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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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KAIROS POWER LICENSING SUBCOMMITTEE

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THURSDAY

SEPTEMBER 24, 2020

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The Subcommittee met via Videoconference, at 2:00 p.m. EDT, Dave Petti, Chairman, presiding.

COMMITTEE MEMBERS:

DAVE PETTI, Chairman

RON BALLINGER, Member

CHARLIE BROWN, Member

VESNA DIMITRIJEVIC, Member

WALT KIRCHNER, Member

JOSE MARCH-LEUBA, Member

JOY REMPE, Member

PETE RICCARDELLA, Member

MATT SUNSERI, Member

ACRS CONSULTANTS:

MICHAEL CORRADINI

STEPHEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

WEIDONG WANG

NRC STAFF PRESENT:

ANTONIO BARRETT, NRR/DANU/UART

BEN BEASLEY, NRR/DANU/UARL

THOMAS DASHIELL, ACRS/PMDA

STU MAGRUDER, NRR/DANU/UARL

SCOTT MOORE, ACRS

DEREK WIDMAYER, ACRS/TSB

ALSO PRESENT:

JORDAN HAGAMAN, Kairos Power

DREW PEEBLES, Kairos Power

C-O-N-T-E-N-T-S

P R O C E E D I N G S

(2:00 p.m.)

CHAIRMAN PETTI: The meeting will now come to order. This is a meeting of the Kairos Power Licensing Subcommittee of the Advisory Committee on Reactor Safeguards. I'm David Petti, chairman of today's subcommittee meeting.

ACRS members in attendance are Charles Brown, Jose March-Leuba, Joy Rempe, Matt Sunseri, Pete Riccardella, Ron Ballinger, Walt Kirchner, and Vesna Dimitrijevic. Consultant Mike Corradini and --- I didn't see Steve Schultz but he may be on. Weidong Wang of the ACRS is the Designated Federal Official for the meeting.

During today's meeting, the subcommittee will review Kairos Power's topical report KP-FHR Risk-informed Performance-Based Licensing Basis Development Methodology, Revision 1. The subcommittee will hear presentations from Kairos Power representatives and the NRC staff and any other interested persons regarding this matter. The rules for participation in all ACRS meetings, including today's, were announced in the Federal Register in June, 2019. The ACRS section of the U.S. NRC public website provides our charter bylaws, agendas, letter reports, and full

transcripts of all full and subcommittee meetings including slides presented there. The meeting notice and agenda for this meeting are also posted there.

We've received no written statements or requests to make an oral statement from the public. However, today's meeting is open to public attendance and we have a public line.

The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full committee. A transcript of the meeting is being kept and made available as stated in the Federal Register. I ask that all participants identify themselves and speak with sufficient clarity and volume so that they may be readily heard. Presenters should speak slowly and tell the listeners what slide they are on to ensure an efficient virtual meeting.

We will now proceed with the meeting and I'd like to start by calling up NRR staff.

MR. BEASLEY: Thank you. This is Ben Beasley. I'm the branch chief for the Advanced Reactor Licensing Branch. Good Afternoon. It is good to meet with you today. The staff is looking forward to our discussions and to receive feedback from ACRS

members today on the draft safety evaluation for the Kairos Power topical report on a Risk-Informed Performance-Based Licensing Basis Development Methodology. As you will hear, this topical report describes Kairos' methodology for implementing the industry-developed Licensing Modernization Project which we will refer to in shorthand as LMP.

This meeting is the second time that the staff in Kairos Power have had the opportunity to brief the ACRS on Kairos Power topical reports. The first meeting was held in February of this year, and the staff appreciated the helpful comments from the ACRS on the reactor coolant and the scaling methodology topical reports.

We do look forward to working with Chairman Petti and the rest of the members and staff over the next several years as we complete reviews of more Kairos Power topical reports and prepare for license applications with the Kairos Power design. I also want to make sure I thank the technical staff from the Advanced Reactor technical branch for their good work producing a high quality safety evaluation. And I also want to note that the working relationship between the staff and Kairos was excellent, and this review was completed without the need for RAIs,

Requests for Additional Information.

So with that, I think I may turn it over to Stu Magruder.

MR. MAGRUDER: Thanks, Ben. I don't have any comments now. I think I will --- let me introduce myself I guess. This is Stu Magruder. I'm the lead project manager for Kairos for the NRC. And I don't want to add anything now. I'll have an introduction when the staff makes its presentation on our review of the topical, so I guess I'll turn it over to Kairos now.

MR. PEEBLES: Alright, thank you, Stu. And good afternoon, everyone, my name is Drew Peebles, I'm the manager of safety integration at Kairos Power. We're here today to give you some background information on our topical report titled Risk-Informed Performance-Based Licensing Basis Development Methodology. We submitted this topical to the NRC in August of last year and just recently received their draft safety evaluation report.

Before we get started I would like to thank the ACRS members for their time and interest in Kairos Power. As Ben mentioned, this is our second time before the committee to present on our topical reports, and we look forward to future interactions on

our licensing submittals.

I'm here today with Jordan Hagaman, our manager of reliability engineering, who will also be presenting. Also from the reliability engineering team are Matt Denman and Matt Warner. We are also joined by Peter Hastings, our vice president of regulatory affairs and quality, Darrel Gardner, our senior director of licensing, and Nicole Schlichting, a licensing engineer. I would also like to thank the NRC staff for their thorough and efficient review of the topical.

So with that, we are ready to get into the presentation, if that is good, Chairman Petti.

CHAIRMAN PETTI: Go ahead.

MR. PEEBLES: So Kairos Power is a mission driven company, so we like to begin all of our presentations with our mission statement, which is to enable the world's transition to clean energy, with the ultimate goal of dramatically improving people's quality of life while protecting the environment.

The methodology in this topical report is an important step in achieving this mission. The methods that we are leveraging from the LMP provide us with a systematic methodology to create a cohesive and robust safety case for our technology.

So a quick look at the agenda. We just completed introductions and opening remarks. Next, I will provide a quick background on where the content of the topical comes from as well as our justification for creating the topical rather than just utilizing NEI 18-04 as-is. And then I will hand it over to Jordan, who will walk us through a more detailed comparison between the NEI document and our topical, which is KP-TR-009-NP.

So the methodology presented in the Kairos topical replicates most of the guidance developed by the Industry-Lead Licensing Modernization Project, or LMP, which was formed to help modernize the licensing framework for advanced non-light water reactor technologies. The methodology in our topical is not new to the ACRS, so I won't spend a lot of time on the background, but I would like to quickly point out the documents that precede our topical.

The LMP team produced several white papers that were reviewed by the ACRS, including the selection of licensing basis events, the probabilistic risk assessment approach, a safety classification and performance criteria for structures, systems, and components, and a risk-informed and performance-based evaluation of Defense In-Depth adequacy.

The LMP team sought NRC endorsement of this guidance, so they integrated the content from the white papers into a single guidance document, which is NEI 18-04, and that's titled Risk Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Basis Development. The ACRS also reviewed this report, and the NRC ultimately endorsed the guidance in Reg Guide 1.233.

So that brings us to the Kairos topical. The endorsed guidance in NEI 18-04 is replicated in our topical report. We could use the NEI 18-04 document in an application, but since this is a new methodology, there were some clarifications and minor changes that are specific to Kairos strategies that we wanted to make, and we wanted early agreement with the NRC on those changes. The Kairos licensing strategy is all about reducing programmatic risk as early in the process as possible. So our motivation for recreating the guidance was not to develop a new method, but rather to point out some differences that bring it in line with our licensing strategy, so that we get that up front agreement with the NRC staff on those points instead of waiting until we submit an application.

So the rest of the presentation is going

to go through those differences and why we felt we needed to make them. Before I hand it over to Jordan to go over those differences, I'll reiterate the regulatory ask from the topical, which is that after reviewing the deltas between our report and NEI 18-04, that the NRC would still consider this methodology an adequate means to define and evaluate our licensing basis events to get the safety classification for our SSCs and assess Defense In-Depth adequacy for our technology.

So I'll pause there before I hand it over to Jordan and see if there are any questions.

MEMBER REMPE: Drew, this is Joy. When I was looking through your report, I was interested in the information on page 29. Where are you --- you talk about you're going to have an additional event list of LBEs, and then of course you will have the design maturing and the level of detail the PRA would become more expanded. Where are you in the process? Are you going to have additional clarifications later on for this topical report, or you think you are far enough in the process that you don't need to make any additional changes?

MR. PEEBLES: We're still early in the process. We did perform a pilot of the LMP process

with the southern team as part of the LMP efforts when they were creating NEI 18-04. So we think we have a good idea of how we are going to implement it. But that should be in future licensing interactions.

MEMBER REMPE: Thank you.

MR. PEEBLES: All right, so with that background in mind, I'll hand the presentation over to Jordan and he'll go over a more detailed comparison of our topical and NEI 18-04.

MR. HAGAMAN: Thank you, Drew. The Kairos Power's topical report replicates the methodology in NEI 18-04, but there are some key underlying differences that will be reflected in the presentation of this comparison. One of the observations is that NEI 18-04 has language that's aimed at two separate audiences. It's aimed at both the developers that need to stand up design processes to iterate between design and analysis for a particular reactor technology. And the second audience (audio interference) will review the design of the final safety case. That's NEI 18-04.

For our topical report, we have just one purpose: to develop a common expectation with the regulator on how a complete presentation of the final design and the final safety case that'll look like for

the KP-FHR. So a lot of the changes in content and the content that didn't get ported over to our topical report is based on this important distinction. KP-TR-009 was written to mirror the structure and the content of NEI 18-04 as closely as possible so that it's easy to conclude that the methodology is the same with minor changes. So this presentation will describe where the documents are similar and highlight where applicant-specific deviations were necessary.

There were many editorial changes that won't be presented in this analysis of the differences. Those editorial changes include reformatting. They include any identifying language that indicates that Kairos Power is the applicant as opposed to (audio interference) which simply refers to an applicant or a vendor. And there is a number of just grammar and syntax corrections that we won't talk about where we try to adhere more to our internal style and grammar standards. So, some examples of that are: we say 'units' instead of 'modules,' and we use more definitive language like 'is' or 'are' instead of 'should be' statements.

The rest of the presentation are going to be organized into three sections that represent the three primary technical areas in the methodology.

That is: the selection of licensing basis events, the safety classification of structure systems and components, and the evaluation of Defense In-Depth adequacy.

So the first section is licensing basis event selection. Can we get the next slide please?

MR. PEEBLES: And Jordan, just a reminder to call out the slide number for the people on the phone.

MR. HAGAMAN: Okay, so we are on slide six now. Slide six provides difference analysis between the table of contents for section three in NEI 18-04 and section three of the topical report. And just reviewing the table of contents, you can conclude that the headings and the subheadings have direct alignment and we point out where there is some differences.

So for example, section 3.2 where NEI 18-04 was written broadly for an audience of different technology vendors in the Advanced Non-LWR field, we were aimed at just the single technology. So we don't say 'Advanced Non-LWR LBE Selection' we just say 'LBE Selection Approach.'

Section 3.2.3 we made a minor editorial change. Instead of saying 'Design and Licensing Stages,' we only say 'Design Stages.' We are not

committing to any iteration in licensing stages. We do not want to set an expectation that documentation will be available for all iterations, and we don't want to confuse the internal product development process. Which specific licensing actions (audio interference). Similarly, to set the change in section 3.2 and 3.3.2, instead of saying 'Non-LWR PRA Scope' we simply have the PRA Scope that applies to our technology.

Section 3.3.4, there is an editorial change where instead of saying 'PRA Safety Functions' as NEI 18-04 uses, we simply use the phrase 'Safety Functions.' And we'll get into that --- we'll elaborate on that in the next slide.

Finally, section 3.3.5 talks about the Selection of Risk metrics for PRA Model Development. Rather than give the impression that we're presenting a methodology for selection, we are presenting in section 3.3.5. what our risk metrics will be for PRA model development. So it's less about the selection process and more about communicating a commitment of which metrics we're using.

So with that overview, we can go into the next slide and talk a little bit more about the similarities and the Kairos specific implementations.

So we are now on slide 7.

As you can see, the similarities between 18-04 and our topical report overwhelm the Kairos-specific implementations. We use the same definitions for licensing basis events, whether they are AOOs, DBEs, BDBEs, or DBAs. We use the same definition of Frequency-Consequence target criteria. Both methodologies use the PRA in the LBE selection process. The PRA scope that's appropriate for both methodologies includes both internal events and external hazards. All reactor safety functions in the safety case correspond to functions modeled in the PRA. We have the same overall plant risk metrics defined and risk-significance evaluations. And our importance measures are selected from the list of possible measures given in 18-04.

