look for that information then.

CHAIRMAN CORRADINI: Okay.

MEMBER BLEY: Is there any -- since it is first of its kind, is there any requirement for tracking this history over the life of the plant that will feed back into the source term work later on?

MR. GRAN: I can't think of any

requirements yet. There will be --

MR. DEHMEL: Yes, Jean Claude Dehmel, NRO health physics, here. Yes, there are requirements built into the Appendix I requirements there is a requirement for the staff to follow the releases reported in the annual effluent release reports. And then you look at this history and determine whether or not some adjustments need to be made. So there is a process by which we can track and make determination as to whether or not certain operational LCOs, limiting conditions for operation, would have to be revised or modified for this particular type of plant. So there are provisions, yes, built in.

MEMBER BLEY: Is that a continuing process or is that an occasional process?

MR. DEHMEL: Well, the annual effluent release reports are issued annually and--

MEMBER BLEY: And you look at them --

(Simultaneous speaking)

MR. DEHMEL: -- so they are looked at by the staff, the region as well as headquarters. So the question then is we need to look at the first results, look at the trend, look what was stated in the FSAR and make some comparison and maybe some

projections.

MEMBER BLEY: Thank you.

MR. GRAN: And I guess the last point we had was the reliance of current waste processing systems to manage waste is still relevant. So the staff would expect NuScale to contain a lot of the same PWR collection treatment systems in some form if they have different names.

MEMBER POWERS: I really get puzzled by how the SCALE results on scaling -- just the corrosion of things from one reactor system to the other, because you have different gradients, different temperature distributions, different absorption, desorption. I mean, that looks like -- you know, if I was confronted with that, I'd have to stay up nights studying to figure that one out.

CHAIRMAN CORRADINI: That's a comment. You don't have to try anything on that.

(Laughter)

MEMBER POWERS: Well, in essence I'm asking how do you stay up nights studying to figure out what's an acceptable way to scale historical data from power reactors down to a smaller reactor?

MR. GRAN: I guess I'd have to see what they kind of give us at first. So if they use --

scale it down --

MEMBER POWERS: Well, I think I would want to think about it first --

MR. GRAN: All right.

MEMBER POWERS: -- and then see if what they said fit in my --

(Simultaneous speaking)

CHAIRMAN CORRADINI: I think the philosophical approach that Dr. Powers is suggesting is that always come up with a first guesstimate to see what you can gauge a submission to. Right?

MEMBER POWERS: Yes, I mean, that's I'm -- I mean, frequently what you look for in looking at a topical report is what's not there.

MEMBER BALLINGER: I think I'd be more interested in looking at area ratios for the different designs if they want to understand.

MEMBER POWERS: Well, that's the first cut, but then you'd have to look at the temperature gradients and what the maximum temperatures are and what the flow gradients are. I mean, there's just -- it looks like a difficult problem for me unless you can persuade yourself that your saturation limited. Then you don't care about the -- you don't care about rate processes as soon as you get

saturation limited.

CHAIRMAN CORRADINI: The only other thing that came to mind is that with their CVCS system, if I were them, I'd essentially have to argue that I've got an operating CVCS system and keep it at some concentration, right? Because the surface area to volume essentially is going to build up more than you suspect unless you hit saturation. And then you've got to remove it from just a continual --

MEMBER POWERS: But see, you've got a very tricky problem there because what you're doing is you're saying, okay, I have a steady state concentration. That means I have balanced a source versus a sink. And where those two come into balance is very sensitive to small things.

MEMBER BALLINGER: But the core is basically a filter.

MEMBER POWERS: No.

MEMBER BALLINGER: Puts crud on the fuel.

MEMBER POWERS: No, they got -- the crud on the fuel will quickly get to a fairly steady state situation.

CHAIRMAN CORRADINI: Your point is it

will get to some steady state unless it's a saturation. Any sort of right-hand side term could change what --

(Simultaneous speaking)

MEMBER POWERS: I mean, small things between the source and the sink change where that steady state is. And so, I mean, the problem is you've got to know both very accurately now. And what you're relying on to some extent is what was observed in a different system.

CHAIRMAN CORRADINI: The only saving grace is we don't expect it to be large. And if you're going to trend it and they're going to estimate and you trend it and the trend doesn't match the estimate, then there's going to have be some essential action.

MR. DEHMEL: Yes, and to follow up on what you just said, and the issue of following what was done in the past with some of the smaller PWR design, some of the issues you've just highlighted plus the different operational history of fuel performance and maintenance of the primary cooling chemistry of those other years I don't think is going to lead and yield much information that's going to be useful here.

CHAIRMAN CORRADINI: Yes, Dennis hit me on the side and told me to --

MR. DEHMEL: Right. So I think that the history is going to be somewhat limited and I would say perhaps we should not burden ourselves with that.

CHAIRMAN CORRADINI: Okay.

MR. DEHMEL: We should look at the current operating history of fuel performance, cladding performance, as well as maintenance of primary and secondary cooling chemistry. We should focus on those and how NuScale is essentially looking at these practices and folding those into this design.

MEMBER BLEY: Are they using -- and I haven't seen any -- are they using any materials that are unique we haven't seen in the current plants? Not that I know of.

MR. DEHMEL: Not that I know of.

MS. BANERJEE: Well, the design has a unique aspect, which is the long riser in the middle.

CHAIRMAN CORRADINI: But not different material.

MEMBER BLEY: But not different

materials, I don't think. So that would be the thing I would --

MR. DEHMEL: They've committed to use alloys that would minimize the corrosion and activation products for sure. I mean, that's kind of an expected practice now.

MEMBER BLEY: Yes.

MEMBER SCHULTZ: What is the GALE code benchmarked to, to the current fleet of reactors? Is it good --

MR. GRAN: Yes, the GALE code would use like the ANSI 18.1 standard, which is benchmarked off the current fleet of reactors.

MEMBER SCHULTZ: Okay.

MR. GRAN: All right. So continuing on, in DSRS Section 11.1 we address the following unique design elements. First, is the integrated PWR design by NuScale. All of the reactor components are contained in the same vessel and are surrounded by an evacuated reactor containment vessel. This evacuated region is subjected to a high neutron flux with the potential for RCS pressure boundary leakage within its volume.

Staff would be reviewing information on the venting operations of this evacuated area as

well as the potential profile of radionuclides that coexist outside of normal refueling source terms. And with all the components being in close proximity to each other, the staff has highlighted the potential for neutron activation of feedwater given the close proximity of feedwater nozzles near the top of the reactor core.

And second, radiological control of the secondary coolant does not use a traditional steam generator blowdown and treatment system. NuScale will need to fully address the performance of the steam generator as its design is different from the traditional steam generators that are currently in use. The staff will be seeking information on steam generator tube failure rates to understand whatever primary to secondary leak rates are proposed.

MEMBER SCHULTZ: Do you expect those -- they're going to be estimates of some kind and you're going to examine the estimates that are provided?

MR. GRAN: Compared to what we have for current data, yes.

MEMBER POWERS: Tell me what the steam generator looks like?

MR. GRAN: The helical coil steam

generator. That's --

PARTICIPANT: Boiling inside the tube.

MEMBER BLEY: Every time they change a steam generator, despite what my materials friends tell me is hard science, we get great surprises.

MEMBER BALLINGER: They're going to get great surprises with this one. That helical coil alloy-690 steam generator has never fabricated before. Helical coil generators have been fabricated alloy-690. Tube steam generators have been fabricated, but not the two in the processing and all that kind of stuff on either end. It's just going to be difficult. They're going to be surprised.

MEMBER BLEY: But they have the secondary on the inside, which is different, which ought to help with some of the chemistry problems we've had.

MEMBER BALLINGER: That's more common with the fossil business anyway.

MEMBER BLEY: Yes.

MEMBER BALLINGER: Yes.

MEMBER BLEY: That's true it is, yes.

MR. GRAN: The NuScale design will be a multi-module design where multiple reactors are

located in a common reactor pool that is also used for spent fuel storage. The staff will be seeking information on maintaining the quality of reactor pool water that may be introduced during maintenance and refueling activities. The staff will also be seeking information on the design of the reactor pool cleanup system and maintaining radioactivity levels in the reactor pool water. The near constant refueling outages will feed into the radioactivity level of the pool.

And last, the NuScale design will have a large volume of reactor pool water that is potentially subject to neutron activation. This includes examples of production of tritium, carbon-14, nitrogen-16 and argon-41 as examples.

CHAIRMAN CORRADINI: So one of our colleagues did their homework and she asked me to ask questions. So the outside water pool is going to consider the operation of the n modules, whatever n is, correct? In other words, if eventually they build 12 of these, you're going to have to consider the sum of all 12 and how they affect the pool?

MR. GRAN: Oh, we'll be looking at that, yes. I'm not sure whether or not they're making the case of whether or not there's -- neutron activation

is not going to go out that far.

CHAIRMAN CORRADINI: Yes, that's for a calculation. But you're going to consider the complete population of water sitting in the pool?