To talk about the Kairos-specific implementation details, you'll notice the first two bullets directly come from our approach to use this methodology to confirm the safety case, rather than give the impression that the methodology is creating the safety case.

So the first example of this is we, throughout the document, we replace phrases such as: 'LBEs identified in the PRA,' we replaced a phrase

like that with 'LBEs corresponding to event sequence family in the PRA.' The process of developing a design ---

DR. CORRADINI: Can I just ask you a question right here? This is Corradini. Does that mean how you are going to develop the event sequence families are different, or are you just trying to be more careful about the wording? I took this to mean that you might have a different approach than the NEI document. Am I incorrect?

MR. HAGAMAN: The actual process of connecting event sequence families to licensing basis events is the same across both methodologies. We are trying to be careful with the wording because we don't want to give the impression that every LBE was first identified in the PRA. The process of developing the design in the safety case is highly iterative. We have rapid iterations, and in practice the original identification of any particular LBE may be the result of a HAZOP, may be the result of engineering judgement, or it may be from PRA insights. And we don't think it is necessarily important that the LBEs were originally identified in the PRA. What we ---

DR. CORRADINI: So something --- I'm sorry, I didn't mean to interrupt you.

MR. HAGAMAN: Yes, go ahead.

DR. CORRADINI: Well, something then would be identified that might be considered of low frequency in the PRA but you thought from the HAZOP that it's something important enough that you would want to consider and analyze. Is that what you are trying to get at?

MR. HAGAMAN: That could be the case, and it could be the case that we --- and it often is the case for most of our licensing basis events that we understand what they are before the PRA is even conducted. And what we are going to do is make sure that we're going to use the PRA as a final check on our list of licensing basis events to ensure that we did not miss anything and that we categorized everything correctly.

MEMBER KIRCHNER: Thank you. Mike Corradini, this is Walt Kirchner. From a designer's standpoint, you do design basis events. I'm curious about, I guess I previously missed the subtlety of licensing basis events versus design basis events. But certainly before you've even done a PRA, you have a conceptual design. You couldn't build the PRA without it. And you identified design basis events that your design--- you know, it's part of the process

that has to cope with. The PRA then just can expand your thinking and your rigor in systematically looking at what you've created in your design. And perhaps things start systematically, in an iterative design PRA process, eliminating vulnerabilities. But in any event, that would be my take. But is there a specific reason why, Drew, you use --- I guess because this is your NRC submittal eventually that you use the word licensing instead of design basis events.

DR. CORRADINI: I guess my thought, Walt, and the reason I asked the question is I was just trying to figure out if they were using something different, which he answered. But the LBEs could be AOOs or could be DBEs depending on frequency. But that would be determined later once they essentially decided what fits, what's in and what's out.

MEMBER KIRCHNER: I agree. For me, DBEs are AOOs and Design Basis Accidents, and then beyond that is beyond Design Basis Accidents. But the terminology seems to be morphing somewhat here to licensing basis events. Would that include Beyond Design Basis Events?

MR. HAGAMAN: Yes.

MEMBER KIRCHNER: Okay.

MR. HAGAMAN: So our licensing basis

events includes AOOs, design basis events, and beyond design basis events. And the design basis event as well. So the LBE is a superset of everything that is in our safety case that we submit for review.

MEMBER KIRCHNER: Thank you.

MR. HAGAMAN: So just like in the first bullet, we want to be clear that all of our LBEs correspond to sequence families without getting into the weeds of where they first came from originally. We similarly --- when we talk about PRA safety functions --- when we talk about safety functions in the safety case, we don't want to suggest that every safety function was born from the PRA analysis. Because just like the licensing basis events, designers have a conceptual design in their head before we even put pen to paper on the PRA. So we want to make it clear that the safety functions are the safety functions, but they also correspond to PRA safety functions when you are in the PRA context. But we don't like using the phrase 'PRA safety functions' outside of the PRA context.

The final Kairos specific implementation bullet has to do with the success criteria for DBA consequence evaluations. So the DBA evaluation model that we'll use for the KP-FHR will provide a bounding

calculation of those consequences, but they include bounding inputs rather than formal, quantitative combination of uncertainties. Justification that the DBA evaluation models are sufficiently bounding may be based on qualitative arguments in some cases so then direct calculation of 95th percentile figures of merit. In 18-04, the statement was that DBAs are all evaluated on the basis of 95th percentile. And we want to leave the door open to consider alternative means to justify that we have a bounding model. So deviation --- yes, sir, you have a question?

DR. CORRADINI: Can you give me an example of this? This one I did not understand. So would a specific example help me?

MR. HAGAMAN: Sure. So if we are calculating the release from a particular area of the plant in a DBA basis, rather than choose a 95th percentile leakage rate, we may choose a very, and obviously bounding input, of 100 percent leakage, or a reasonably high leakage rate that is not based on a particular quantile like 95th percentile on the input. Therefore the output of the analysis, to call that a 95th percentile consequence metric may not be completely accurate. So we want to say that our DBA evaluations are going to be bounding, but we don't

want to restrict that statement to a specific 95th percentile a priori.

DR. CORRADINI: So let me just say it to you, back at you. Are you saying that in some cases it would be too hard to compute the 95th percentile, and it's easier to basically bound it and just develop a qualitative argument that what you've decided to use is bounding and not try to characterize it beyond that?

MR. HAGAMAN: Yes.

CHAIRMAN PETTI: I have a question then. You specifically said a DBA here. But as I recall, on the frequency consequence plot, you tend to plot DBEs and put error bars on those. Are you still planning on doing that? And it's only in the DBA consequence where you allow credit for safety related equipment, et cetera?

MR. HAGAMAN: Yes, and that's an important distinction. So there are --- as you said, AOOs, DBEs, and BDBEs get evaluated against frequency consequence criteria, and there we do our best estimate of a 95th percentile. However, in the methodology, on the back side of those event sequence families we have deterministic design basis accidents that are derived from the design basis events, and for

those we use more --- something that looks more like a traditional design basis accident analysis where we use deterministic assumptions and deterministic inputs.

MEMBER KIRCHNER: You know, for me, Drew, an example, it may not be relevant to you would be Appendix K, which is kind of a bounding deterministic set of criteria rather than a best estimate with some uncertainties associated with it, et cetera. Of course that's not a good analogy here because I don't think that applies to your design, but that would be, for me, for DBAs an example of using a bounding model.

MR. HAGAMAN: I agree that that is the spiritual example of what we are talking about when we say design basis accidents. We are talking about a universe of options that includes something like LWRs when they use Appendix K. And we will talk about design basis accident evaluation models in future submittals. So the main purpose of broadening the criteria, or the possible criteria here, is that we can speak more clearly about what our DBA evaluation models should look like in future submittals. We want to create room to do that without giving the impression in this submittal that we are going to calculate specific quantiles.

DR. CORRADINI: But I guess let me ask me ask my question again. Member Petti asked if you were going to do it for the DBEs, but if you're going DBEs, then you'd already have the calculation that told you what your 95th is, and you would then choose to go even further and more conservatively assume 100 percent? Or a 99? What I'm still struggling with is, if you did it for one, why not use it for the other? But maybe I misunderstand what your point is.

MR. HAGAMAN: That's a good clarifying question. I appreciate the way you put it there. And the answer is: there are advantages to reducing the number of assumptions in the design basis accident evaluation model. As you can imagine, every assumption that goes into that calculation is going to get derived into design criteria for safety related equipment. So if instead of taking 10 probabilistic assumptions, if you could use reasonably bounding conservative assumptions, then there is fewer criteria that need to float down to your safety related equipment in terms design space. So there are advantages to simplifying the design basis accident evaluation model where there is an argument that you are still bounding.

DR. CORRADINI: I think I get it. I'm

still looking for --- maybe this is inappropriate because this is an open session. I'm still looking for a specific example to lead me through this empirically.

CHAIRMAN PETTI: Mike, the way I think about it is, if you look at light-water reactors, there is a certain margin. Here the margins are probably larger, and so they are able to be more cavalier for lack of a better word in their DBA consequence calculation, and not have six safety systems having a safety requirement. Whereas I'm just going to calculate it with one safety function operating, and I'm still okay because of all the margin that's there. That's what I think.

MEMBER REMPE: This is exactly what GA did. I can remember them coming to a meeting with Fred Sillady talking about this, that it's how you pick the safety related equipment, and then you only rely on the safety related equipment, right?

CHAIRMAN PETTI: In DBA space, yes.

MEMBER REMPE: Yeah, and so that you don't go and do this 95th percentile and all that for the DBAs.

CHAIRMAN PETTI: Right.

DR. CORRADINI: But I think --- let me

press the point, then I'll stop because maybe I'm making too much of this. But in the past examples you guys have, it's a single-failure criteria and I would essentially have three things and I'd only need one to work. Here, the single-failure criteria is disappeared so I have a probabilistic criteria, so the 95th percentile seems to have to be considered. Again, maybe I need an example that would drive this and I'll just wait and stop at the moment.

MEMBER REMPE: So they're, again, for the DBA, you only assume the safety-related systems are working. Which is not how you would do --- Fred used to have a plot and he'd show how the same sequence would be plotted on this frequency-consequence plot and, again if you did the DBE that was in the DBA space, assuming everything worked with the appropriate likelihood of it working with the uncertainty bars. And then he'd also do the DBA for that particular sequence. Does that help at all? If you pull up his old slides, you can see it.

DR. CORRADINI: No, I know what you're trying to show me on the plot. I'm trying to understand why not use the information I've got because we're talking about the x-axis not the y-axis. So once I have the x-axis and the dose is going to be

calculated, I have to understand the effectiveness of the safety system that is being used. And the effectiveness is not a single point value, it's a potential range, which allows me then to have a 5th and a 95th. So, once I have it operating, I can assume a bunch of things don't operate, that's fine. But once I assume something operates, I have to assume a performance of it to get a source term.

MEMBER REMPE: So what you'd like them to do is if you had three systems, and only one operates, you'd like them to have that range for its operations, but then they might not, in some designs, they might not meet the criteria. And so back in the old days in the gas reactor, that's why we used to do it that way. I don't know about their design if it's got it. But that's --- it was getting close to the boundary is why they used to do it that way in the old days.

DR. CORRADINI: I don't want to take any more time. I was looking if I was going to get an example. I'll wait and come back to this when we can do a very specific example on their specific design.

MR. HAGAMAN: Okay, so with your permission, we will move on to the next technical area?

CHAIRMAN PETTI: Go ahead.

MR. HAGAMAN: So the second of three technical areas --- we're now on slide eight by the way. The second of the three technical areas is the safety classification and performance criteria for structures, systems and components. And from now on, instead of structures, systems and components, I'm just going to say SSCs.

A comparison of the table of contents between 18-04 topical report for this section shows that there are only editorial differences to the general outline. Like we saw before where 18-04 applies to all advanced non-LWRs, ours is simply just for our technology.

There is another editorial change in section 4.4.2 where we deleted the word regulatory from design requirements. This was an effort to clean up the language. We believe that design requirements are more appropriate than regulatory design requirements because they exist in design space and we want to separate the thinking from the actual transition to a regulatory submittal.

If we move to the next slide, we can talk about the similarities and any differences.

So we are on slide nine right now. And once again there's broad similarities between 18-04

and our topical report for this methodology. We had the same safety classification approach. We have the same definitions for safety significance and risk significance. And we similarly include in the population of safety-significant SSCs that are required for Defense-in-Depth adequacy. We have the same required functional criteria with the addition of one more, which we'll talk about in the Kairos specific implementations. We have the same process of flowing down design requirements for safety related SSCs. And we have the same evaluation of SSCs that are safety related or non-safety related with special treatment where we measure their performance against frequency-consequence targets. And we have the same special treatment requirements that flow down from safety related to non-safety related with special treatment SSCs.

There's two important distinctions --- differences that we want to highlight here that we saw fit for the Kairos specific implementation. The first has to do with the word shall when talking about integrated plant risk targets. NEI 18-04 talks about how the plant risk targets shall not be exceeded. We think it's more important to say the phrase should not be exceeded when talking about integrated plant risk

targets. Shall is the language of verifiable regulatory compliance, and that doesn't fit necessarily the intent or the technical capability of PRAs, which combine data based on engineering judgment and assessment of uncertainties. We deliberately use the term targets when we are talking about plant risk. To ensure our commitment is clear, we will provide justification that the risk targets are not exceeded, but PRAs cannot possibly do this in any verifiable way in terms of Appendix B quality.