MR. GRAN: Correct.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. GRAN: And the staff will also be looking into information on performance of their HEPA filters and charcoal absorbers given the possible cool water evaporation rates as well and the ventilation of the building.

CHAIRMAN CORRADINI: I have another question --

MR. GRAN: Sure.

CHAIRMAN CORRADINI: -- I've been asked to ask. So the fuel defect assumption of 0.25 to 1 percent is the same simply because it's oxide fuel, just half sized?

MR. GRAN: So I'm trying to think of how to --

CHAIRMAN CORRADINI: You can say yes and we can move on.

MR. GRAN: All right.

CHAIRMAN CORRADINI: I was guessing the answer was yes because assuming it was the same fuel

technology, but personally I couldn't see anything about half height affecting that, but --

MR. GRAN: I don't think it would, but I'd have to I guess take a look at the information, because obviously there's different source terms provided within 11.1 of the normal, and the 1 percent and the 0.025 percent being provided in Chapter 12.2.

CHAIRMAN CORRADINI: Okay.

MR. DEHMEL: Yes, I'd like to add on this, is that they requested and they will be addressing this and including it, maybe not in the topical report, but later on in the FSAR that they would establish specific technical specification for the fuel. So we'd like to see what the proposed technical specification is going to be for this particular fuel and any operating condition within the reactor vessel.

CHAIRMAN CORRADINI: Thank you.

MEMBER SCHULTZ: Won't they have to set -- you're saying you don't know if that level of detail will be in the GALE document, the revised GALE document --

(Simultaneous speaking)

MR. DEHMEL: Yes, the GALE document --

MEMBER SCHULTZ: In order to exercise it you'd think they would need that information.

MR. DEHMEL: Ultimately it will be in the FSAR.

MEMBER SCHULTZ: Yes.

MR. DEHMEL: It may be premature to have that in the first part of the GALE code. The GALE code, our understanding right now is going to be half of the code, half of the documentation only addressing the modeling of fission products from the fuel into the coolant and into the secondary coolant and estimates of activation and corrosion products. That's all it's going to be at this point. And some estimates of failed -- fuel failures obviously. Scale on operating practices right now. The other aspects on the operational and constrained LCOs and tech specs is going to be addressed later on. That information is really not necessary for the development of the GALE code.

MEMBER SCHULTZ: Thank you.

MR. GRAN: I guess this concludes my presentation on the unique elements of the DSRS 11.1. Thank you.

CHAIRMAN CORRADINI: Other comments or questions for Zach? Okay.

MEMBER POWERS: Well --

CHAIRMAN CORRADINI: Oh, Dr. Powers?

MEMBER POWERS: It just excites my intrigue because everything we know about chemistry becomes very funky in this operating environment because the dielectric constant of water is so low. And the shorter rod means that you have less -- you have a very much sharper temperature gradient and you have a very hot top where absorption onto the oxidized cladding -- things don't want to be in solution here. This is more like acetonitrile than it is water.

CHAIRMAN CORRADINI: I was going to say this is more like a BWR --

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: -- because the delta-T is going to be a lot more --

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: -- kind of like a quasi -- it's not a P, it's not a B, it's kind of like an inbetweener.

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: So I was guessing the chemistry words would be more like a B, knowing nothing about -- but I think their delta-Ts are

smaller than a typical P, if memory serves me. I don't actually --

MEMBER POWERS: Interesting.

CHAIRMAN CORRADINI: I suggest you engage Dr. Powers offline about what you could think about, because he enjoys this.

(Laughter)

CHAIRMAN CORRADINI: And he's full of energy.

MEMBER POWERS: I'm intrigued.

CHAIRMAN CORRADINI: All right. Anything else for Zach?

MEMBER BALLINGER: -- definition of torture.

MEMBER SCHULTZ: Just to comment on the last bullet there, I think you need to turn that around to more of an expectation; that is, rather than the potential production. And you do of course require information, but you need to have a high expectation that this is going to be covered in the topical.

CHAIRMAN CORRADINI: You're talking of the large outside pool and how they're going to --

(Simultaneous speaking)

MEMBER SCHULTZ: Yes.

CHAIRMAN CORRADINI: Yes.

MEMBER SCHULTZ: That's a unique feature of the facility; and you mentioned it earlier, and you want to carry it through to make sure that the conclusions are in their discussion associated with the overall evaluation with the revised methodology.

MEMBER BALLINGER: Isn't this big pool sort of -- like from the standpoint of dose because the vessel is going to be shielded and all that kind of stuff sort of --

CHAIRMAN CORRADINI: There is a containment in here, too.

MEMBER BALLINGER: There is a containment, all that kind of stuff that's in the pool, but there's going to be gamma dose, but not neutron dose.

CHAIRMAN CORRADINI: Right. Well, there will be some --

MEMBER BALLINGER: And so this is sort of like s spent fuel pool --

CHAIRMAN CORRADINI: But it's always I think --

(Simultaneous speaking)

MEMBER BALLINGER: -- fuel elements in there.

CHAIRMAN CORRADINI: I think the staff's issue is it's always there, which mean it's going to be accumulating something that one has to consider. That was my --

MEMBER BALLINGER: Like a spent fuel pool.

MR. GRAN: So you have -- I mean, the constant refueling, there's going to be more and more radionuclides building up in there. The information on the treatment systems will be key to identifying what --

MEMBER BALLINGER: Well, I mean from the standpoint of the radiolysis products in the pool.

MR. GRAN: Yes.

MEMBER BALLINGER: Not fission product, not that kind of stuff.

CHAIRMAN CORRADINI: When we were out there I seemed to remember if they had leakers, they had at least a mechanism if they want to get the leakers out of the -- they're not going to leave them inside the spent fuel pool. They're going to reduce them.

MR. DEHMEL: No, there's a correction here we need to point out. We're aware that as part of the refueling process they're going to open up

each vessel in the pool. So you have two issues: One is the generation of neutron activation products within the pool itself: the tritium, the carbon-14, nitrogen-16 and argon-41. And then the other thing when each on each module is the refuel. The plan right now or what they propose is that they would cycle it out through the reactor vessel to the CVCS and cleanup system and then open it up underwater within the pool.

So ultimately as you do normal refueling they would be essentially a gradual increase of fission product within the pool. So essentially it's multiple source term, what you would normally expect in a spent fuel pool, neutron activation of water components. And then there is slow increase potentially of fission activation or fission products in the pool because of each refueling process.

MEMBER BALLINGER: But that's no different than a regular light water --

CHAIRMAN CORRADINI: But I think his point is that you've got 12 of these guys and they're going to be continually --

MR. DEHMEL: Yes, exactly.

CHAIRMAN CORRADINI: -- doing these

operations, so they're going to have to come up with some staff and then we're going to have to come to some expectation it can't be greater than X or the impact of X on dose, right?

MR. DEHMEL: Correct, and they also -- there are some preliminary discussions. The thinking is that they may have tech specs on the activity on the fuel pool. So they're thinking about that. They realize that there's a potential increase for accumulated activity as they go to multiple refueling and perhaps there should be tech specs on maximizing a limited controlled amount of activity within the pool.

CHAIRMAN CORRADINI: Ron, did you have a follow-up?

MEMBER BALLINGER: No.

CHAIRMAN CORRADINI: No? Okay.

MEMBER SKILLMAN: Mike, I think you're right when you say this is really a hybrid. It's not a P, it's not a B. It has elements as far as source term for the primary coolant in both designs. But what I'm pondering here is the work that B&W did years and years ago on the CNSG, but more importantly the work that was done by all the boiler manufacturers for natural circulation and where --

CHAIRMAN CORRADINI: What's the CNSG?

MEMBER SKILLMAN: That was the consolidated nuclear steam generator.

CHAIRMAN CORRADINI: Oh.

MEMBER SKILLMAN: And I don't know if you remember when NuScale was here. They said there are elements in this NuScale design that are absolutely derived from what was that CNSG. That was a hard-earned patent by Babcock. Most people don't even know that that design was out there. It was intended to be a merchant ship design. But what I'm thinking is the secrecy around which the downcomer or the recirculation rates were held for the big boiler, the downcomer flow rates, because it was all driven by natural circulation.

This machine is really driven by natural circulation. And so what we see in the big Ps with very high Reynolds numbers is a clean function of the corrosion products and the transport of those ultimately to CVCS or to the makeup and purification system. This plant will have a much different residence time and probably a different generation time of corrosion products.

CHAIRMAN CORRADINI: You're talking on the primary system side?

MEMBER SKILLMAN: Yes.

CHAIRMAN CORRADINI: Okay.

MEMBER SKILLMAN: I am. And so the source term, or the primary -- the coolant source terms will be very different than a big pump-driven P, and probably also different from a very large B with fairly high circulation rates.

So to Dana's point, there are going to be some very different -- at least my sense is some very different source term concentrations based on a very different interior circulation of the primary system. And we ought to be on top of that. And I don't know if that means that NuScale is going to have to base their GALE -- their custom GALE code on what are the very much smaller reactor coolant system volume and very differently circulation rates and a very small volume. My sense is that's going to drive what will be the NuScale GALE code.

MS. BANERJEE: I have a question.