The second Kairos specific implementation detail is we added an additional required functional design criterion for our safety related SSCs. The two that are common between 18-04 and our topical report are the criterion first to mitigate DBEs within the FC target, and DBAs within the frequency-consequence limits. The second common criteria is that we're going to prevent high consequence beyond design basis events from exceeding ten to the minus four per year in frequency. And to these two, we added a third one that our --- we have required functional design criteria to shut down the reactor and maintain it in a safe shutdown condition.

We've identified that this criterion is part of the 50.2 definition for safety-related

structures, and we have further identified that the reactivity criterion would like have naturally fallen out of this methodology frequency-consequence process. And we decided to include it for completeness and to maintain consistency with the 50.2 definition so we don't have to take a regulatory exemption from that rule.

MEMBER KIRCHNER: Drew, this is Walt Kirchner again. This now is just one member's opinion: I commend you for adding this because that, as you correctly point out, that is part of the safety-related definition. If you were to go forward under 10 CFR 50 or 52, that is a functional requirement as to meet the definition of safety-related SSCs. Thank you.

MEMBER MARCH-LEUBA: Yeah, let's go back one bullet that replaced shall with should. I almost lost a heartbeat here when --- the honesty of you saying I cannot possibly certify through risk analysis that this thing happens. I have high confidence it does, but it doesn't --- it shall is not achievable. I think this should be engraved on a plaque and put on the wall because this is true and real and honest. This is the first time I heard this said. I want to put you on the record. Okay ---

MR. KIRCHNER: Jose, I concur as well on that one. As Drew pointed out, there's no way in an Appendix B space with a PRA demonstrate shall.

MEMBER MARCH-LEUBA: For the record this is not a Kairos problem, it's a risk analysis problem.

MR. KIRCHNER: But these are good insights going forward, I think, as we consider this LMP.

MEMBER MARCH-LEUBA: Okay.

MR. HAGAMAN: Thank you. Are there any other comments or questions before we move on to the third technical area? Okay. Hearing none, Drew, can we move on to slide 10 please?

So the third and final technical area is the evaluation of Defense in-Depth adequacy. So it would be --- the table of contents for this section is long so we split it across two slides. In the first slide you see there is almost identical table of contents between 18-04 and our topical report. I'll highlight the one difference is in section 5.4. Instead of where 18-04 says it is technically inclusive RIPB framework, we simply had an RIPB framework. Again, we are focused only on our technology.

The next slide, slide 11, provides the second half of its table of contents. Here there is

a couple of differences. The first example of which is in section 5.7.2. where we have evolved the definition of IDP from 18-04's definition of Integrated Decision-Making Process to an Integrated Decision-Making Panel. I'm going to talk about this more substantively in the next slide. I just wanted to highlight it here because it shows up in the table of contents.

The second difference to highlight is section 5.9.3 which the title indicates in 18-04 that the IDP Actions Establish Defense In-Depth Adequacy. In our methodology, however, we make sure that the IDP actions confirm DID adequacy, but we don't want to give the impression that DID adequacy is first established by any IDP action. The IDP doesn't necessarily document the Defense In-Depth baseline. Rather, our panel will ensure that the baseline is documented with adequate completeness.

Sections 5.9.5 and 5.9.6 in 18-04 were not copied over into our topical report. They provide helpful information on how you get the baseline evaluation of Defense In-Depth for a vendor that's cycling through design iterations. But we didn't find anything actionable from a regulatory perspective there. So, while it's good information and we're glad

that it appears in 18-04, we didn't see any purpose in copying it over into our topical report.

MEMBER KIRCHNER: So, Drew, this is Walt Kirchner again, interrupting. I kind of, once again, concur with where you are coming from, but it begs the question then, what is the fundamental basis that you are going to use in determining adequate Defense In-Depth? What philosophical concept and set of metrics or criteria are you going to use, Kairos. Or maybe this a closed-session question. But I'd be very interested to see --- I would say that a weakness in LMP and 18-04 is it's more process than it is substance.

So what substantively are you going to base your confirmation of Defense In-Depth on? Is it the IAEA kind of approach of lines of defense? Or is it something comparable to what is used for --- my colleague, Charles Brown, has been promulgating for quite some time, where one looks at fundamental principles that counter common cause failure kind of issues that are rather unique to digital I&C. So, philosophically, how are you going to address this?

MR. HAGAMAN: Thank you. We are going to address Defense In-Depth --- there's basically a three-pronged approach that we are trying to make sure

we don't lean on any particular element of the safety case to be the primary leg of the stool. We have three elements to our safety case. We have plant capability, where we have our Defense In Depth guidelines around the identification of our design basis accidents and the safety related equipment that's credited in our design basis accidents, and we have very deterministic inputs that come out of that. We have our risk-informed performance-based elements where that's typically where we have our license basis events plotted on an F-C chart and we're making sure that we have all of our licensing basis events are within the targets that we agree upon. And, like you said, there's the IAEA layers of defense, and that framework is actually incorporated into our ---

(Audio interference.)

CHAIRMAN PETTI: Does anybody hear him? I think we lost him.

MEMBER REMPE: I don't hear anything, too.

DR. CORRADINI: I thought I was kicked offline. I've lost him.

MS. LUI: I think he was disconnected for some reason.

CHAIRMAN PETTI: Can somebody from Kairos, who's listening?

MR. PEEBLES: Yes, we're working on it.

CHAIRMAN PETTI: Great.

DR. CORRADINI: This is the topical area that I am most uncertain as to what is in the NEI document. So, Walt asked the question. I want to hear the answer.

MEMBER KIRCHNER: Yeah, pardon my saying it, it's the least --- I was going to say the weakest part. I'll say that it's the least mature and least well tested and proven. It's never going to be proven that you have adequate DID. It's going to be something in the eye of the beholder. But the reason for my question is to see, like I said, philosophically from a designer's standpoint how you're systematically approaching this particular aspect of the LMP.

DR. CORRADINI: Let's wait until he comes back.

MR. PEEBLES: Yeah, Jordan should be reconnected.

MR. HAGAMAN: Hi. I reconnected. I'm sorry, I was gesturing, and I ended up dropping the call.

MR. KIRCHNER: I apologize, Jordan, I thought it was Chris, but it's Jordan. So, thank you.

CHAIRMAN PETTI: You broke up from, you said that you had three legs of the stool. You talked about the first two but you got cut off before the third.

MR. HAGAMAN. Right, so the third is the programmatic Defense In Depth which is basically systematically going through and looking at the assumptions from our plant capability Defense In Depth and our risk-informed performance-based evaluations and understanding what were the assumptions underlying those evaluations and making sure that our plant has programmatic characteristics built in to ensure that those assumptions remain true in the life of the plant. So we have, I think, very systematically we go through the plant capability with our deterministic DBAs and our layers of defense. We have risk-informed approach where we let the PRA inform judgment that we are within our frequency-consequence target criteria, and we ensure all of the assumptions from those two evaluations remain true programmatically whether --- in the programs that maintain our SSCs that follow our SSCs through the design process and the sourcing process and inspections and all of that.

Does that address your question?

CHAIRMAN PETTI: Well, I'm just trying to

understand how it's different than the NEI. Or is it?

MR. HAGAMAN: It's --- so this part is exactly the same with the nuance that we are presenting all of these elements together to our integrated decision making panel for the integrated decision making panel to go through and agree that we have checked all of these boxes. So we approach this --- we use the framework to confirm our safety case but not necessarily to establish it. That's the only difference between the methodologies.

MEMBER KIRCHNER: Jordan? Again, Walt Kirchner. Who would be on your integrated decision-making panel?

(No audible response.)

MEMBER KIRCHNER: Not by name, obviously, but by ---

(Laughter.)

MEMBER KIRCHNER: What would be the composition of it? Much like PIRT panels. I'm curious about your approach. Well, I'll jump to what I would like to hear. As someone who is not a Kairos Power person, which is hard to do when you're dealing with proprietary information and so on. But getting someone outside of the cooler or coffee klatsch could be extraordinarily valuable to challenge your

colleagues when you go through that exercise.

DR. CORRADINI: I agree with Dr. Kirchner, Member Kirchner on this. In fact, the panel is what I was going to ask about anyway, about the construct or the constitution of it, so.

MR. HAGAMAN: So with regards to the composition, whether it is a mix of internal and external resources, we're not prepared to give an answer to that today. But what we are committed to is ensuring that the panel has sufficient independence and sufficient diversity in technical disciplines and expertise to make judgments. But anything more specific than that on composition, we're going to have to get back to you.

MEMBER KIRCHNER: No, this was --- I wasn't looking for an answer, it was a suggestion. Having been in your shoes, one gets to believe what one is doing so strongly, that the outsider's look, certainly at this point in the LMP process, can be invaluable to look for things that you may not have considered and other oversights, and there is good experiential data to back up my point.

CHAIRMAN PETTI: Yeah, it's even beyond nuclear. It's in all logic projects. It's logic project group think. There's tons of papers in the

literature on that sort of stuff and how you can get blindsided.

MEMBER REMPE: I went back to the Southern pilot study and it looks like at the point it was issued, no one had done anything on Defense In Depth. Have you tried to do this and moved along in this project a bit more to try and see if --- where are you? You said you'd done this pilot with Southern. Had you gotten any further with it?

MR. HAGAMAN: We --- so, yes. We went through and we piloted every step of the process with Southern. We don't currently have any other pilots docketed. We haven't performed the formal IDP yet. But I want to observe that when we do get to the point where we're commissioning an IDP, I'll observe that Kairos Power regularly uses external resources in sort of a red-team model whenever we are making important decisions and where we are considering submitting important documents externally. And it's reasonable to assume that we have that tool in our toolbox when we're thinking about IDP. I'm just not prepared in this meeting to commit a specific process or format.

MEMBER MARCH-LEUBA: Will this panel be empowered to do the postulated DBAs? Because it is --- when you have the frequency-consequence chart, it

makes very logic. It look really scientific until you realize that it's based on some frequencies calculated by some PRA that doesn't exist. So, the way we had reactors 50 years ago, safer, is by postulating accidents saying, I don't think this accident like a double-ended guillotine break LOCA is going to happen. But let's make sure that if it were to happen, nothing bad happens to the core. So those are the postulated accidents that --- they are not AOOs but you still have to survive. And this panel would be in charge --- I assume this will be the panel that will be in charge of looking for this deterministic accident because --- especially in this revolutionary, with emphasis on the r at the beginning, reactors, we don't have any operating experience. It truly, once you look at what could possibly happen, whether you expect it to happen or not, and see what happens to the core.

That's just my comment.

MR. HAGAMAN: Thank you. So the panel absolutely is --- the whole purpose of the panel is to introduce engineering judgment and to do a comparison of uncertainties, and yes, to make an evaluation that the design basis accident selection, and the assumptions in design basis accidents are reasonably bounding. And the judgment of the panel could

certainly be that no, the design basis accident selection is not complete and to identify where that might be --- which areas that might be in. And then the burden will go back to design and analysis iteration to incorporate that feedback and come up with a revised safety case for the IDP to look at again.

So, yes, the power does rest in the IDP in that we need the IVP to confirm our safety case or we can't move forward.

CHAIRMAN PETTI: So let me just ask a question, more from a design perspective. You know, let's look at redundancy and diversity and independence, and assessing whether or not you've got enough of that, you know, against a certain safety function. It seemed to me that how one evaluates that question is really a function of the technology. So in a light water reactor construct, what might work there, and be optimal there, today, may not be optimal for an advanced reactor where there's no operating experience, or limited operating experience, as I say. There's a lot more uncertainty and so you have to somehow compensate with additional redundancy or additional diversity, and highlight --- to me, that would be highlighted as, look this is what the process

could do. Is that a fair way to think about how you guys from the design perspective are going to think about these things to compensate for the fact that we've never built one of these types of new machines before?

MR. HAGAMAN: Yes, and we expect those judgments to appear both when we're talking about plant capability and dealing with the assumptions there. But we also expect these types of judgments to naturally fall out of the risk-informed process where if we need to use broad uncertainty distributions on individual pieces of knowledge in our PRA model, that'll naturally lend itself to judgments that it's an area where conservatism in margin is needed to compensate for a growing state of knowledge.

CHAIRMAN PETTI: But in the end, I mean I sort of agree with that, does that in fact, though, make it difficult to really get the risk insights because you've had to put more margin in, if you will, or compensate for more uncertainty than if you were to go back and redo this ten years after the plant had operated, you might get a different set of risk insights because you've got some experience?