CHAIRMAN CORRADINI: Sure.

MS. BANERJEE: I'm stuck on the tall riser and I'm wondering if that flow through -- the natural circulation flow through the riser is going to precipitate heavier elements down towards the bottom of the reactor.

MEMBER SKILLMAN: And, Maitri, that's the kind of thing I'm driving at, too. This is all driven by this elevation. It's -- a thermalsyphon actually is what drives this process.

CHAIRMAN CORRADINI: Well, their mass flux through the core is lower, but it's not substantially lower. I'm not sure we can say what it is because I don't even remember if we were ever told it, but in public -- in a meeting in Chicago just a couple weeks ago they did a number of thermal hydraulic scaling presentations and it's approximately half of P. So it's not really low, but it is lower.

MEMBER SKILLMAN: Lower, yes. My only point is that since this is a natural circulation-driven machine, we're probably going to see some source term differences that we had not anticipated. I don't know that they will be a problem, but like Ron says, expect surprises. We ought to be expecting surprises.

CHAIRMAN CORRADINI: Okay. Bob is up. The world of electrical.

MEMBER BLEY: But before Bob gets started, I have a comment and a couple of questions. And they might be more aimed at Greg than Bob.

As we go through this series of guides, review standards, we always begin with the design of NuScale, which doesn't need AC power for safety functions for 72 hours. And after 72 it's non-safety-related. Where in the overall review process does that assumption get analyzed for sure? I mean, it isn't an electrical question. The electrical is designed to that. It really comes out of the thermal hydraulics and everything else.

CHAIRMAN CORRADINI: This is a non-Chapter 11 question.

MEMBER BLEY: Well, I'm not sure. I don't know where it is. Chapter 11; and Bob will do this some, I hope, shows some places where they make you justify these assumptions in these Chapter 11 DSRS, but that overall assumption of how this system performs and whether it needs power or not seems like it's probably somewhere else. And where in the whole scope of the DSRS are our reviewers driven to be sure that's a valid design criteria?

MR. CRANSTON: Yes, they'll be looking in the reactor systems areas as far as how the systems --

MEMBER BLEY: Have we already done that one? I think we --

MR. CRANSTON: No.

MEMBER BLEY: No, we haven't? Okay.

MR. CRANSTON: And how the systems are classified, how they have to operate during normal operations, how they have to operate post-accident, post-LOCA in order to maintain plant safety as far as shutdown and cooldown and all those things, those are all analyzed from that perspective. And that will actually -- once we determine what systems are needed for that based on our reviews, then we look at what electrical power is needed or what other things are needed to support those systems. And out of that we'll determine whether or not -- for example, do they need Class 1E power here or not? If nothing needs to operate --

MEMBER BLEY: I mean, but that all makes sense to me, but when we get to the reactor systems, will there be anything in there that talks about -- that reflects over to the electric power part to say what's being done over there is appropriate for what we know about the thermal performance of this plant, from hydraulics performance?

CHAIRMAN CORRADINI: Can I try his question? Can I try his question differently?

MR. GRAN: Okay.

CHAIRMAN CORRADINI: So maybe I'm even generalizing it more, but what he says, what I saw, which is you guys picked 72 hours. And I thought, well, that makes sense because you forced AP-1000 to do that and the ESBWR to do that, and now you're back -- well, let's just leave it there.

So for the other passive plants 72 hours is a magical time where before thou shalt show that you can do things passively and after that if necessary you have to -- you can use some sort of AC power assist. So is that just a carryover from that policy applied to the large passive plants, or is there something more -- is there other rationale? That's kind of how I frame what I thought you were asking.

MEMBER BLEY: That's basically the same thing, yes.

MR. CRANSTON: No, it's a carryover.

CHAIRMAN CORRADINI: So what makes -- okay. So now the next question is why 72 hours? Was that a policy decision? I sense yes.

MR. CRANSTON: I will have to get back to you on that. I don't know the details.

CHAIRMAN CORRADINI: Or where is it justified?

(Simultaneous speaking)

MEMBER BLEY: Where is it codified that we understand technically why there are not 48 hours, or 24 hours, or 96 hours?

MR. FITZPATRICK: The 72 hours has come down from the SECY papers.

CHAIRMAN CORRADINI: Are you turned on? Down at the bottom.

MR. FITZPATRICK: The 72 hours has come down to us from SECY papers that discuss that.

CHAIRMAN CORRADINI: I was guessing that.

MR. FITZPATRICK: Yes, and that is the --

CHAIRMAN CORRADINI: For us that are forgetful, if you could refresh us as to that SECY paper, that would help us.

MR. FITZPATRICK: Yes.

MEMBER POWERS: Is the 72 hours codified in the advanced reactor requirements document that EPRI put together?

CHAIRMAN CORRADINI: Now, that I can't remember. This is a thing from the '90s, right?

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: The ALWRS

thingamajigger?

MEMBER BLEY: Yes, I don't remember if it's in there.

MEMBER POWERS: I think that's where 72 hours comes from.

CHAIRMAN CORRADINI: Comes from? Oh, it is.

MEMBER SCHULTZ: I think it is in there. I don't know if that's where it came from or the dialogue was going on at that time.

MEMBER POWERS: Well, I think it did and the discussions and whatnot just got codified here in a -- and that became an object of the oral traditions of reactor safety.

CHAIRMAN CORRADINI: What did you say?

(Laughter)

MEMBER POWERS: The oral traditions of reactor safety.

CHAIRMAN CORRADINI: Mythology?

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: Okay. Fine.

MEMBER POWERS: So, I mean, I think it's -- people said, gee, we've been thinking in terms of 24 hours. Now we'll think about 72 hours. That seems better. And that's largely where it came

from.

CHAIRMAN CORRADINI: Well, I mean, if that's the source of it, then it always goes back to the '80s when they were saying that you want to show essentially containment, lack of -- high probability of containment survival for a few days, whatever a few days was. Right?

MEMBER POWERS: Yes.

CHAIRMAN CORRADINI: I think they -- if that's the connection.

MEMBER POWERS: I think a few turned out to be three.

MS. BANERJEE: Now, I have a question to the staff. We are not going to do any DSRS sections that are currently planned that we'll revisit this area, if I can remember.

PARTICIPANT: That's true.

CHAIRMAN CORRADINI: The SECY would help us. Now to Bob.

MEMBER BLEY: And as you go through, Bob, if you'll highlight places where there are differences --

MR. FITZPATRICK: Certainly.

MEMBER BLEY: -- here, we'd appreciate it.

MR. FITZPATRICK: I'm Bob Fitzpatrick. I'm a member of the Electrical Engineering Branch in NRR. The label says NRO, but that was a used to be. And I'm going to speak to you today about Chapter 8 of the DSRS. I'm here because I led the effort within the staff, within the branch to develop the Chapter 8 for mPower, and then I also led the effort to develop Chapter 8 for NuScale. And we actually derived NuScale DSRS from the work we had already accomplished with mPower.

CHAIRMAN CORRADINI: That's kind of noticeable. There are still remnants of mPower sprinkled in the text.

MR. FITZPATRICK: Yes.

CHAIRMAN CORRADINI: Just a side note.

MEMBER BLEY: And, well, since that's been brought up, in 8.4 in particular the last paragraph of the introduction says if you don't have enough guidance here, go to the mPower. And that seemed really odd.

CHAIRMAN CORRADINI: I haven't looked, but I bet you NuScale caught that.

(Laughter)

MR. FITZPATRICK: I may not have, but they did, yes.

The agenda is a brief introduction, and then going through the sections, and a quick summary at the end.

The purpose of my being here today is to really present the highlights of the NuScale design philosophy; and I say philosophy because they haven't given us a design to this point, and present changes, highlight changes to the SRP that we've made accordingly.

I do want to highlight the following items before we get started:

We have not received the detailed design. We've seen pieces of design along the way. I don't think we've attended any two meetings. We don't meet that often with them, but they've had the same electrical design of the pieces we've been looking at. CHAIRMAN CORRADINI: So they're evolving?

MR. FITZPATRICK: They're absolutely evolving. I was at the very first meeting with the staff, maybe four years ago or whatever, and ever since then it's evolved and matured in the process. So we'll see. We'll see what we get when that finally comes in.

CHAIRMAN CORRADINI: So to put it

another way, when I read Chapter 8, and I have a lot of -- not a lot, a couple of questions, it's more like on the one hand and on the other --

MR. FITZPATRICK: Yes.

CHAIRMAN CORRADINI: -- the way it's written.

MR. FITZPATRICK: Right.

CHAIRMAN CORRADINI: Maybe this, maybe that?

MR. FITZPATRICK: That's exactly right. We've tried to keep flexibility in there, just depending on what we had.

MEMBER SKILLMAN: Bob, let me ask this: As I read 8.1, 8.2, 8.3, 8.4, it seemed that the staff was attempting to preserve in the DSRS every opportunity to maintain an active power supply even though the bidding is toward not needing an active power supply because the system is passive. It appears as though you were always retaining an option for a Class 1E AC, some form of a backup Class 1E AC, or -- and Class 1E DC.