MR. HAGAMAN: That could be the case, and it could be the case that future technology iterations

of the FHR could take advantage of the operating experience from the first plants. And those subsequent nth of a kind plants may have a different safety case than the original one because we have better knowledge and that reflects in margins.

CHAIRMAN PETTI: Right.

MEMBER KIRCHNER: I'm tempted to say this, David. There is no immaculate conception in advanced reactor designs. You always learn as you design, build, test, and you see that in the generations of improvements that have been made in the existing fleet. I think that's a given. But I think Dave's point more relevant here is just, again, those concepts of diversity, independence, redundancy, and deterministic performance, which I have learned from my colleague Charles Brown very well now, would serve one well in doing this DID confirmation of adequacy, especially for a new design without the large, experimental, or operational base.

MEMBER REMPE: So let me try to ask my question a different way. To the level that you did the Defense In Depth adequacy evaluation with the Southern assessment, did you get any insights that fed back to other portions of the LMP?

MR. HAGAMAN: Directly, no, but that was

because of the scope of the evaluation. Because of our state of design at the time, we took a narrow slice approach to piloting each of the steps in the LMP process. So we took a single initiator through a single event tree and a single set of event sequence families to illustrate what the steps might look like for the FHR design. But we would have needed a complete evaluation based on a more complete, more mature design to yield the kind of iterative insights because this is the type of discussion that applies to the whole plant and not individual event sequences and individual SSCs.

MEMBER REMPE: Thank you.

MEMBER KIRCHNER: Jordan? You made a good point, and I shouldn't let it go uncredited. It applies to the whole plant. One of the things that you have to do now at this phase in this DID adequacy, or whatever, confirmation, whatever the process is called, is look holistically at things, step back and say, okay, we decided that, based on our design, based on our PRA work, et cetera et cetera, these are the categories of scenarios that we have to deal with. But now is the time to step back and say, is there something in the non-safety related SSC category that just could undo everything, all of our best intent and

design? So it really is the point where you step away from, how should I say it, the regulatory classifications and look at the whole in a holistic sense. And again, that's where having some outside participation of your choice could be invaluable.

MR. HAGAMAN: Thank you. We've recorded the comment.

CHAIRMAN PETTI: Keep on going, Jordan.

MR. HAGAMAN: So if we can move on to Slide 12.

So we've actually touched on most of the content of this slide, so I will review it relatively quickly. We have common methodologies between 18-04 and our Topical Report as for defense-in-depth adequacy. We use the same defense-in-depth philosophy, the same framework as I was mentioning previously split up to Plant Capability elements, Programmatic elements, and Risk-Informed elements. The same 18 task process is used.

We evaluate the LBEs against a layers of defense approach or to the IAEA approach. We established the adequacy of programmatic defense-in-depth using the same guidelines in 18-04. And we have the same Risk-Informed performance-based evaluations.

The Kairos-specific implementations, we

just spent a good deal of discussion talking about how we replaced the integrated decision-making process with an integrated decision-making panel. And I would like to elaborate just a little bit more on that, that when we talk about process, that can tend to get vague or create the potential expectation for documentation and procedures and training associated with individual design decision iterations.

And in our methodology, we move away from that process, and we get very specific in talking about we're going to have a panel. The panel is going to meet and perform out discrete, specific activity to review the defense-in-depth adequacy of the design, and we can commit to, in licensing action, we will have this panel. We will have the records and process associated with the panel, any specific documentation on when the panel met, what the information they reviewed was, and what the conclusions were. And this is something specific that we can commit to this information being available for review to support a safety determination.

The second Kairos-specific implementation has to do with programmatic focus on event sequence frequency targets rather than SSC reliability targets. Our approach to establishing programmatic defense-in-

depth focuses on activities that assure that frequency targets are maintained at a sequence level. At our detailed SSC level, however, the focus shifts away from the reliability targets and towards performance-based measures such as surveillance frequency and test success rates; things that are actionable, things that are documentable, and performance-based.

And like we mentioned on the last slide in this final bullet, there were sections that we decided not to copy over into our Topical Report. It did provide good information for developers but not any actionable information for Kairos as an applicant.

And so if we can move on to the final conclusion slide, Slide 13.

So just to reiterate, Kairos Power considers the LMP methodologies an adequate means to develop LBE, SSC safety classifications, and to confirm the adequacy of the defense-in-depth attributes of the KP-FHR.

Our report details the KP-FHR specific methodologies, which are based on 18-04 and on the Reg Guide approving 18-04, 1.233. And to repeat the ask that Drew gave at the top of the meeting, Kairos Power requests the NRC review and approval of the methodology as an adequate means to define and

evaluate LBEs, classify SSCs, and assess DID adequacy. NRC produced a draft SCR to approve the methodology.

That concludes my presentation, and I would entertain any other questions you might have.

MEMBER MARCH-LEUBA: Yes, it is Jose. I would like to bring a separate topic. I apologize for bringing it first. Okay, how does functional containment fit into this methodology? Are we going to explicitly model the source term and the radiation or isotope transport with or without a containment or with a functional containment? Can you say something about functional containment?

MR. HAGAMAN: Yes. So the functional containment will be evaluated both in our Risk-Informed evaluations and in our Deterministic evaluations. So you can expect in the PRA treatment of all the radionuclide retention barriers, whether they're physical or functional. So for the FHR, that includes the characteristics of the TRISO kernels and our salt, specifically in design basis accidents based and in the Risk-Informed space and the PRA, we also take realistic probabilistic assumptions associated with transport to the building and transport from inside the building to the site boundary.

MEMBER MARCH-LEUBA: So if I understand

correctly, all the LBEs will be evaluated with the radioisotopes transport to the boundary and a dose at the boundary, not just figures of merit or something like that. But if we don't have a real containment, and we are relying on a functional containment, my opinion, the LBEs should be analyzed a little further than normal and take it to dose at the boundary. That's my personal opinion. And if your dose at the boundary is ridiculously low, which it's likely to be in this design, fantastic.

MR. HAGAMAN: Yes. And this is consistent with the non-LWR PRA standard, which is in its final stages of publication right now. For a non-LWR PRA, we don't have logical surrogates like LWRs do, such as core damage or large early release. So every non-LWR PRA is effectively a Level 3 PRA where we take every event sequence through to release, and we calculate a dose at the boundary like you say.

MEMBER MARCH-LEUBA: Is that a regular commitment? I mean, that's what you plan to do, because that's great. This is a very good commitment or standard. It is a very logical way to demonstrate that my plant is safe. I wish, I hope you do it.

MEMBER KIRCHNER: Yes. Jose?

MEMBER MARCH-LEUBA: And I applaud you.

MEMBER KIRCHNER: Jose, I would submit that, if you're going to do the frequency consequence basis for licensing, you have to do it, as you suggest, for all the licensing basis events, not just a subset. That is almost a -- I would assume, unless I misunderstood the LMP process, that that would be a requirement that they demonstrate that, as you suggest.

CHAIRMAN PETTI: That's how I understood it.

MEMBER MARCH-LEUBA: I've never seen it in black and white, but, I mean, I will take your word for it. And I think that's what we should do.

MR. HAGAMAN: So I'd like to reiterate that LBEs are evaluated on that SC chart, and the x-axis is a 30-day total effective dose equivalent at the site boundary. So all of our LBEs need to be evaluated on that basis.

MEMBER MARCH-LEUBA: Let me just say one word: wow. I like it.

MEMBER KIRCHNER: And, Jordan, then I -- this is Walt Kirchner again. Then I would assume you would, in the interim, while 10 CFR 53, quote-unquote, is in rulemaking, in development and rulemaking, that you would fall back on 10 CFR 50 and 52, don't quote

me on the numbers, 34 dot whatever, for dose at the exclusion area boundary and at the low population zone, if I'm getting this correct, right? I mean, those are some of the anchor points, essentially, in the frequency-consequence curve, at least as presented by the staff.

MR. HAGAMAN: Yes, but I want to be specific with my agreement that we use 50.34 criteria when we're talking about our deterministic design basis accidents, which like the PRA, the design -- the deterministic design basis accidents need to be taken all the way to release to look at the dose at the boundary. 50.34 is not directly used when we're talking about DBEs and BDBEs, however. Then we're using the 30-day criteria on the frequency-consequence chart. So there's a subtlety there that I want to make sure is captured for anything else --

MEMBER KIRCHNER: Well, what is the 30-day, just for the record, could you share what your definition of the 30-day criterion is?

MR. HAGAMAN: The frequency-consequence chart has a series of diagonal lines that give, that are based on anchor points. So that's what I'm talking about. That is the basis for the 30-day dose. So we would have to look at the chart to say for an

event of particular frequency what the appropriate consequence target is.

MEMBER KIRCHNER: Okay.

CHAIRMAN PETTI: Any other questions, members?

DR. SCHULTZ: Dave, this is Steve Schultz.

CHAIRMAN PETTI: Hi, Steve.

DR. SCHULTZ: Jordan, when you describe the panel, the way the panel would be working, it sounded as if you were describing it as a one-time event that you would contract the panel or red team, however you want to describe it, and there would be an evaluation that would be performed and then completed and documented.

It seems to me that the panel activity, given everything that needs to go on, as some of the members have described today, things are bound to come up in the design and licensing process over the course of that activity where the panel might want to -- you might want to have that panel get together on a periodic basis, and I'm not sure what that is; it depends on your pace, of course. But things are going to come up, as Jose mentioned.

It is very important that you continue to ask the what-if questions even as you go through the

overall process. You may think you've got a final design, but as you go through the process of design and application, things are going to change, and there is a real benefit of to having a panel that stays organized and continues to ask these questions, both individually and collectively, to make sure that things that you may not think of on day 1 or 10 or 20 are identified later on and handled appropriately.

MR. HAGAMAN: I agree and, although our specific commitment is to have a panel sign off on our final safety case, we, as a matter of doing the business of iteratively creating a design, we naturally touch on all of these topics when we go through the analysis of the plan. So we regularly exercise the process, and what we want to do is focus on the fact that the commitment is that when we submit a final design and a final supporting safety case for a plant, that you can expect to find available for review in our records at least one IDP evaluation that confirms our safety case. But informally, all of these things get exercised on a regular basis.

MEMBER KIRCHNER: That's good. Thank you.

CHAIRMAN PETTI: Okay, then. Thank you. And now I guess we will turn to the staff, Stu.

MR. MAGRUDER: Thank you, Dr. Petti. Let

me start sharing my screen here. Okay, hopefully you can see our screen, the NRC slides. Can I confirm that?

CHAIRMAN PETTI: Yes.

MR. MAGRUDER: Okay, thank you. Thank you. So, again, my name is Stu Magruder. I'm the project manager in NRR for the Kairos Project here, and I just have a couple introductory remarks, and then I will turn it over to Antonio Barrett from NRR also who is the lead reviewer here.

Let me say that the draft safety evaluation for this technical Topical Report here was provided to the Subcommittee and to Kairos a couple of weeks ago. It is publicly available now. This is a nonproprietary report, and so our safety evaluation is also nonproprietary, so it's in ADAMS available to the public.

As we've discussed earlier, the safety case is largely built on the fact that the staff has endorsed the industry LMP methodology in Reg Guide 1.233. Antonio will explain how we did the review and our conclusions of the review.

I note that other staff from NRR, particularly Ian Jung, Hanh Phan, and Marty Stutzke, are also on the phone and are available to answer

questions, particularly if you want to talk about our endorsement of the LMP and the non-LWR PRA standard. So, Antonio, let me turn it over to you, and we will go to Slide 2.

MR. BARRETT: All right. Thank you, Stu. This is Antonio Barrett, NRR, Advanced Reactor Technical Branch. In this presentation for the Topical Report review, I'm going to cover the regulatory basis, the review scope and approach, deviations from NEI 18-04, and the conclusions.

All right. Stu, can you go to the next slide?

All right, for Slide 3, an approved methodology to select the licensing basis events, classify the structure systems and components, and assess defense-in-depth adequacy is used to inform the licensing basis and contents of applications for non-light-water reactors. Applicable regulations for contents of applications are 10 CFR 50.34, 52.47, 52.79, 52.137, and 52.157.

Regulatory Guide 1.233 provides the NR staff guidance on use of a technology-inclusive, risk-informed, and performance-based methodology to inform the licensing basis and contents of applications for non-light-water reactors. The Reg Guide endorses NEI

18-04, Revision 1, with clarifications as one acceptable method for non-light-water reactor designers to use when preparing their applications.