MR. FITZPATRICK: We certainly tried to do that, yes.

MEMBER SKILLMAN: That appears to --

MR. FITZPATRICK: Yes.

MEMBER SKILLMAN: -- show up through --

MR. FITZPATRICK: Right.

MEMBER SKILLMAN: -- the DSRS. And it also appears as though the wording is such that you could delete that if the mature design should be proven to not need the active and passive AC and DC. Nonetheless, you preserve that option through the DSRS.

MR. FITZPATRICK: Right. Another point I make during the presentation here is that we won't know really the acceptability of this design as they say it's going to be configured until we get to the end of the review, because a lot of it is dependent on all -- the NRC staff that supports Chapter 15 analyses. If this things really performs exactly the way they say it will, then that's a different story. But that has to be proven.

MEMBER BLEY: So I guess the thing I'm thinking about a little is the poor guy who has to review the system when it comes in, a little bit about the applicant when they come in. And they're going to want everything done at once, I'm sure. We try to -- end up doing all this stuff in parallel. It sounds like whoever reviews the electrical is going to have to review it under two different

options essentially and generate questions under each option until it becomes clear that either we need some 1E power or we don't ever. And then half that work wasn't needed, whichever way it goes. Am I reading that wrong? That's the way it --

(Simultaneous speaking)

MR. FITZPATRICK: I personally don't envision that. I think that the reviewer would be going in and reviewing what's there and determining, in the context of the way it's presented, is that really going to make it?

MEMBER BLEY: Unless there's a challenge from --

(Simultaneous speaking)

MR. FITZPATRICK: And then if we got a challenge at the end -- well, it's a big deal getting it at the end, but I mean, that's their design on what they defended. If they didn't make it -- but I don't see the staff really doing a double parallel review.

CHAIRMAN CORRADINI: Well, I guess what I heard Dennis asking is what I was thinking, too, which is in some sense you guys are going to come in with an expectation that's going to look like X. Then you're going to see does the system perform

like X, which requires certain instrumentation and electrical systems that support X in terms of safety.

MR. FITZPATRICK: Right.

CHAIRMAN CORRADINI: And then it turns out it's not X, it's X minus delta-X, or X plus delta-X. Then you have to come back and say, well, what you proposed for the -- I'm focusing on instrumentation because when we visited there was -- as I was telling one of the members when we visited, there was this discussion between the ACRS members and NuScale about, well, don't you want to know what's happening? And the answer was no. It will all be good. And the answer was, well, don't you want to at least know it's good?

(Laughter)

CHAIRMAN CORRADINI: So what power are you going to provide so you know that the instruments are powered, so you know it's good? And so, I guess what I'm getting to is that eventually if it does perform you may actually agree to certain of what they're claims are, but you won't know until pretty much the end of the review.

MR. FITZPATRICK: That's true.

CHAIRMAN CORRADINI: Okay.

MR. FITZPATRICK: If we find out we're wrong, then we'll have to go back. And they'll really need to change the design before we review it again. There's that possibility as well.

MEMBER BLEY: Let me just ask one other thing, because I've never had to review anything against an SRP. I've read them before.

CHAIRMAN CORRADINI: Count yourself lucky is what I sense.

MEMBER BLEY: Well, yes, but as I go through the first three sections of all of these, the first one says here's what we're going to review and it kind of lays it out and gives the guidance that you'll use that you'll review against. The next one is the criteria that you're going to use, which is almost like the first part. And the third one is the process that you're going to use, which is almost like the first two. It seems to me it's an extremely redundant set of things. But I guess the whole SRP is done that way and --

MR. FITZPATRICK: Yes, it is.

MEMBER BLEY: -- is that really tough for somebody doing a review, or you get used to that in a hurry?

MR. FITZPATRICK: I guess we're used to

it because --

CHAIRMAN CORRADINI: Don't answer that question.

(Laughter)

CHAIRMAN CORRADINI: No, I'm joking.

MR. FITZPATRICK: But it is cumbersome.

MEMBER BLEY: It's almost redundant, and yet each section has a little bit that's different from the others. So keeping track of that seems tricky.

Anyway, go ahead, Bob.

MR. FITZPATRICK: Okay. So, the second bullet on this slide, the classification of electrical loads dictate the classification of that power source. This is an important element along the way because when they say they're not going to have any safety-related loads of AC power, then that means they're not going to have a Class 1E AC power system. And the same with the DC.

So, I wouldn't say that's a 100 percent driver for the outcome, but it's certainly a big factor in what we do and how we react to what their design ultimately turns out to be. And again, I've already stated that the ultimately acceptability is really we won't know that until near the end. So

that makes it a little more difficult as well.

Section 8.1, the introduction. This pretty much provides an executive summary of what's going on in the rest of the chapters. Unfortunately, none of the reviewers are executives, so this really doesn't help us a whole lot in the review itself, but it was there -- put in there from the beginning and we deal with it.

The main reason we have 8.1 is the table 8-1, and that's where we outline the acceptance criteria on guidelines for all the electrical power systems throughout the rest of the sub-chapters. And I'll try hit some of the table 8-1 things we've done as we go through the rest of the --

MEMBER BLEY: Yes, the 8.1's kind of a minimally informative table, but it does show where the acceptance criteria are and where the guidelines are. Is this used as like a checklist as I'm a reviewer to make sure I find all of those?

MR. FITZPATRICK: Yes.

MEMBER BLEY: Okay.

MR. FITZPATRICK: Yes.

CHAIRMAN CORRADINI: Can I ask a different question about the table, if I can find my question? So at this point that table is on the one

hand and on the other. In other words, in some sense it's not -- I don't want to use the word "consistent," but it's meant to be all inclusive, so just in case they go one direction, it helps the reviewer. And just in case they go the other direction, it helps the reviewer. Have I read this right?

MR. FITZPATRICK: That's pretty much the case, yes.

CHAIRMAN CORRADINI: Okay. Fine. Because I looked and I thought, good God, it was just -- I didn't mean it like that.

MR. FITZPATRICK: Right.

CHAIRMAN CORRADINI: I just meant if I were in your shoes, I wouldn't know what to do with it. It looks --

MR. FITZPATRICK: Right.

JUDGE KENNEDY: -- so inclusive as to be -- well, "confusing" I guess the word that comes to my mind.

MR. FITZPATRICK: We did do a trim on some of the items in there that we figured just will not apply --

CHAIRMAN CORRADINI: Okay.

MR. FITZPATRICK: -- to the passive

design, but a lot of it's been retained because -- I'm not sure.

Next page. Off site power. I think the biggest thing to talk about with offsite power in the design philosophy is that they will request -- they've told us they will request a partial exemption to GDC 17. And the request will seek approval for zero credited offsite power circuits. And as you know, GDC 17 states that there should be two offsite power circuits from the grid right down into the buses of the plant. And they want to go with zero. The AP-1000 was approved with one offsite power circuit. That's one credited circuit because it -- actually for like Vogtle they have four, four lines. So they have one that they dedicate and then they have three backups.

CHAIRMAN CORRADINI: What -- I don't remember. So what is that needed for in the AP-1000, because my question really is if they had one, what would they do with it? In this design, if it stays the way it is, there's nothing to do with it.

MR. FITZPATRICK: Well, this design as well as all the others we expect that offsite power will be the power that actually runs everything in the plant. That's steady state power operation

right down to not utilizing the batteries, but running off of --

CHAIRMAN CORRADINI: Oh, okay.

MR. FITZPATRICK: So it will be the power source. We don't expect that to be different.

MEMBER BLEY: And if that's true, if you ever have an event, you have to shift to some other power supply.

CHAIRMAN CORRADINI: But I guess -- okay. So, all right. I guess I misinterpreted. So your point is if they're down, it's shutdown conditions, this is their power source for all their auxiliaries?

MR. FITZPATRICK: Yes.

CHAIRMAN CORRADINI: So you've yet to inquire with NuScale why they need zero?

MR. FITZPATRICK: Well, I --

CHAIRMAN CORRADINI: I'm struggling to understand that -- they do get to shutdown mode, so they might need something.

MR. FITZPATRICK: Right. I interpret this as basically -- well, the same interpretation I gave personally to the AP-1000. It's a marketing tool. There's no real technical necessity to not have -- that they can do off these lines. This is a

power generating facility, and so it's going to have lines anyway that come into the plant, but the same lines go back out again. And to have less than two is economic suicide because if you lose the single line, you've lost the entire plant. So on practicality basis there is a --

CHAIRMAN CORRADINI: Okay. I understand.

MR. FITZPATRICK: But in terms of actually requiring something to be there, that's where we are. And what the staff -- recently in response to a gap analysis that -- presented by NuScale we sent a letter to NuScale on 9/15, so a week, two weeks ago, telling them two things: Currently there's insufficient information to do much of anything and make any kind of judgment on almost anything in the plant. And the second one, the one that I actually quote on the screen here is that NRC staff believes that given considerations for defense-in-depth one offsite power circuit should be available. So, we've already given them a heads up. We'll listen, but that's where we stand at the moment.