Additionally, SECY paper 19-0117, request the Commission to find that the staff's use of the Reg Guide and NEI 18-04 as a reasonable approach to establish key parts of the contents of applications for non-light-water reactors. An SRM to the SECY paper approves the use of the methodology from the Reg Guide in NEI 18-04.

All right. Stu, can you go to the next slide?

This is Slide 4 for the review scope and approach. The Topical Report methodology is based on the NEI 18-04 document and Reg Guide 1.233. The NEI 18-04 methodology has been updated to be specific to KPH -- KP-FHR and there is a small number of minor deviations that don't change the methodology or principles of the 18-04 document.

The review scope is focused on the differences between the Topical Report and the NEI 18-04 document and confirms that the Topical Report incorporates the clarifications from Reg Guide 1.233. All differences have been reviewed but the focus is mainly on those of some significance.

The presentation covers the most significant ones. While the SE has a couple more minor ones and then there is no mention of some of the more smaller ones that are pretty much editorials, but those were reviewed as well.

Stu, can you go to the next slide?

For Slide 5, in Section 3, the Topical Report deviates from the NEI document in that it allows for a qualitative arguments instead of quantitative calculations for uncertainty for determining bounding consequences of each design basis event. The methodology commits to justify these qualitative arguments in the future licensing submittals. This is reasonable from a methodology perspective because the staff will have a future opportunity to assess the acceptability of these qualitative arguments, and it is not making a finding from a technical perspective.

Can you go to the next slide, Stu?

For Slide 6, Topical Report, Section --

CHAIRMAN PETTI: Could you go back for a minute? This is Dave.

MR. BARRETT: Yes.

CHAIRMAN PETTI: This is not exactly what I thought we just heard from Kairos, a qualitative

argument. This implies to me that there is not going to be a number. There is going to be a number. The technical basis on how bounding it is may be qualitative. Is that what -- instead of a statistical --

MR. BARRETT: Right. So instead of, so they're going to make a qualitative argument that could be based off of some other numbers that are bounding, but they're not going to do the 95 percent number in this particular case. And they're going to justify those qualitative arguments on, for a bounding model in a future licensing submittal.

CHAIRMAN PETTI: Great, yeah. Okay, now I'm with you. Thanks.

MR. BARRETT: Okay. Thank you. Slide 6, Topical Report Section 3.36 describes the process for establishing the risk significance of SSCs. The process is found to be reasonable because it is an element of the integrated Risk-Informed Performance-Based approach in the Topical Report and is the same as what's in NEI 18-04.

However, currently, there is an industry-led PRA standard for a non-light-water reactor which is being developed and expected to be endorsed by the NRC staff through a Reg Guide. This particular

standard may define risk significance of SSCs differently from what's in the Topical Report. Therefore, Item 2 was added to the Limitations and Conditions sections of the safety evaluation, which states that the applicant should address or justify alternatives to the acceptance criteria in the endorsed standard or Reg Guide related to the determination of risk significance of SSCs as part of implementing the methodology in this topical report.

DR. CORRADINI: Can I -- this is Corradini. I guess I'm reading the words and you're implying that the non-LWR, excuse me, the non-LWR PRA standard would have a different definition. Is the definition in a state of flux, and it's still yet to be determined? Can you help me a little bit here?

MR. BARRETT: Yeah. So Kairos is actually leading the development of the standard. So it's intended to be consistent with this methodology. So, however, it's not complete yet. It hasn't been endorsed by the staff either.

DR. CORRADINI: Okay, all right. Okay, I think I get it. Thank you.

MR. BARRETT: This is to just basically make sure that that gets tied into this Topical Report.

DR. CORRADINI: Okay, but the intent is that the definition or the method of determining the SSCs would be the same?

MR. BARRETT: That's my understanding. But if they do happen to be different, there has -- it would be expected that they would say something about it.

DR. CORRADINI: Okay, thank you.

MEMBER KIRCHNER: So, Antonio, this is Walt Kirchner. So risk-significant then they would go with safety-related, non-safety related with special treatment, and just non-safety related. That would be the risk-significance of SSCs?

MR. BARRETT: I think this is a little bit different. I think it's just defining -- yeah, so eventually I think you would get there to those but this is going --

MEMBER KIRCHNER: Yes.

MR. BARRETT: -- about the initial assignment of what the risk significance of a particular SSC is in the PRA.

MEMBER KIRCHNER: Yeah. There is PRA-speak and then there is regulatory-speak, and I'm just trying to reconcile those.

MR. BARRETT: Yes. I think this is PRA-

speak.

MEMBER KIRCHNER: Okay. Thank you.

MR. BARRETT: Okay, Stu, can you go to the next slide, unless somebody else has a question? Okay. Thank you.

For Slide 7, in Section 4 the Topical Report deviates from NEI 18-04 in that it adds an additional third criterion to the definition for safety-related SSCs. The third criterion is for a set of SSCs performing the reactive shutdown function. The Topical Report states that this is to ensure that the safety-related definition in 10 CFR 50.2 is addressed with the exception of the portion of that Kairos plans to request an exemption for.

Adding the criterion is acceptable because it is consistent with regulations, and it has the potential to increase the number of safety-related SSCs. Additionally, Item 1 was added to the Limitations and Conditions section of the safety evaluation, which states that the NRC is not approving any exemptions from NRC regulations and an applicant using the Topical Report will need to address compliance with pertinent regulations and request exemptions as needed.

All right, Stu, can you go to the next

slide?

For Slide 8 in Section 5, the Topical Report deviates from NEI 18-04 in that it does not include some general guidance for defense-in-depth layers and source term that do not translate to specific actions or documentation for the process described inside of the NEI document.

The methodology commits to justify the mechanistic source term and future licensing submittals, and the defense-in-depth process is already described in other parts of the Topical Report. So this is reasonable from a methodology perspective because the staff will have a future opportunity to assess the acceptability of the mechanistic source term and is not making a finding from a technical perspective.

All right, Stu, can you go to the next slide?

Slide 9 is the conclusions, and the staff proposes to approve the Topical Report methodology to select the licensing basis events, classify the structures, systems, and components, and assess defense-in-depth adequacy to inform the licensing basis and content of applications, subject to the safety evaluation Limitations and Conditions.

The methodology is essentially the same as what the NRC staff approved for NEI 18-04, Revision 1, and incorporates the applicable clarifications and points of emphasis from Reg Guide 1.233, Revision 0. The differences between the Topical Report and NEI 18-04 have been evaluated to be reasonable.

And I think that should be the end, and if there is any questions, I'd be happy to answer them.

CHAIRMAN PETTI: Members, questions?

(No response.)

CHAIRMAN PETTI: Okay. Thank you.

MR. MAGRUDER: Well, thank you very much, Chairman Petti. This is Stu Magruder again. Let me just kind of conclude by saying that the staff is not specifically asking for a letter on this Topical or safety evaluation, but we would be happy to brief the full committee. And I think tentatively we are on the agenda for the October meeting. So I will leave it to you, Chairman Petti, to decide on that. We will be happy to support that if you would like to do that.

I will also note, as we alluded in the discussions here, we have several other Topical Reports from Kairos under review, including the mechanistic source term methodology. I think next up would probably be the fuel performance methodology

Topical and we, I think we are tentatively scheduled to brief the Subcommittee on that early next year. But we also have other topicals that we just started review on fuel qualification, metallic materials qualification, and the quality assurance program. So we would be happy to come back to the Subcommittee and talk about any of those in the future. So thank you very much.

CHAIRMAN PETTI: Great. Well, members, there are a couple of things we need to talk about. First, we should go around and ask members for individual comments, but second, we should talk about whether or not we need to write a letter.

I can tell you that we had a phone call with Kairos last week or maybe this Monday. Yes, we had a meeting on Monday. And Dennis was of the opinion that we didn't need a letter. I had a draft letter started before I knew where Dennis was on these things. So I am open to hearing what other members think. So should we just go around --

MEMBER REMPE: Dave, should we first just ask for public comments and get that box checked.

CHAIRMAN PETTI: Oh, oh, oh, right. Yeah, thanks. I'm assuming, Thomas, the public line is open. Thomas, is the public line open?

MR. DASHIELL: The public line is open for comments.

CHAIRMAN PETTI: Okay, anybody on the public line wishing to make a comment, please do so. Okay. I don't hear anything, so I guess there's no comments.

So let's go around and see what folks think. Charlie?

MEMBER BROWN: Am I first?

CHAIRMAN PETTI: I'm doing it alphabetically. Sorry.

MEMBER BROWN: Okay. I thought you were going to get Ron that's why it took me a while to find my button.

CHAIRMAN PETTI: He doesn't come up on my list here. He's on a list of the participants. He shows up under R instead of B.

MEMBER BROWN: That's all right. I just didn't want him to get mad.

CHAIRMAN PETTI: I've been chewed out by professionals.

MEMBER BROWN: I'm not chewing. I don't want to get chewed. Let Ron go first. We will do it --

CHAIRMAN PETTI: Okay, Ron. Go first,

please.

MEMBER BALLINGER: Geez. Yes, I'm inclined to, since this is the first of the, what may be many non-light-water reactor designs, I'm inclined to think that we should write as many letters as possible. Thank you.

CHAIRMAN PETTI: Okay. Charlie.

MEMBER BROWN: Well, I'm not in favor of writing as many letters as possible. Okay. I'm kind of in a quandary as to what to do. This was a fairly sparse set of information that was provided, but the staff seems satisfied. It seems like there is more to come. I don't know what this would be a, what are we endorsing? What are we approving, or what are we agreeing within this letter? That's why, that's my question. Just this technical, this Topical Report, period?

CHAIRMAN PETTI: Yes. That's what it would be.

MEMBER BROWN: Okay, no other, we don't lose the track on anything else?

CHAIRMAN PETTI: No. I mean, my personal opinion is the discussions that we had, which are part of this broader discussion that we've been having in other contexts like Part 53 --

MEMBER BROWN: Yeah.

CHAIRMAN PETTI: -- are really where everything is at and whether or not we feel that's important enough to highlight in such a letter; otherwise, we're just, you know, yeah, they're applying LMP. They've made some small changes. We would have to talk about, I think to make the letter have some value, in my opinion, some of the other questions that we -- I've asked about is just things to be cognizant of as one applies the LMP.

MEMBER BALLINGER: That's where I come from. I think there's an opportunity in these letters to kind of poke at what we think needs to be discussed in a little bit more detail.

CHAIRMAN PETTI: That's where, I was struggling so, you know, I've asked questions about this as part of our Part 53 deliberations and, again, I've been on the Committee long enough to know. I mean, we're iterating the same thing in multiple letters, you know, it might have value. Others may think that it's a little redundant. I don't know.

MEMBER BROWN: I missed -- I guess my only point relative to is, was your comment relative to the qualitative aspects, not much quantitative but yet the argument was made that there will be -- I'm not sure

I'm phrasing this right -- something quantitative later. And I, so I wasn't sure where that's coming from based on the discussion. So that's my only, if we write the letter, we ought to make sure we have some point that we want. That was the only thing that stuck out in the overall discussion to me. I might have missed something else, but if somebody else has a comment, go ahead.

CHAIRMAN PETTI: Okay.

MEMBER DIMITRIJEVIC: Dave?

CHAIRMAN PETTI: Yes, you're next. Yeah. I was just going to call you.

MEMBER DIMITRIJEVIC: Okay. So, you know, the, I sort of agree with Dennis because this is not really deviation from NEI 18-04, which is a part of this Reg Guide 1.233 future design, you know 50.53, which we already reviewed. Why would I want that we don't really write a letter, but I really don't have a strong opinion if you find somebody to write the letter, is because they don't have anything specific for them.

And we don't really know how their, you know, their PRA is going to look like, how their other design documents are going to look, there is nothing there that we can actually estimate how will this

application -- there is nothing on application of the NEI except saying we are going to apply.

So there is no information related to application itself except it's just, you know, saying okay there is this guide that I'm going to essentially apply with these minor changes. So, in my opinion, I don't think we need to write letter to this. It's, you know, good opportunity for, you know, when we review our, when we continue our future plant design deliberation to keep in mind those changes they find necessary to make and what some of selections that didn't but that's all so -- that's my opinion of the subject.

CHAIRMAN PETTI: Jose.