MEMBER SCHULTZ: Bob, is zero credited offsite power circuits the NuScale terminology?

MR. FITZPATRICK: No.

MEMBER SCHULTZ: It is not?

MR. FITZPATRICK: No.

MEMBER SCHULTZ: It's what you're --

MR. FITZPATRICK: Right, what I'm calling it.

MEMBER SCHULTZ: What you're calling it?

MR. FITZPATRICK: Right.

CHAIRMAN CORRADINI: So there's a level of reliability that's required to go from zero to one that they wouldn't have given what you know to be the design? What I'm trying to say is they're going to have what -- when you were explaining it to me, they're going to have this anyway, multiple lines.

MR. FITZPATRICK: Yes.

CHAIRMAN CORRADINI: It's just they're not dedicated or reliable based on some sort of QA requirement to be counted upon. That's what I interpret what you were saying.

MR. FITZPATRICK: Well, there's not a whole lot of QA requirement on an offsite power line. Basically it would keep offsite power lines out of the tech -- those lines out of the tech specs.

CHAIRMAN CORRADINI: Yes, okay.

MEMBER SCHULTZ: So is it fair to say then that you could approve zero credited offsite power circuits, but you want to be sure that one offsite power circuit is in fact reliably available?

MR. FITZPATRICK: I think that's a fair characterization.

MEMBER SCHULTZ: Good. Thanks.

CHAIRMAN CORRADINI: Say that characterization again?

MEMBER SCHULTZ: That zero credited offsite power circuits could be approved, zero credited, but one offsite power circuit --

CHAIRMAN CORRADINI: Will be there?

MEMBER SCHULTZ: -- should be reliably available.

CHAIRMAN CORRADINI: Reliably available.

MEMBER SKILLMAN: Well, let me push back on that. I can understand the marketing strategy here. I believe you're accurate, Bob. It's suicide. But they're saying we want to be a ship. We want to be able to site this thing in Caribou, Maine or in Hudson Bay or in the Arctic or in the Antarctic, and there aren't going to be any other power lines. We are it.

CHAIRMAN CORRADINI: Just be a power supply, yes.

MEMBER SKILLMAN: Bingo. We're a ship. The *Sturgis*. The *Savannah*.

CHAIRMAN CORRADINI: He always goes back to the same ship. He can't stop.

(Laughter)

MEMBER SKILLMAN: Well, pick any ship.

(Simultaneous speaking)

MEMBER POWERS: -- for years because it's a totally filled concept and they've given up on it.

(Laughter)

MEMBER SKILLMAN: Yes, economically that's accurate. It was very successful. But that's what they're campaigning for here, I think. And you get 12 of these things in a big box, I think sticking with General Design Criteria 17, no exemptions, makes a whole lot of sense. I mean, I think there's a reason that the industry has complied with 17, and it's served us well.

MEMBER BLEY: Well, yes, but every plant we've got out there and where it came from were plants that absolutely have to have electric power.

MEMBER SKILLMAN: Well, and I'm not so

sure that this plant --

CHAIRMAN CORRADINI: That's up to them to prove. So that's where we're -- we're back to the discussion that Dick wasn't at in Oregon, which was that --

MEMBER SKILLMAN: At least you need to see it.

CHAIRMAN CORRADINI: -- unless they prove this design is X in terms of safety and reliability, your point is well taken.

MEMBER SKILLMAN: That's my point. I think you're saying --

MR. FITZPATRICK: Right. My response to that would be if they come with a COL, then we'll review that for the DCD.

MR. CRANSTON: But going along with what you're discussing --

MR. FITZPATRICK: They're going to do that as a land-based unit in the middle of here.

MR. CRANSTON: Going along with what you're discussing, this is not something they've officially put in -- documented per se, but from the commercial standpoint some of the plants that they're considering would be located adjacent to a facility that needs to be powered all the time. And

if the whole grid goes down around that facility and now the NuScale plant is the only source of power, they want to be basically an extended island mode type plant to be able to keep that facility up and running because of --

MEMBER BLEY: Like a major chemical plant or something like that?

MR. CRANSTON: Something like that, yes.

CHAIRMAN CORRADINI: This would be their dedicated --

MR. CRANSTON: So then they would essentially be in an island mode and they're the only source of power, and they'd want to be able to do that. We haven't seen anything like that officially, but that's some of the discussions that have gone on.

MR. FITZPATRICK: But that scenario is actually design basis. I mean, all the plants -- you lose offsite power, you just react to it. It's all designed in.

MR. ZIMMERMAN: Excuse me. This is Jake Zimmerman. I'm the Chief of the Electrical Engineering Branch at NRR. I just want to reiterate what Bob said. So from a design certification standpoint we have to be careful how far we go with

the exemption that they potentially request. And we would certainly evaluate a COL application in their particular location where they want to put it and the circumstances surrounding it. It may in fact require then -- if they do want to seek a full exemption, it may require a design modification such that maybe they would need to have Class 1E emergency diesel generators as backups where they're not currently going to have Class 1E emergency diesel generators for this facility.

CHAIRMAN CORRADINI: Oh, I see.

MR. ZIMMERMAN: So we're going to have to balance that out.

CHAIRMAN CORRADINI: So can I say it back to you so I get it right? So your point is if we go with Bob's thinking process for the moment that they've got to have -- however Steve said it -- I'll say it wrong, but some sort of reliable outside line, then there may be then an ability to say that I don't need Class 1E power. But if I want to say that I can go into an island mode and an isolated thing -- and for that site and that construction you guys may say, well, to be absolutely positively sure we might need a different sort of modification to the reliable onsite power.

MR. ZIMMERMAN: Yes.

CHAIRMAN CORRADINI: Is that what you're getting --

MR. ZIMMERMAN: Yes, based on the land use, the history and some of the applications they're talking about, it appears that it will be acceptable to only have one offsite source. But the devil's in the details, and that may very well be. And that's something they're going to have to consider and I'm sure we'll be talking about.

MS. BANERJEE: Can I ask a question?

CHAIRMAN CORRADINI: Sure.

MS. BANERJEE: This may not be a very smart question, but number of units, does that make a difference in the design of the electrical power system and whether we need offsite power or not? The smaller plant versus a bigger one?

MR. FITZPATRICK: No, not in terms of whether they'll need offsite power or not.

CHAIRMAN CORRADINI: So whether it would be 1 module or 12 modules, from your standpoint --

MR. FITZPATRICK: Right.

MEMBER BLEY: And from what we heard they don't want a design cert for anything less than a full package.

MR. FITZPATRICK: They can go to partial packages, but they're going for the full case, so to speak.

MEMBER BALLINGER: Can one power another? No?

CHAIRMAN CORRADINI: My understanding is the modules are separate. Separate turbine generator sets, separate everything. But I'm not sure if there's cross-over.

MEMBER BALLINGER: That's what I mean.

(Simultaneous speaking)

CHAIRMAN CORRADINI: Yes, but not until you hit the switch.

MEMBER BLEY: I think that's what we heard, but I don't --

CHAIRMAN CORRADINI: That's what I thought I remembered.

If you get a break, go ahead, Bob.

(Laughter)

MEMBER BALLINGER: They don't have in effect X independent power sources being the reactors themselves?

MEMBER BLEY: I have to see their exact design, but they're claiming they're most independent. They're all in the same pool.

MEMBER BALLINGER: Yes, but I think what --

MEMBER BLEY: But out past the generator they're separate.

MR. FITZPATRICK: I'm sure there are ways they could pull that back in from the switchyard, but we just don't know what they plan to do in any detail. I have yet to see a one-line diagram of the plant.

So getting back to Section 8.2 in terms of the SRP, the SRP had a reactor coolant pump discussion in terms of if the grid should decay, the frequency might be such that it would slow down the reactor coolant pumps and maybe get into some DNBR considerations. This thing has absolutely no reactor coolant pumps, and so that discussion was removed, things like that. But that's a good example of just think we've pulled out.

I would note that guidance for having a stable grid and for having protection of the onsite power system from the offsite power system, that's all retained. And we've actually added to the DSRS in table 8-1 the newly approved Branch Technical Position, BTP 8-9, Open Phase Conditions and Electric Power System.

CHAIRMAN CORRADINI: We would have asked you about that if you hadn't.

MR. FITZPATRICK: And so, on AC power there's not a lot to say here that we already haven't said. They claim there was no need for safety-related Class 1E power supplies. And our guidance includes flexibility reviewing with and without. And that's basically where we stand. And we can say the same thing for the onsite AC power system. This will be a little bit more interesting review because no one's made this claim before on the DC side, and so we'll be taking a harder look at it, but that's the way it's coming in with no Class 1E power sources.

CHAIRMAN CORRADINI: So the implication of this is they would go black and not after once -- of course they would run their batteries very efficiently to get as long -- but once that's gone, they have no instrumentation at all, that the control room would be able to see.

MR. FITZPATRICK: They intend to provide very small diesel generators to cover that.

CHAIRMAN CORRADINI: But they're not safety-related?

MR. FITZPATRICK: No, nor supposedly

would they have to be.

MEMBER BLEY: And they would just supply UPS, is that right?

MR. FITZPATRICK: Right. Right, and that would take care of the instrumentation, HVAC, if necessary, although they've spoken about passive --

(Simultaneous speaking)

CHAIRMAN CORRADINI: That's how they explained it to us when we were there.

MR. FITZPATRICK: Right, lighting, communications. And it's probably going to be for all 12 modules because it's kind of -- all that's centered in the control room, but they're not going to be big.

CHAIRMAN CORRADINI: So just say it again. At least the version you've seen so far is they would have an non-safety diesel to continue to power instruments.

MR. FITZPATRICK: The DC bus.

CHAIRMAN CORRADINI: DC bus? And therefore provide --

MR. FITZPATRICK: Expect to see two diesels, one for each of the two DC buses that are -- but again, they would claim it to be not in Class

1E. 8.4 on station blackout --

MEMBER SKILLMAN: Bob, what method -- is this a situation where the staff is so rigidly connected to the SRMs and other documentation that they're paralyzed from challenging nonsense? I don't mean that unkindly.

CHAIRMAN CORRADINI: What did you say, though? I didn't hear what you said.

MEMBER SKILLMAN: In these passive designs it seems like it's possible to get so tied up in the web of regulation that there's no opportunity to say, stop, this doesn't meet the Snickers test. There's something wrong. Would you really design a plant that has 12 modules, each of which could be doing something differently because each core, my view, has a different personality? And you have a colossal blackout and you accept the idea that you can have a little Evinrude with a small Home Depot generator giving you a couple of lights and a couple indications, and that's plenty okay.

In my view there's something that's baffling about being willing to accept that. We ought to be saying, wait a minute, you're not going to run 12 of these modules with the power levels

that the aggregate can create and not have at least some modicum of compliance with backup instrumentation, lighting, ventilation, access to the power supplies that might be available somewhere else. If there's this overriding philosophy it's a passive plant that doesn't need any of the standard equipment that we've learned is important over the last five decades, six decades, then I say to myself what are we doing here? We ought to be saying, now wait a --

CHAIRMAN CORRADINI: So just to turn to be the NuScale proponent, AP-1000 with one dedicated outside AC line is essentially that at 3,400 --

(Simultaneous speaking)

MEMBER BLEY: Well, wait a minute. Wait a minute. The system Dick put forward is one nobody would buy into. Don't forget RTNS. We might not be happy with the way RTNS has been handled so far, but nobody's really handled it yet, because we haven't gotten that far, and we've been tracking that. But all of this stuff that's non-safety in the long term has to meet -- that you need in the long term has to meet the RTNS requirements. You have that somewhere in these documents.

MR. FITZPATRICK: Yes.

MEMBER BLEY: I saw it. And that's kind of like a tech spec, but it's not. So it has to have some pedigree to it. And the amount of that depends on how important it is.

Now, I agree with you. I'd sure want to be able to see what was going on and a few other things like that, but I don't think that necessarily has to be with 1E, and it's been done with this other kind of stuff in other designs. But it can't just be something you go down to the hardware store and by either.

CHAIRMAN CORRADINI: Yes, it can't be an Evinrude, I guess. But on the other hand, it doesn't have to be safety-related. I mean, again I'm remembering -- I could be remembering it incorrectly for the ESBWR and the AP-1000, but with the dedicated line they have shown that for the first three -- back to the three days, for the three days they can sit there and essentially remove decay heat. Now, in their case they're so big they have to come back with some sort of AC non-safety after three days to take now where they are in terms of pressures and temperatures down to a cold shutdown, but for those three days they're sitting there totally on passive thing. I'm just fighting back a

little bit, very politely.

MEMBER SKILLMAN: That's fair enough.

MEMBER BLEY: And I don't quite know, and I don't remember what you have in here on it, what the requirements on the batteries are going to be. They're surely not going to last for 72 hours, I don't expect.

MR. FITZPATRICK: Yes, they're going to have a bank of 24 and one of 72.

MEMBER BLEY: There are going to have one that lasts 72 for instrumentation and --

MR. FITZPATRICK: Right.

MEMBER BLEY: -- things like that. Okay. I didn't remember that.

CHAIRMAN CORRADINI: Because if -- again I'm pretty sure that Dennis and John were here when we were arguing about the worry about overheating of the batteries because they were in the control room and what the ventilation was. So all this kind of ties together. So what you're saying is not -- I'm not dismissing it. It's just that --

MEMBER BLEY: Oh, yes, absolutely.

CHAIRMAN CORRADINI: -- it's going to have to be looked at, because for at least the ESBWR there was a big discussion about the extreme weather

conditions. You have to show that all these things would function for the three days.

MEMBER SCHULTZ: Well, from what you've described, Bob, and what is in here in the draft -- well, in the current version is that you've got the opportunity for both approaches. You weave that in because you don't know that the case is going to be made that it can be done without, not having seen the comments coming back from NuScale. I would have expected that they might push back on that approach here. We shall see, but the option is here that if you can't make the case, then it's with a Class 1E onsite DC.

MEMBER SKILLMAN: Yes, Steve, I looked at the comments. There are about 350 pages of comments, and the Chapter 8 comments pick up at page 162 and run to 204. And NuScale definitely did push back. I mean, they're definitely heading towards this idea we are passive, passive, passive and we don't got to do any of that stuff. And I guess I'm expressing my own personal frustration at that, at maybe being forced to buy that at this point, because I'm not buying it.

It seems to me we learned a lot of stuff in the past number of decades, and at the end of the

day you've got to be able to breathe, you've got to be able to see and you've got to be able to understand what each core is doing. And what we learned at TMI is when the lights go out, things really get scary. You've got to know what the core is doing and you've got to know is it -- either cooling it yourself or being cooled, either actively or passively.

And so, it seems that there are a couple of things we've learned and they are foundation posts that have kept us safe for a long time.

MR. FITZPATRICK: And it was the same at Fukushima.

MEMBER SKILLMAN: Yes, and we ought not to be carried away with this idea of full passive. So first of all, I'm comfortable that you've woven into the proposed changes the ability to require active, but I think you're right, until we see the accident analysis and understand how the pieces fit, this game's not over. We don't know what this design really looks like.

MR. FITZPATRICK: That's right. And in defense of the branch, again the quality of the loads are determined by others, and then we make sure they get a power supply to go with it. So from

our perspective we're on board with you.

MEMBER SKILLMAN: So, I'm sorry for having a wild hair, but I --

MEMBER BLEY: No, no, that was good.

MEMBER SKILLMAN: -- just remember losing the lights at TMI about three days in and we said what do we do now?

MEMBER BLEY: I've been places with the lights out. It's confusing.

MEMBER SKILLMAN: It's really scary.

MEMBER BLEY: Bob, I have a couple particular questions, specific questions. And I think you answered this one, but I just want to be sure. On the second page of this DSRS you had that sentence about if additional guidance is needed, the reviewer is directed to the mPower DSRS. That's going away, right?

MR. FITZPATRICK: Yes.

(Laughter)

MEMBER BLEY: Just want to be sure.

MR. FITZPATRICK: Yes.

MEMBER BLEY: Then a couple of pages later on technical rationale there's a -- No. 1 paragraph talks about GDC 17 and some things. And then it has a second paragraph, which to me is an

oxymoron. I think you really mean something different. It says, "Meeting the independence and capacity capability requirements of GDC 17 provides assurance that a reliable electric power supply will be provided to fully respond to an SBO." If you have an SBO, your system is no longer reliable. I think what you're trying to say is reduce the likelihood of an SBO and maybe have ways to recover.

MR. FITZPATRICK: Yes.

MEMBER BLEY: But we've moved out of the realm of a reliable electrical power system at that point.

MR. FITZPATRICK: That's a good point.

MEMBER BLEY: Seems to me.

MR. FITZPATRICK: Thank you.

MEMBER BLEY: Yes, that one I liked. Somebody here covered some of these other questions I had already with they need to prove these things.

Ron, you did talk about this on the batteries. The one on the equipment will be considered acceptable for SBO temperature environments if an assessment has been performed that there's reasonable assurance that necessary equipment will operate. Most of the places where they have real temperature problems in plants, when

the power goes away, the temperatures go away. Now, not everywhere, but most of the places. So I don't know if it would make sense to be a little more specific about that, or maybe that's good enough. I think people just need to understand it.

I asked that one already.

This place where I talked about redundancy as you go from those first three sections one to another, again I think it's probably no big deal, but for me who hasn't used these, you come back in the third section and find a statement that says, "specifically an IE AC power source is not necessary for passive plants." When this was already covered two sections earlier, it just seems like overkill.

MR. FITZPATRICK: Yes.

MEMBER BLEY: But maybe you need it, because it's a different section that's now on how you do the review.

And that same section has a Part 10 that talks about the reviewer should determine the plant operating procedures to develop and respond to SBO are consistent with the following guidelines. A few of these, a couple of them seem like we were expecting more from procedures than we're likely to

get.