MEMBER MARCH-LEUBA: Hold on, it took a while to -- yeah. I'm going to disagree with some of my colleagues. I think we do need a letter. I encourage a letter because this is an Earth-shattering event. It's an incredible deviation from the state-of-the-art. This is the first time a plant comes to us and says we are going to use LMP to define our LBEs. Definitely, ACRS should opine on that. And deviations from NEI, I think we should wade into them, but the fact that they use it, as I said, is Earth-shattering. It is game-changing. We should not be

silent on it. Thank you.

CHAIRMAN PETTI: Okay. Walt, sorry I skipped you. I --

MEMBER KIRCHNER: Yes. It is something of a precedent and that may be, assuming that we have something of substance to say in the letter, should be acknowledged. So I'm with, I guess I'm in Jose's camp, but I'm also sympathetic to Vesna's point at this, we don't have a lot of detail. The few changes from the NEI document may or may not be of note.

We did have an interesting discussion with the applicant on the defense-in-depth approach. If there is something of merit there, then that probably is worth a comment. And, of course, they scratched my particular itch about shutdown and maintaining shutdown conditions. So from my standpoint, that's a nice precedent to document and share with future applicants, but that's one member's opinion.

CHAIRMAN PETTI: Joy.

MEMBER REMPE: So before I mention my thoughts on this, I'd also remind everyone of the point I brought up to Jose earlier today about that all we can do as a Subcommittee is make a recommendation for consideration by the full Committee. So this is a little late to say, we're not

going to write a letter other -- unfortunately, you could really have a very short presentation, but we need to have some sort of process in mind because it's a bit late to decide that we will or won't have a letter as a Subcommittee for what's going to happen at the full Committee meeting, okay? With just --

CHAIRMAN PETTI: Our P&P would be too late, right?

MEMBER REMPE: Yes. And so, you know, we're kind of trapped by process here, and that's something we can talk about tomorrow at the retreat. But this is a little late in the process to make that decision other than come to the meeting and then decide that we don't want to do a letter. But yet anyway, that's kind of where that's at.

With respect to a letter, I wholeheartedly agree unless there is something worthwhile to say, it doesn't mean a lot unless it is a very short letter. Despite the, and so the differences of what they've said about looking at the third critical safety function about make sure you're in a stable, safe shutdown state is great.

I note that we didn't discuss that even though they have the first critical safety function about maintaining radioactivity in that report, they

actually mention that they plan to ask for an exemption for that critical safety function. So we will have to see what that's about in the future. And clearly what's going to be interesting is when they finally pick the licensing basis events, and we start evaluating the application.

So, you know again, I would make the letter pretty short, note some differences that we will be very interested in seeing how the defense-in-depth thing is being applied ultimately and, you know, things like that, that I wouldn't buy in whole-hog to the report because it's got a lot of open items to be determined.

CHAIRMAN PETTI: So let me just ask a process question. The fact that NRC did not ask for a letter, is that a get out of jail free card that we could just decide not to write a letter?

MEMBER REMPE: No, we write letters often when we're not asked for one. You know, again, we --

CHAIRMAN PETTI: Okay, Dennis is of a different opinion. When we talked about this, he thought we had a way out but --

MEMBER REMPE: -- but again, we can't -- it doesn't matter whether they ask for one or not. And yeah, that might be a way out, but that way out

has to be stated at the meeting, you know.

MEMBER BROWN: Dave, for your information, I have had subcommittee meetings and I have not written letters on them. So that's --

MEMBER REMPE: Right. But we last P&P said we we're going to do a letter, and now we're doing this decision-making at a subcommittee and usually you've got a whole month and there's a bit more time.

MEMBER BROWN: I agree with that point, Joy. I'm just saying that we do have subcommittee meetings typically in my circumstances, they've been an early review followed by a subsequent subcommittee meeting before we wrote the letter if we were -- and there have been one two of them when I didn't write a letter all. But the NRC didn't ask for one, and we finished the review. It was kind of pro forma, and we didn't do anything, but that was some years ago.

So Dennis is right. We have not always written letters on this meeting, but we did commit to this, and we've got that on the schedule. And to me, the only way we get out of that, in one way, is to reschedule the letter for a later full Committee meeting and then try to refine our differences in a subsequent subcommittee meeting to know where we want

to go with it because we're putting our Betty Crocker/ Good Housekeeping seal of approval on this. And Joy is right, we really didn't go into the -- oh, geez. My brain just fried.

MEMBER SUNSERI: This is Matt. I would like to weigh in on the governance of this topic a little bit. First off, I don't think it's, I wouldn't characterize it as late or whatever. I mean, it's pretty typical that we have subcommittee presentations on topics and then the next full Committee meeting we write the letter.

And I've also seen it pretty typical in the past, as Charlie has mentioned, where a subcommittee has convened and decided not to write a letter. Just because the P&P a couple of months ago without the benefit of any discussion of this made room for a letter on the full Committee agenda, doesn't mean we're obligated to write a letter.

So I think we're at our complete discretion at this Subcommittee. If the Subcommittee agrees that no letter is required, then that report goes forward to the full Committee, of which by the way, everyone is here except for one right now. And that would be perfectly in line with our by-laws, which I've just reviewed quickly, and I don't see

anything to the contrary there.

MEMBER REMPE: Well, we can decide at the full Committee, but I would contend a subcommittee cannot make a decision, even though only one member is missing and that member may not be there at the full Committee. It's just historic that the full Committee makes decisions. Because if you start --

MEMBER SUNSERI: Yes.

MEMBER REMPE: -- saying we can make that decision --

MEMBER SUNSERI: I --

MEMBER REMPE: -- at the subcommittee meeting, you might have three members at present or two trying to make the decision.

MEMBER SUNSERI: And that's the authority that the full Committee has delegated to the subcommittees.

MEMBER RICCARDELLA: I thought the, this is Pete, I thought the process was the subcommittee makes a recommendation to the full Committee as to whether or not a letter was required and the full Committee makes a decision.

MEMBER REMPE: That's the way I understand the process.

MEMBER RICCARDELLA: And we could do that

at P&P.

MEMBER REMPE: Yeah. And, you know, I don't think you can let a subcommittee start making recommendations and assume it's going to be accepted at the full Committee even though it's very likely here.

CHAIRMAN PETTI: So Pete, what's your viewpoint on the need for a letter?

MEMBER RICCARDELLA: I tend to lean with not thinking one is needed because I don't see where it would have anything substantive to say, and the staff hasn't requested it, but I'll go along with whatever the Committee decides on, whatever the majority of the Committee feels.

CHAIRMAN PETTI: Well, I think it's close. It's kind of like, what, there's only eight of us. I think it's 5-3.

MEMBER DIMITRIJEVIC: Dave?

CHAIRMAN PETTI: Yeah.

MEMBER DIMITRIJEVIC: Dave, I was thinking what I forgot to tell you when I was talking that if we didn't write the letter on 123, right, Reg Guide 1.223, which endorses 18-04. So what will happen, like technically, what if we don't endorse 18-04 but here we write a letter prematurely? I mean, you know,

that's one of the things that technically one should come after another.

CHAIRMAN PETTI: Yeah --

MEMBER DIMITRIJEVIC: I don't think we really want to; you know, we had the meetings about the 1.223 Reg Guide, which endorsed NEI. But I don't, I mean, I know that --

MEMBER RICCARDELLA: Yes.

MEMBER SUNSERI: We did.

CHAIRMAN PETTI: Well, maybe we did though. Other members know? Did we write one on 1.233?

MEMBER REMPE: We wrote in the -- I thought we did on the LMP. I thought it was more on the NEI document rather than the Reg Guide, but I'd have to go back and --

MEMBER DIMITRIJEVIC: That I guess -- yeah, he may know.

MEMBER REMPE: I guess I --

MEMBER SUNSERI: Yes. I think we're on record with regards to the LMP.

MEMBER BROWN: We did do an LMP letter. That was Dennis' committee --

MEMBER SUNSERI: Yes.

MEMBER BROWN: -- a while back now.

MEMBER KIRCHNER: Dave? This is Walt. One thought is, you're the chair of this particular project. Since it's kind of a mixed, you're getting a mixed set of opinions, maybe we should defer to your recommendation. This is one of, well we did two previous ones, if in your assessment this is an important thing to document as part of our deliberations on the Kairos eventually, I'm hopeful that we will see an application. And maybe we follow your lead since you already admitted you had a draft and made that much of an effort. If you think this is a good, worthwhile thing to document in the path forward, then I think the Committee would follow your recommendation.

MEMBER MARCH-LEUBA: Yeah, I want to put another concept in there. I mean, it is true that those Reg Guides we already have letters and everything, but we just got a couple of things from the applicant that are important.

Number one, the only I really care, is they said if we use LMP, we believe we have to use PRA Level 3 for every event. On just that one, deserves a letter and our endorsement and high publicity. You do whatever you want, but the fact that this applicant is at least said verbally, that if I use LMP, I think

that the logical progression of that requires me to do a PRA Level 3 for each and every one of my transients, that's big. That's big. All right, over and out.

MEMBER DIMITRIJEVIC: Jose, how do you mention they are going to use F-C curve? They need those. They need the frequency and the only Level 3 means is, you know, the PRA which calculates dose release. So without Level 3 PRA, you cannot use the F-C curve.

MEMBER MARCH-LEUBA: Yeah, yeah. But this is in writing.

MEMBER SUNSERI: So Dave, I think, to me, I guess I will weigh on the letter or not letter. I don't think a letter adds much value at this stage because they're just outlining the process that they're going to bring their application forward with. Our detailed safety review will be done on the parts and if there is a significant finding associated with the PRA or the way they encompass safety systems or anything else, we will weigh in at that time based on specific information that is provided to us, not speculation at this time what might or might not be before us.

So I would say the fact that they're following the LMP and laid out a road map on how they

are going to do that, and the staff agrees with that, is sufficient. It should be sufficient for us. And, therefore, I would conclude no letter is necessary.

CHAIRMAN PETTI: Derek tells me on the chat that he's got information about the letter we wrote. Derek?

MR. WIDMAYER: Yes. The letter that you guys wrote on that Reg Guide, it was an early version of the SECY paper and an early version of the Regulatory Guide. And you did endorse it. You haven't said anything about the final versions, but those were minor edits that were made. And, in fact, Dennis, on his own, decided it wasn't needed to review the final Reg Guide. It was pretty much the same as the draft.

MEMBER DIMITRIJEVIC: Okay, well thanks, Derek. That means we will not have a contradiction if we endorse already the Reg Guide. So that means we endorse NEI. Do we endorse F-C curves? That means that --

MR. WIDMAYER: Yes, and of course, he said, you know, the proof of the pudding is when the rubber meets the road, so to speak. So but, yes, you said it was a reasonable approach.

CHAIRMAN PETTI: So here's what I'm

thinking, I'm not -- all the issues that we have raised, we've raised in other contexts of Part 53, right, for instance, isn't on the street yet, I don't think, but we went over it at the last meeting. I would like to request a delay of the full Committee meeting to November. In October I will make the recommendation. The Committee can vote. I hope they would take the recommendation of the chair of no letter and then we would not have that meeting in November. That's the only way I can see this staying inside all of these crazy rules.

Because what I don't want to do is to drag the staff from Kairos because, you know, a lot of P&Ps at the end of the week, not at the beginning of the week, that sort of stuff. Is that a way around things?

MEMBER REMPE: With the current situation, I think it's a great way to go.

CHAIRMAN PETTI: Yeah.

MEMBER SUNSERI: So, I mean, so it's already on the agenda, right? I mean, if it's already been issued and --

MEMBER REMPE: Well, we've regularly said we're going to delay something.

MEMBER SUNSERI: I know, but, I mean it

won't even get to the November, right? So if we start the October meeting, we don't have the presentation, we wait 'til Friday on the P&P, Dave makes his presentation, we vote. I mean, it's done, right?

MEMBER REMPE: That's what I would think.

CHAIRMAN PETTI: Yeah. I just don't want to drag the NRC staff and Kairos to the October meeting.

MEMBER REMPE: Are there enough members that you got a majority here, Dave? I kind of lost track, but I would second with what you're saying, but we need to go through and make sure we have a majority if we're going to delay, right?

MR. MOORE: This is Scott. May I be recognized, Mr. Chairman, Chairman Petti?

CHAIRMAN PETTI: I thought you were talking to Matt.

MR. MOORE: No, I'm talking to you, Chairman Petti.

CHAIRMAN PETTI: Okay. Yes, go ahead.

MR. MOORE: So Vice Chairman Rempe and the others that weighed in, I think are correct that the subcommittee can't make specific decisions in the subcommittee. The by-law actually says that, you know, a subcommittee may also recommend a particular

course of action to the full Committee.

That said, I think that the Committee wants to be careful about considering non-actions. For instance, not doing something as needing votes because the Committee does that kind of thing all the time. I don't think in the past when the Committee has decided not to write letters that those have been going to the Committee for votes.

And so I think if needed in cases when the Committee is, well, excuse me, when the subcommittee is split on something or if there is a reason to take it to the full Committee, sure, go to the full Committee. But I think it would be not recommended for every subcommittee to have to go to the full Committee every time it didn't want to write a letter on something.

MEMBER REMPE: So the reason I have my opinion is because of the numerous MELLLA+ reviews we did, and we had to be, decide with a lot of forethought, and we could not just make that decision. And it took a lot of support that way to do it.

MEMBER KIRCHNER: But, Joy, wait a minute.

MEMBER REMPE: So that's -- it's not that background.

MEMBER KIRCHNER: -- wait a minute. The

MELLLA+ things were license amendments and that's a different category altogether. That's a statutory responsibility. There's no proscribed statutory responsibility to review these TRs.

MEMBER REMPE: That's true, but then we've had this discussion with Jose on other topics that way, and I think this is something we need to really iron out in the retreat and document so that it's available for all members to see in the by-laws to try and make sure it's well understood.

MR. MOORE: Okay.

MEMBER MARCH-LEUBA: Yeah, I concur. That we need the rules -- we don't need to modify the by-laws but have the rules understood because when I get an email saying this is the list of Topical Reports are available for review and I say this one, this one, and that one. Why do I have to do that? We need to decide on these things and come up with a process.

MEMBER KIRCHNER: You're a good judgment, Jose.

MEMBER MARCH-LEUBA: I know, I know. I like my judgment.

MEMBER KIRCHNER: Just like the Reg Guides.

MEMBER MARCH-LEUBA: Yes.

MEMBER KIRCHNER: Just like the Reg Guides.

MEMBER MARCH-LEUBA: Yeah.

MEMBER KIRCHNER: Because again, it falls in a similar category and then we follow the lead of our lead member on the topic.

MEMBER MARCH-LEUBA: My judgment says to have a little guidance and not have one or B or three, and I've been overruled on both. Okay, so let's just --

MEMBER BROWN: I'm going to chime in. I'm going to be consistent somehow here with Scott in that I definitely did make some decisions to not write letters on stuff during a subcommittee meeting along with the members of the subcommittee, but we normally had follow-up meetings scheduled later, generally. I will say that there was one or two times when I didn't, but that was six or seven years ago. So we've been more aggressive in the last few years at making sure we documented, ran it through the, you know, confirm we were going to do a letter early. But I don't think it's against any of our rules for the Subcommittee to decide we're not going to do a letter on this. This is a Topical Report. It's not a statutory item. So Walt's right from that standpoint.

MEMBER REMPE: Actually, MELLLA+ wasn't a statutory item. It was something that the ACRS requested and then we decided to stop.

MEMBER BROWN: That was a licensing, the initial parts of it were licensing events.

MEMBER REMPE: It's not like a power uprate. It was basically a way of --

MEMBER BROWN: Getting more power.

MEMBER REMPE: -- controlling the reactor and so it was -- yes, it was a licensing amendment request but, frankly, there are a lot of license amendment requests that we don't write letters on, too. So, again, I just think we need to be careful because I wanted to stop them a long time ago, and we could not do that. Anyway, it's just from what has happened to me in the past. But I don't think the laws, by-laws are very clear about it.

CHAIRMAN PETTI: Okay. Well, I'm sure we will discuss this more tomorrow.

MEMBER SUNSERI: But, Dave, do you have a clear course of action that you're going to have right now? Do you feel like you got the majority point here to proceed down the path you've described?

CHAIRMAN PETTI: Yeah. I think so. So all I need is a majority, right? A simple majority?

MEMBER SUNSERI: Well --

MEMBER BROWN: Yes.

MEMBER SUNSERI: -- I suppose if you want to call a vote but if you're the decision-maker of the Subcommittee and you just get everybody's input --

CHAIRMAN PETTI: Right.

MEMBER SUNSERI: -- your counts 10, I don't, you know, it's your call.

CHAIRMAN PETTI: Yes. No, I prefer to do what I said I was going to do, which is, I guess, officially delay it, delay the full Committee meeting and then --

MEMBER SUNSERI: Yes, and then --

CHAIRMAN PETTI: -- then not have it.

MEMBER KIRCHNER: Yes. We need to be decisive here in fairness to the staff and the applicant.

CHAIRMAN PETTI: Right.

MEMBER KIRCHNER: And just say, we're not going to do it in October. And we can deliberate all the other ins and outs after. But, you know, I think that would be a reasonable conclusion to draw at this juncture.

CHAIRMAN PETTI: Right. So that's my position. If we don't have to vote, fine.

MEMBER BROWN: I have no problem with that.

CHAIRMAN PETTI: Probably back to you then, Mr. Chairman. I guess we're done with the subcommittee meeting.

MEMBER SUNSERI: No. You're the chairman. So --

CHAIRMAN PETTI: Okay. I'm ready to adjourn unless someone has another discussion point.

MEMBER SUNSERI: No, I'm good, Dave. Thanks.

MEMBER BROWN: I'm good also, Dave.

CHAIRMAN PETTI: Okay.

MEMBER REMPE: Thank you.

CHAIRMAN PETTI: Then we're done. We will see everybody tomorrow.

(Whereupon, the above-entitled matter went off the record at 4:10 p.m.)

Kairos Power

KP-NRC-2009-006

September 18, 2020

Docket No. 99902069

US Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Kairos Power LLC
Presentation Materials for Kairos Power Briefing to the Advisory Committee on Reactor Safeguards on the Risk-Informed Performance-Based Licensing Basis Development Methodology Topical Report

This letter transmits presentation materials for the September 24, 2020 briefing for the Advisory Committee for Reactor Safeguards (ACRS), Kairos Power Subcommittee. At the meeting, participants will discuss the Risk-Informed Performance-Based Licensing Basis Development topical report (KP-TR-009-NP) that was submitted to the Nuclear Regulatory Commission for review and approval (ADAMS Accession No. ML20101P623).

Enclosure 1 provides the non-proprietary presentation materials. Kairos Power authorizes the Nuclear Regulatory Commission to reproduce and distribute the submitted non-proprietary content, as necessary, to support the conduct of their regulatory responsibilities.

If you have any questions or need any additional information, please contact Drew Peebles at peebles@kairospower.com or (704) 275-5388 or Darrell Gardner at gardner@kairospower.com or (704)-769-1226.

Sincerely,

Darrell Gardner for

Peter Hastings, PE
Vice President, Regulatory Affairs and Quality

Enclosures:

1) Presentation Materials for the September 24, 2020 ACRS Briefing (non-proprietary)

xc (w/enclosure):

Benjamin Beasley, Chief, Advanced Reactor Licensing Branch
Stewart Magruder, Project Manager, Advanced Reactor Licensing Branch
Weidong Wang, Senior Staff Engineer, Advisory Committee for Reactor Safeguards

Enclosure 1

Presentation Materials for the September 24, 2020 ACRS Briefing (non-proprietary)

Kairos Power

RISK-INFORMED PERFORMANCE-BASED LICENSING BASIS DEVELOPMENT METHODOLOGY

ACRS SUBCOMMITTEE MEETING

SEPTEMBER 24, 2020

Kairos Power’s mission is to enable the world’s transition to clean energy, with the ultimate goal of dramatically improving people’s quality of life while protecting the environment.

Agenda

- Introductions and Opening Remarks
- Background of content in Kairos Power's LMP Topical Report
- Comparison of NEI 18-04 and KP-TR-009-NP

Background

- NEI Papers on LBE, PRA, SSC safety classification, and DID adequacy
  - Reviewed by ACRS
  - Input to an integrated guidance document
- NEI 18-04
  - Integrates the guidance from the NEI papers into a document for NRC endorsement
  - Reviewed by ACRS
  - NRC RG 1.233 endorses guidance in NEI 18-04
- Kairos Power Topical Report is based on NEI 18-04
  - Same fundamental methodology
  - Minor changes/departures
- Kairos Power requested NRC review and approval of the methodology as an adequate means to define and evaluate LBEs, classify SSCs, and assess DID adequacy for KP-FHR technology. The NRC has produced a draft SER to approve this methodology.

Comparison of NEI 18-04 and KP-TR-009-NP

- The Kairos Power topical report (KP-TR-009-NP) replicates the methodology from NEI 18-04 with minor changes to the content.
- This presentation will compare and contrast the substantive differences between the reports.
- Editorial changes are excluded from this comparison, including:
  - Re-formatting
  - Identifying language that indicates Kairos Power is implementing methodology
  - Grammar/syntax corrections
  - Style choices (replace "**modules**" with "**units**", replace "**should be**" with "**is**" or "**are**")

Section 3 Selection of Licensing Basis Events

- NEI 18-04, Rev. 1
  - 3.1 Licensing Basis Event Definitions
  - 3.2 **Advanced Non-LWR** LBE Selection Approach
    - 3.2.1 Frequency–Consequence Evaluation Criteria
    - 3.2.2 LBE Selection Process
    - 3.2.3 Evolution of LBEs Through Design **and Licensing** Stages
  - 3.3 Role of the PRA in LBE Selection
    - 3.3.1 Use of PRA in LBE Selection Process
    - 3.3.2 **Non-LWR** PRA Scope for LBE Selection
    - 3.3.3 PRA Scope Adequacy
    - 3.3.4 **PRA** Safety Functions
    - 3.3.5 **Selection of** Risk Metrics for PRA Model Development
    - 3.3.6 Contributors to Risk and Risk Importance Measures
- KP-TR-009-NP, Rev. 1
  - 3.1 Licensing Basis Event Definitions
  - 3.2 LBE Selection Approach
    - 3.2.1 Frequency–Consequence Evaluation Criteria
    - 3.2.2 LBE Selection Process
    - 3.2.3 Evolution of LBEs Through Design Stages
  - 3.3 Role of the PRA in LBE Selection
    - 3.3.1 Use of PRA in LBE Selection Process
    - 3.3.2 PRA Scope for LBE Selection
    - 3.3.3 PRA Scope Adequacy
    - 3.3.4 Safety Functions
    - 3.3.5 Risk Metrics for PRA Model Development
    - 3.3.6 Contributors to Risk and Risk Importance Measures

Section 3 Comparison of NEI 18-04 and KP-TR-009-NP

- Similarities
  - Definitions for AOOs, DBEs, BDBEs, DBAs
  - Definition of the Frequency-Consequence target criteria
  - Use of PRA in LBE selection to develop a comprehensive set of initiating events and event sequences
  - PRA scope addresses spectrum of internal events and external hazards
  - Reactor safety functions defined to correspond to functions modeled in the PRA
  - Overall plant risk metrics defined and risk-significance evaluations performed
  - Kairos importance measure selected from the list of possible measures given in NEI 18-04
- Kairos-specific implementation
  - Replace "The LBEs **identified** in the PRA…" with "The LBEs **corresponding to event sequence families** in the PRA…"
  - Replace "**PRA** Safety Functions" with "Safety Functions"
  - DBA consequences to be calculated using sufficiently bounding models that may not include direct 95th percentile calculation

Section 4 Safety Class and Performance Criteria for SSCs

- NEI 18-04, Rev. 1
  - 4.1 SSC Safety Classification Approach **for Advanced Non-LWRs**
  - 4.2 Definition of Safety-Significant and Risk-Significant SSCs
    - 4.2.1 Safety-Significant SSCs
    - 4.2.2 Risk-Significant SSCs
  - 4.3 SSCs Required for Defense-in-Depth Adequacy
  - 4.4 Development of SSC Design and Performance Requirements
    - 4.4.1 Required Functional Design Criteria for Safety-Related SSCs
    - 4.4.2 **Regulatory** Design Requirements for Safety-Related SSCs
    - 4.4.3 Evaluation of SSC Performance Against Design Requirements
    - 4.4.4 Barrier Design Requirements
    - 4.4.5 Special Treatment Requirements for SSCs
- KP-TR-009-NP, Rev. 1
  - 4.1 SSC Safety Classification Approach
  - 4.2 Definition of Safety-Significant and Risk-Significant SSCs
    - 4.2.1 Safety-Significant SSCs
    - 4.2.2 Risk-Significant SSCs
  - 4.3 SSCs Required for Defense-in-Depth Adequacy
  - 4.4 Development of SSC Design and Performance Requirements
    - 4.4.1 Required Functional Design Criteria for Safety-Related SSCs
    - 4.4.2 Design Requirements for Safety-Related SSCs
    - 4.4.3 Evaluation of SSC Performance Against Design Requirements
    - 4.4.4 Barrier Design Requirements
    - 4.4.5 Special Treatment Requirements for SSCs