Plant operating procedures should consider the loss of any heat tracing that would affect equipment necessary to cope with an SBO. I guess that's true, but we ought to be considering that somewhere else, too, because if -- maybe it's okay this way, but what do you do if you don't have heat tracing? It depends on the system and what the heat tracing is there for. If it's there to keep something from freezing -- I think that's probably not true here because everything is all inside. We don't have a yard with all those tanks and things out there. And I don't even remember where they use heat tracing in this kind of plant. I was just wondering if that's something an operating procedure can deal with or if you need some other way to deal with that.

Plant operating procedures should identify any portable lighting necessary for ingress and egress to plant access areas. Don't usually see that in the operating procedures. You need that, but it seems an odd place to put it. We haven't had that -- I don't know of any operating procedures that have the emergency lighting stuff built into them. I could be wrong. But I'm not sure it

belongs there.

The rest of them all made sense to me. So that was it. Back to you.

MR. FITZPATRICK: Okay. For a station blackout NuScale claims that the design will maintain all safety functions without electrical power, any, relying solely on natural circulation. And here this design, I don't know, but may or may not need a 72-hour battery versus some other length, because it seems to go right into what it needs to do and just stay there.

CHAIRMAN CORRADINI: The way it was explained to us, at least in July, was they would in a station blackout mode go immediately to their DHRS system and sit there.

MEMBER BLEY: It would take them there. I mean, it would --

CHAIRMAN CORRADINI: Right, it would take them to some sort of stable state that wasn't cold shutdown, but would take them to a stable state.

MEMBER BLEY: And all the stuff about that seemed to make sense to me except -- it's not an except -- it's those few valves, two in each system have to actuate and they have to actuate in

the failed position. Were they air op valves? I've forgotten if they're air op valves. They might be solenoids. But the reliability of those is really important. And I guess it doesn't go here at all, even if they're solenoids. That's electrical. But somewhere the reliability of those and given their importance, the testing of those is going to be really crucial. And I don't think we've seen that flagged either by them

-- they just said, well, we got a redundant set, so we're okay -- nor by anything I've read so far by the staff. And I'm not sure where that needs to be picked up, but it seemed to me that was crucial.

CHAIRMAN CORRADINI: You mean that was in terms of guarantee based on testing, periodic testing?

MEMBER BLEY: Yes, because those kind of valves -- I mean, you're relying on a spring to put them back where they belong, and very often deposits and other things keep spring return valves from going where they were supposed to go.

(Simultaneous speaking)

MEMBER BALLINGER: Memory serves they're fail open.

MEMBER BLEY: They're fail open.

MEMBER BALLINGER: So, they still got to fail open.

MEMBER BLEY: Unless the operating fluid is opening them in a guaranteed way. So you really have to think about just being cocked all kinds of problems that occur in real --

(Simultaneous speaking)

CHAIRMAN CORRADINI: We did -- I'm trying to think of the staff member who we questioned on this one. This was back in August. Wasn't it back in August? It was -- well, I know who he is. I can't -- I know his --

PARTICIPANT: Are you talking about Jeff?

CHAIRMAN CORRADINI: Jeff? No, it was before Jeff. It was -- but the DHRS -- it wasn't that ECCS review. It was the DHRS review in August when we were talking about this, because that's where you had added in all the stability questions relative to coming stably to essentially this state and where we were asking what is that stasis? It's not cold shutdown. It's some intermediate pressure and temperature state.

MEMBER BLEY: But it's removing the decay heat.

CHAIRMAN CORRADINI: Correct.

MEMBER BLEY: Yes.

CHAIRMAN CORRADINI: And as you said we only need one --

MEMBER BLEY: From the electrical side the only important thing of this that I'm thinking about

-- are there any funny failure modes in which we could lose the power to the other stuff we care about and still keep power on these solenoids to keep them in the wrong position? We ought to look at that pretty hard and they ought to look at that pretty hard.

MR. FITZPATRICK: And then just the final part of this is changes to the SRP. NuScale will utilize non-safety diesels to recharge the batteries. That's something we didn't actually put in there. So in this new phase we're going through where we're going to make some changes -- were not based on their comments, the comment period. I think that should be beefed up a bit.

CHAIRMAN CORRADINI: But that is part of their design?

MR. FITZPATRICK: As far as I know.

CHAIRMAN CORRADINI: Okay. That's what

I thought they had said.

MEMBER BLEY: Have you thought any about what RTNS criteria would have to be on those kind of diesels?

MR. FITZPATRICK: No.

MEMBER BLEY: Is somebody thinking about that?

CHAIRMAN CORRADINI: They promised us -- and when we were there --

MEMBER BLEY: Well, they should be proposing it.

CHAIRMAN CORRADINI: Well, they promised a what-do-you-call-it, a technical report that was going to be -- because this goes back to the topical report you wanted to see that is the first one they released in terms of, what is it called, risk important factors.

MEMBER BLEY: Oh, yes. Yes.

CHAIRMAN CORRADINI: So we're going to get that. I think you guys just got it.

MEMBER BLEY: Yes, this should be in there.

CHAIRMAN CORRADINI: So that should be in there as to what they're going to decide as their criteria for classification, right? Isn't that

where it would be?

MEMBER BLEY: I don't know.

MR. CRANSTON: Well, we just received a --

MEMBER BLEY: I would look for it there.

MR. CRANSTON: We just received a risk -- topical report on risk, which the PRA Branch is looking at. And we are going to be getting their electrical topical report either this month or next at the latest. And again, that's another opportunity for us to see exactly where they're coming from.

CHAIRMAN CORRADINI: So when the time is right after you've scoured it, we would appreciate looking at it.

MS. BANERJEE: Well, we have the schedule, the January Subcommittee Future Plant Design --

MEMBER BLEY: Well, that's the one.

MS. BANERJEE: -- yes, to look at the risk topical report.

CHAIRMAN CORRADINI: Yes.

MEMBER BLEY: So the sooner we can see it, the better. But you'll have an SER on it or something?

MR. CRANSTON: Yes, that's correct.

MEMBER BLEY: Okay.

MS. BANERJEE: We can get the topical report at this time, right?

MR. CRANSTON: Yes, you can.

MS. BANERJEE: Okay. I'll ask for it.

MEMBER BLEY: Our risk people are excited.

MR. CRANSTON: And then we can also forward to you the electrical topical report when we receive it.

MS. BANERJEE: Okay. Thank you.

MR. FITZPATRICK: But to answer your question, to date we haven't put a lot of thought into any of that.

MEMBER BLEY: Okay.

MR. FITZPATRICK: Until we get something concrete --

MEMBER BLEY: Well, you don't have a design yet, do you?

MR. FITZPATRICK: No. So we can fantasize about it, but --

(Laughter)

MR. FITZPATRICK: And then the other thing is that they will not have an alternating C

power supply. So if we haven't called out all of that, we'll call out whatever is left that talks about that. And with that, I've tried to highlight the novel aspects of the NuScale electrical power systems design. And as we've discussed all through this, we've tried to retain the flexibility in the VRS to accommodate the design review, but we don't really know what's coming. Thank you.

CHAIRMAN CORRADINI: Thank you. So questions from the Committee?

MEMBER BLEY: Well, you've got their comments. Have you given any thought to how you're responding to those? I guess I'm in Dick's court on this. I'd sure not like to see you cut a lot of stuff out of this DSRS, but for -- we have the design before us that people have looked at and really understood. So I like the idea you have in there of flexibility and looking at this, depending on what the actual design looks like.

MR. FITZPATRICK: Well, we can certainly take that under advisement and maybe that leave that in. Less work to do.

MR. CRANSTON: I have a general comment that we consider in conjunction with the DSRSs and

why we established them. I know I've mentioned that we're considering maybe moving some back to SRPs, and it sounded appropriate. But the advantage of the Design Specific Review Standard is it does have the flexibility of being revised quicker than if we had to go through the whole revision process for a standard review plan, which can affect a lot of other power plants.

CHAIRMAN CORRADINI: So keeping it in the DSRSs gives you flexibility?

MR. CRANSTON: That's correct, because we can focus on NuScale. And as things -- as we learn more or if something changes, we can accommodate it more rapidly.

CHAIRMAN CORRADINI: Which should help the review schedule.

MR. CRANSTON: That's correct. But schedule is not our primary goal. We want to find the best place for the information and make sure we review the plant properly.

CHAIRMAN CORRADINI: I guess my only -- since I've never reviewed any of this stuff and it confuses the heck out of me when I read these documents, is I don't really care about anything other than that the reviewers aren't confused, so

that they understand what is appropriate to look at and kind of mull over as they're looking at how the design evolves. Because the design is going to evolve. I can't imagine it doesn't. It did with the other plants, the other passive plants.

MEMBER SCHULTZ: Greg, I think you're right on target. I think I understand the pullback to say, well, the SRP is just fine for this, but I think that needs -- if that is indeed the case, it needs to be established very carefully so that it's not a situation that you've just described or that in fact there are some subtle differences that should be captured in a DSRS so that for the purposes you've indicated it is a good move forward in a better fashion. You've got the right reference. You have the basis, very clear basis upon which the approval was made. You don't have to continuously document the differences or the additions that come from the standard review plan. I think you're on the right track.