Section 4 Comparison of NEI 18-04 and KP-TR-009-NP

- Similarities
  - SSC safety classification approach
  - Definitions of safety-significant and risk-significant SSCs
  - Safety-significance of SSCs required for Defense-in-Depth adequacy
  - Required functional design criteria for safety-related SSCs includes mitigating DBEs and DBAs, and preventing high-consequence BDBEs
  - Design requirements established for safety-related SSCs fulfilling Required Safety Functions
  - Evaluation of safety-related and NSRST SSC performance against Frequency-Consequence targets
  - Radionuclide retention barriers have design criteria derived from evaluation of LBEs against F-C Targets and RFDCs
  - Special treatment requirements added for safety-related and NSRST SSCs
- Kairos-specific implementation
  - Replace "**shall** not exceed" with "**should** not exceed" for integrated plant risk targets
  - Additional required functional design criterion included for shutting down the reactor and maintaining safe shutdown

Section 5 Evaluation of DID Adequacy (1 of 2)

- NEI 18-04, Rev. 1
- 5.1 Defense-in-Depth Philosophy
- 5.2 Framework for Establishing Defense-in-Depth Adequacy
- 5.3 Integrated Framework for Incorporation and Evaluation of DID
- 5.4 How Major Elements of the **TI-**RIPB Framework are Employed to Establish DID Adequacy
- 5.5 RIPB Compensatory Action Selection and Sufficiency
- 5.6 Establishing the Adequacy of Plant Capability DID
  - 5.6.1 Guidelines for Plant Capability DID Adequacy
  - 5.6.2 DID Guidelines for Defining Safety-Significant SSCs
  - 5.6.3 DID Attributes to Achieve Plant Capability DID Adequacy

- KP-TR-009-NP, Rev. 1
- 5.1 Defense-in-Depth Philosophy
- 5.2 Framework for Establishing Defense-in-Depth Adequacy
- 5.3 Integrated Framework for Incorporation and Evaluation of DID
- 5.4 How Major Elements of the RIPB Framework are Employed to Establish DID Adequacy
- 5.5 RIPB Compensatory Action Selection and Sufficiency
- 5.6 Establishing the Adequacy of Plant Capability DID
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  - 5.6.2 DID Guidelines for Defining Safety-Significant SSCs
  - 5.6.3 DID Attributes to Achieve Plant Capability DID Adequacy

Section 5 Evaluation of DID Adequacy (2 of 2)

- NEI 18-04, Rev. 1
  - 5.7 Evaluation of LBEs Against Layers of Defense
    - 5.7.1 Evaluation of LBE and Plant Risk Margins
    - 5.7.2 Integrated Decision-Making **Process** Focus in LBE Review
  - 5.8 Establishing the Adequacy of Programmatic DID
    - 5.8.1 Guidelines for Programmatic DID Adequacy
    - 5.8.2 Application of Programmatic DID Guidelines
  - 5.9 Risk-Informed and Performance-Based Evaluation of DID Adequacy
    - 5.9.1 Purpose and Scope of Integrated Decision-Making **Process**
    - 5.9.2 Risk-Informed and Performance-Based Decision Making
    - 5.9.3 IDP Actions to **Establish** DID Adequacy
    - 5.9.4 IDP Considerations in the Evaluation of DID Adequacy
    - **5.9.5 Baseline Evaluation of Defense-in-Depth**
    - **5.9.6 Considerations in Documenting Evaluation of Plant Capability and Programmatic DID**
    - 5.9.**7** Evaluation of Changes to Defense-in-Depth

- KP-TR-009-NP, Rev. 1
  - 5.7 Evaluation of LBEs Against Layers of Defense
    - 5.7.1 Evaluation of LBE and Plant Risk Margins
    - 5.7.2 Integrated Decision-Making **Panel** Focus in LBE Review
  - 5.8 Establishing the Adequacy of Programmatic DID
    - 5.8.1 Guidelines for Programmatic DID Adequacy
    - 5.8.2 Application of Programmatic DID Guidelines
  - 5.9 Risk-Informed and Performance-Based Evaluation of DID Adequacy
    - 5.9.1 Purpose and Scope of Integrated Decision-Making **Panel**
    - 5.9.2 Risk-Informed and Performance-Based Decision Making
    - 5.9.3 IDP Actions to **Confirm** DID Adequacy
    - 5.9.**4** Evaluation of Changes to Defense-in-Depth

Section 5 Comparison of NEI 18-04 and KP-TR-009-NP

- Similarities
  - Defense-in-depth philosophy
  - Framework for establishing DID adequacy includes Plant Capability, Programmatic, and Risk-Informed elements
  - 18 tasks in an integrated framework for information of evaluation of defense-in-depth
  - Approach to establishing the adequacy of plant capability DID using the same guidelines
  - Evaluation of LBEs against layers of defense
  - Establishing adequacy of programmatic DID using the same guidelines
  - Risk-informed, performance-based evaluation of DID adequacy using the IDP
- Kairos-specific implementations
  - Replace “Integrated Decision-Making **Process**” with “Integrated Decision-Making **Panel**”
  - Programmatic focus on event sequence frequency targets rather than SSC reliability targets (at the SSC level, focus on performance-based measures)
  - Section 5.9.5 and 5.9.6 in NEI 18-04 provided helpful information for developers on internal baselines and documentation, but these sections were relevant to the topical report

Conclusions

- Kairos Power considers the Licensing Modernization Project methodologies as an adequate means to develop Licensing Basis Events, SSC safety classifications, and to confirm the adequacy of the defense-in-depth attributes of the KP-FHR.
- The report details the KP-FHR methodologies, which are based on the methodologies presented in NEI 18-04 and RG 1.233
- Kairos Power requested NRC review and approval of the methodology as an adequate means to define and evaluate LBEs, classify SSCs, and assess DID adequacy for KP-FHR technology. The NRC has produced a draft SER to approve this methodology.


Questions

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

Presentation to the ACRS Kairos Power Subcommittee

Staff Review of Kairos Topical Reports

KP-TR-009, REV 1,
"KP-FHR Risk-Informed Performance-Based Licensing Basis Development Methodology"

Presenters:

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(Open Session)

"KP-FHR Risk-Informed Performance-Based Licensing Basis Development Methodology" Review Overview

- Regulatory Basis
- Review scope and approach
- Deviations from NEI 18-04
- Conclusions

Regulatory Basis

- An approved methodology to select the licensing basis events, classify the structures, systems, and components, and assess defense-in-depth adequacy is used to inform the licensing basis and content of applications for non-light water reactors (non-LWRs).

- Applicable regulations:
  - 10 CFR 50.34, 10 CFR 52.47, 10 CFR 52.79, 10 CFR 52.137, and 10 CFR 52.157 "Contents of Applications" require a safety analysis and an evaluation of the safety features and barriers to a radioactive release to be included in a preliminary or final safety analysis report.

- Regulatory Guide 1.233 provides the NRC staff's guidance on using a technology-inclusive, risk-informed, and performance-based (TI-RIPB) methodology to inform the licensing basis and content of applications for non-LWRs. It endorses, with clarifications, NEI 18-04, Revision 1, as one acceptable method for non-LWR designers to use when carrying out these activities and preparing their applications. (Regulatory Guide 1.233 is the finalized version of Draft Regulatory Guide 1353)

Review Scope and Approach

- Topical Report (TR) Methodology Basis
  - Based on NEI 18-04 and RG 1.233 (DG-1353)
  - Customized version of the technology-inclusive NEI 18-04 methodology updated to be specific to the KP-FHR technology
  - Deviates from NEI 18-04 with a limited number of minor differences that do not alter the principles and methodology of NEI 18-04 and RG 1.233 (DG-1353)

- Deviations from NEI 18-04
  - Review scope narrowed to assessing the differences between the TR and NEI 18-04 and confirming that the TR incorporates the applicable clarifications identified in RG 1.233
  - All the differences reviewed but primarily focused on those considered to be of some significance

Deviations from NEI 18-04

- TR Section 3
  - In describing Task 7a of Figure 3.2 the TR deviates from NEI 18-04 in that it allows for the use of qualitative arguments instead of quantitative calculation of uncertainty for determining the bounding consequences of each design basis accident. The TR methodology commits to justify that the design basis accident evaluation models are sufficiently bounding using future licensing submittals.
  - This is reasonable from a methodology perspective because the staff will have a future opportunity to assess the acceptability of any qualitative arguments and does not make a finding on the acceptability of potential future qualitative arguments from a technical perspective.

Deviations from NEI 18-04 cont.

- TR Section 3
  - TR Section 3.3.6 describes the process for establishing the risk significance of SSCs. The process is reasonable because it is an element of the integrated RIPB approach in the TR and is the same as NEI 18-04.
  - Currently an industry led PRA standard for non-LWRs is being developed which is expected to be endorsed by the NRC staff via a Regulatory Guide. The standard may define risk significance of SSCs differently from the TR.
  - Item 2 of the Limitations and Conditions section of the safety evaluation states the applicant should address, or justify alternatives to, the acceptance criteria in the Regulatory Guide and endorsed PRA standard related to the determination of risk significance of SSCs as a part of implementing the methodology in this TR.

Deviations from NEI 18-04 cont.

- TR Section 4
  - The first two criteria used as the definition for safety-rated SSCs in the TR are the same as those in NEI 18-04. The TR adds a third criterion for a set of SSCs performing reactor shutdown function. The TR states that the addition is to ensure that the definition in 10 CFR 50.2, "Definitions," is addressed with the exception of the portion of this definition for which Kairos plans to request an exemption.
  - Adding the third criterion is acceptable since the prescriptive criterion is consistent with the regulations and has the potential to increase the number of safety-related SSCs beyond those identified by the two other criteria.
  - Item 1 of the Limitations and Conditions section of the safety evaluation states that the NRC is not approving any exemptions from NRC regulations, and an applicant using the TR will need to address compliance with pertinent regulations and request exemptions as needed.

Deviations from NEI 18-04 cont.

- TR Section 5
  - TR Section 5.7 does not include general guidance for defense in depth layers and source term that do not translate to specific actions or documentation for the process described in NEI 18-04. The TR commits to justify the mechanistic source term approach using future licensing submittals.
  - This is reasonable from a methodology perspective because the staff will have a future opportunity to assess the acceptability of the mechanistic source term approach and does not make a finding on the acceptability of the mechanistic source term approach from a technical perspective.

Conclusions

- The NRC staff proposes to approve the KP-TR-009 topical report methodology to select the licensing basis events, classify the structures, systems, and components, and assess defense-in-depth adequacy to inform the licensing basis and content of applications, subject to the safety evaluation Limitations and Conditions.
  - The methodology is essentially the same as NRC staff approved NEI 18-04, Revision 1, and incorporates the applicable clarifications and points of emphasis from DG-1353, which has been finalized and issued as Regulatory Guide 1.233, Revision 0
  - The differences between the TR and NEI 18-04 have been evaluated to be reasonable

Backup Slides

Limitations and Conditions

- **1. (Section 3.1)** This SE does not approve any exemptions from NRC regulations, and an applicant using this TR will need to address compliance with pertinent regulations and request exemptions as needed.

- **2. (Section 3.3.6)** The JCNRM of the ANS/ASME is developing a PRA standard for non-LWRs. If the NRC staff concludes that the ANS/ASME PRA standard is acceptable, the staff expects to endorse the standard via a Regulatory Guide. If the Regulatory Guide is issued 6 months before submission of the licensing application, the applicant should address, or justify alternatives to, the acceptance criteria in the Regulatory Guide and endorsed PRA standard related to the determination of risk significance of SSCs as a part of implementing the methodology in this TR.

Safety-Related SSC Criteria

- NEI 18-04 and TR Criteria
  - Mitigate DBE within the F-C Target and DBAs within 10 CFR 50.34 dose limits
  - Prevent high-consequence BDBEs (those with doses exceeding 10 CFR 50.34 dose limits) from exceeding 10E-4/plant year in frequency and thereby migrating into the DBE region of the F-C evaluation
  - Shut down the reactor and maintain it in a safe shutdown condition

- 10 CFR 50.2
  - The integrity of the reactor coolant pressure boundary
  - The capability to shut down the reactor and maintain it in a safe shutdown condition
  - The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1) or § 100.11 of this chapter