MR. CRANSTON: Thank you.

CHAIRMAN CORRADINI: We're going to go around the table for the Subcommittee, but this is a time for public comments. Apparently, I'm going to ask if there's somebody from the public that wants

to make a statement in the room.

Otherwise, I'm going to ask the staff to please turn on the outside lines -- or un-mute it, I should say, so that if there's a public comment on our telephone line, we can receive it and record it. I'm looking forward to the crackling. A-ha.

So if anybody's out in the phone line could you please acknowledge your presence by anything at all?

MEMBER POWERS: You don't have the best selling Subcommittee.

CHAIRMAN CORRADINI: Yes, I don't have a popular Subcommittee.

So, why don't we close the phone line? Okay.

So, I'm going to turn -- we'll go this way this time. We're right-handed today. So, I'll go with Dr. Ballinger first.

MEMBER POWERS: Intrigued.

CHAIRMAN CORRADINI: But Zach knows that and will use that intrigue to help him.

MEMBER POWERS: I'm independent.

CHAIRMAN CORRADINI: Dick?

MEMBER SKILLMAN: Yes, just thank you

for the presentation. Let's keep the DSRSs flexible until we know what this design looks like, because it could be at the 11th hour we say enough's enough. We really want 1E power, a moderate amount, AC and we want 1E DC, 120 and 240, because we've learned those are very important.

MEMBER POWERS: We want a lot.

MEMBER SKILLMAN: We want enough to carry the day. So let's keep these open and flexible until we really understand the design. Thank you.

MEMBER SCHULTZ: I agree on all accounts. Thank you for the presentations. And as I just said, I agree with the approach related to DSRS and the approaches that have been taken to maintain the options open until the design is well understood.

CHAIRMAN CORRADINI: Dennis?

MEMBER BLEY: I agree with my colleagues. I think you've done a good job on this. If I had to use these -- any of the SRP, not just this DSRS, I would be so consumed in checking all those boxes from the sections and making sure I got everything right. I wonder if I'd have the time to sit back and ask those big questions and say does

this whole thing make sense now? And I hope we have a way to make sure our reviewers keep that as a big focus as you do this review, because that's where we're going to find the problems, not in all the little details. But we've got to meet those criteria.

CHAIRMAN CORRADINI: Okay. Thanks to the staff. I know that we've been having side meetings so that we can organize this is an understandable fashion, so I appreciate all their flexibility.

As I understand it, assuming we are around in two weeks, we will see each other talking about Section 6 -- well, yes, I'm sorry, Section 6.2 in all its glory on Wednesday the 7th. So that's our next planned get together.

And other than that; I'll say this to the Subcommittee, you guys can react, I still don't see anything here that rises to the need for a letter. I see a lot of logistical changes in the DSRS about making sure mPower is excised appropriately and the right pointers to the right places, but other than that, I still don't see -- and you have copies of all our minutes from the meetings; this will be our third meeting, and we've

tried to with that and the transcript at least identify things that we're kind of thinking about. But I don't think at least at this point to me; you guys jump in, nothing rises to the point that we are going to write you a letter about what we're thinking. It's all about just mulling over these things so we get a better understanding.

MEMBER BLEY: I agree with you.

CHAIRMAN CORRADINI: Okay. So with that, thank you all and I guess we'll see you all in two weeks, fingers crossed. I'm not sure what side of that coin you're on, but adjourned.

(Whereupon, the above-entitled matter went off the record at 10:09 a.m.)

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

ACRS Presentation on the NuScale Design Specific Review Standard (DSRS) Sections 11.1, 8.1, 8.2, 8.3.1, 8.3.2, and 8.4

Gregory Cranston,
Sr. Project Manager
Office of New Reactors
September 24, 2015

NuScale DSRS Briefings to the ACRS Subcommittee on Future Reactors

- Third in series of meetings on selected draft DSRS sections
- Comments received and being processed
- Opportunity for updates during comment incorporation
- Some DSRS sections may revert back to SRP sections

NuScale DSRS Briefings to the ACRS Subcommittee on Future Reactors

- Purpose: provide ACRS with approach staff took developing selected DSRS sections
- During the course of these presentations staff will cover:
  - What changed SRP to draft DSRS
  - Why change made (new system, elimination of system, significant design difference, etc.)
  - Questions based on the design information available to date

The Status of the NuScale DSRS

- Draft NuScale DSRS issued for public comment on 6/30/2015
- Public comment period closed on 8/29/2015
- Comments being processed and sent to staff for disposition
- Schedule for issuing Final DSRS based on magnitude and complexity of comments and DCA submittal date

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

NuScale DSRS 11.1 Coolant Source Terms

by
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September 24, 2015

DSRS 11.1 Coolant Source Terms

- Current DSRS is based on Design Information provided in late 2013
- DSRS 11.1 acknowledges that current PWR-GALE is not applicable
- NuScale is submitting a Topical Report on source term development based on an independent GALE code.

DSRS 11.1 Coolant Source Terms PWR-GALE Applicability

- While PWR-GALE is not applicable, elements of its guidance are still relevant.
  - Use of ORIGEN and SCALE is relevant since common PWR fuel is used.
  - Operating experience in estimating coolant activity is still relevant.
  - Operating history in characterizing fuel performance is still relevant.
  - Reliance of current waste processing systems to manage waste is still relevant.

DSRS 11.1 Coolant Source Terms Potential Unique Design Elements

- Integrated PWR design
  - Reactor components are contained within the same vessel and are surrounded by an evacuated reactor containment vessel.
  - Activation of feedwater nozzles near top of core
- Radiological control of secondary coolant
  - Currently does not utilize a traditional steam generator blowdown and treatment system
    - Require information on assumed Steam Generator Tube Failure Rates
    - Require information on assumed Primary to Secondary leakage rates

DSRS 11.1 Coolant Source Terms Potential Unique Design Elements (cont.)

- Multi-module reactors located in a common reactor pool that is also used for spent fuel storage
  - Require information on maintaining reactor pool water quality
  - Potential uniqueness with maintaining radioactivity levels in the reactor pool water
- Large volume of reactor pool water that is potentially subject to neutron activation
  - Potential production of H-3, C-14, N-16, and Ar-41
  - Require information on the performance of HEPA filters and charcoal absorbers.

PRESENTATION TO THE ACRS September 24,2015

NuScale Design-Specific Review Standard (DSRS) Chapter 8 “Electrical Power Systems”

Bob Fitzpatrick
NRR/DE/EEEB

AGENDA

- Introduction
- DSRS Section 8.1 Introduction
- DSRS Section 8.2 Offsite Power
- DSRS Section 8.3.1 Onsite AC Power
- DSRS Section 8.3.2 Onsite DC Power
- DSRS Section 8.4 Station Blackout
- Summary

INTRODUCTION

Purpose:

- Present highlights of the NuScale design philosophy
- Present changes to the SRP

INTRODUCTION (2)

Highlight the following items:

- We have not received the detailed design.
- The classification of electrical loads dictate the classification of their power source.
- We will not know the ultimate acceptability of not having a Class 1E power system until the overall staff review is essentially completed.

Section 8.1: “Introduction”

- Provides executive summary
- Serves as a repository of acceptance criteria (Table 8-1 “Acceptance Criteria and Guidelines for Electrical Power Systems.”)
- Ensuing chapter sections: characterize changes to Table 8-1.

Section 8.2: “Offsite Power”

NuScale Design Philosophy:

- NuScale will request a partial exemption to GDC 17.
- Request will seek approval for zero credited offsite power circuits.
- Staff Letter to NuScale (9/15/2015): currently insufficient information. “…NRC staff believes that given considerations for defense-in-depth, one offsite power circuit… should be available.”

Section 8.2: “Offsite Power” (2)

Changes to the SRP:

- Reactor coolant pump discussion removed
- Guidance for having a stable grid and for having protection of the onsite power system from the offsite power system retained.
- One addition to the DSRS (and Table 8-1) is newly-approved Branch Technical Position (BTP) 8-9 “Open Phase Conditions in Electric Power System.”

Section 8.3.1: “Onsite AC Power”

NuScale Design Philosophy:

- NuScale claims there is no need for safety-related (Class 1E) AC power supplies.

Changes to the SRP:

- Guidance includes flexibility for reviewing with/without a Class 1E onsite AC power system

Section 8.3.2: “Onsite DC Power”

NuScale Design Philosophy:

- NuScale claims that no Class 1E DC power supplies are required.

Changes to the SRP:

- Guidance includes flexibility for reviewing with/without a Class 1E onsite DC power system.

Section 8.4: “Station Blackout”

NuScale Design Philosophy:

- NuScale claims design will maintain all safety functions without electrical power
- Relying solely on natural circulation

Changes to the SRP:

- Clarifications:
- NuScale will utilize non-safety diesel generators to recharge the batteries (to be added)
- Will not use Alternate AC power supplies (to be deleted)

SUMMARY

- We have highlighted novel aspects of the NuScale electrical power systems design.
- We have retained flexibility in the DSRS guidance to accommodate the design review.

Closing Remarks

Comments or Questions?