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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FUTURE PLANT DESIGNS SUBCOMMITTEE

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THURSDAY

FEBRUARY 18, 2021

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The Subcommittee met via Video-Teleconference, at 9:30 a.m. EST, Dennis Bley, Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS BLEY, Member

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

VESNA B. DIMITRIJEVIC, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

DAVID A. PETTI, Member

JOY L. REMPE, Member

ACRS CONSULTANT:

MIKE CORRADINI

DESIGNATED FEDERAL OFFICIAL:

DEREK A. WIDMAYER

KENT HOWARD

ALSO PRESENT:

BOB BEALL, NMSS

CYRIL DRAFFIN, Public Participant

SCOTT MOORE, Executive Director, ACRS

WILLIAM RECKLEY, NRR

JOHN SEGALA, NRR

MARTIN STUTZKE, NRR

NANETTE VALLIERE, NRR

*Present via telephone

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

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

(9:30 a.m.)

CHAIRMAN BLEY: Good morning, the meeting will come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, Subcommittee for Future Plant Designs.

I am Dennis Bley, Chairman of the subcommittee. And ACRS Members in attendance, I'm going to track them all down, Derek, maybe you can help me as I go through it?

Joy Rempe, Ron Ballinger, Charlie Brown, Walt Kirchner, Dave Petti, Vesna Dimitrijevic, Jose March-Leuba, and our consultant Mike Corradini, I think is with us, but I haven't seen him on there among us.

Two of our members were not able to get here, one because of all the miserable weather in Texas. Derek Widmayer of the NRC staff is the designated federal official to this meeting. And Kent Howard of the ACRS staff is the backup designated federal official. Charlie Brown is my backup in case I get knocked off, and will take over chairing until I can get back.

The purpose of today's meeting is to discuss the primary rule language for 10 CFR Part 53

Licensing and Regulation of Advanced Nuclear Reactors, Subpart C, Design and Analysis Requirements and Subpart D, Siting Requirements. The subcommittee will gather information as well as relevant issues and facts and formulate proposed positions and actions as appropriate.

The subcommittee meeting is the second of several scheduled to discuss preliminary proposed rule language for Part 53. The current plan is for all these subcommittee meetings to be held before any proposed rule language is presented to the ACRS full committee.

However, at the subcommittee's discretion any matters can be considered for presentation to the full committee. The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. However, a committee can only speak through its published letter reports.

We hold these meetings to gather information and perform preparatory work that will support our deliberations, our deliberations at a full committee meeting. The rules for participation in all ACRS meetings including today's, were already announced in the Federal Register on June 13th, 2019.

The ACRS section of the U.S. NRC public

website provides our charter, bylaws, agendas, letter reports and transcripts of all full and subcommittee meetings, including slides presented there. The meeting notice and agenda for this meeting were also posted there.

As stated in the Federal Register Notice, and in the public meeting notice posted to the website, members of the public that desire to provide written or oral input to the subcommittee may do so. You should contact the designated federal official, five days prior to the meeting when it's practicable.

Today's meeting is open to public attendance, and we have received no written statements or requests to make an oral statement. We have also set aside ten minutes in the agenda for spontaneous comments from members of the public who are attending or listening to our meetings.

Due to the COVID pandemic, today's meeting is being held over Microsoft TEAMS for ACRS and NRC staff attendees. There is also a telephone bridge line allowing participation of public over the phone.

A transcript of today's meeting is being kept. We therefore request that meeting participants on the bridge line, identify themselves when they ask to speak and to speak with sufficient clarity and

volume so they can be readily heard.

At this time, I ask that attendees on TEAMS and on the bridge line, keep their devices on mute to minimize disruptions and any online discussion.

We will now proceed with the meeting and I'll call on John Segala, Chief of the Advanced Reactor Policy Branch of NRR to make introductory remarks. John, please go ahead.

MS. SEGALA: Thank you and good morning. Consistent with the Nuclear Energy Innovation and Modernization Act, we are developing 10 CFR Part 53 a new alternative regulatory framework for Advanced Reactors that embraces risk-informed approaches and performance-based criteria that will be technology inclusive to a wide range of new technologies.

In order to meet the Commissions directed, schedule to publish the final Part 53 rule by October of 2024, we are having extensive stakeholder engagement to solicit feedback to better inform the staff's proposals. And to ensure a shared understanding of what will be included in the final rule.

We are here today, in the second of many ACRS meetings we will be having this year, to seek

ACRS feedback on NRC's development of Part 53 preliminary proposed rule language for Advanced Reactors. We previously briefed the ACRS Subcommittee meet in January on the first set of preliminary rule language, Subparts B and F.

Today we will be seeking ACRS feedback on the second set of preliminary rule language in Subpart C, Design and Analysis Requirements. And Subpart D, Siting Requirements. Since November, we have held three public meetings with stakeholders and have received a wide range of feedback, which the NRC staff is still assessing. We plan to share some of the stakeholder feedback with the ACRS today.

We are looking forward to hearing from the ACRS today on this second set of preliminary rule language for Part 53 and any insights and feedback that you all may have. This completes my opening remarks. Thanks.

CHAIRMAN BLEY: Thank you, John.

MR. CORRADINI: Hi, John, just can I ask quick question?

CHAIRMAN BLEY: Sure, go ahead, Mike.

MR. CORRADINI: John, the industry feedback seems to be, a quick read of it, seems to be -- I'm trying to find a good word, but I'll just say,

all over the map and not as positive as I suspect you'd want from a brand new rule for Part 53.

What is the plan for the staff? Are you going to answer the comments one by one? Or are you going to kind of give some sort of discussion on broad aspects of industry feedback?

MS. SEGALA: Well I think, you know, because Part 53 is, you know, technology inclusive, you know, we do have a broad range of stakeholders that are interested in this new regulation. So, it's not surprising that we're receiving, you know, a spectrum of comments and feedback on the proposed rule.

But what we've been doing is as we have been engaging with stakeholders on a particular subpart, we're trying to make sure that we hear from all stakeholders on a particular subpart. And then start looking at those, the feedback that we got and propose changes to those subparts and then discuss those at future stakeholder meetings to get feedback on where we're going.

So I think that's the general approach we're taking. I don't know if, Bob Beall or Bill Reckley, or Nan Valliere want to add anything to that?

CHAIRMAN BLEY: Okay, well thank you,

John.

MEMBER BALLINGER: This is Ron Ballinger.

CHAIRMAN BLEY: Go ahead, Ron.

MEMBER BALLINGER: You know, I went through and I've tried to more or less correlate the comments in the NEI letter with the slides that you're going to present today. And apart from not calling it NEI comments, stakeholder comment, a lot of the stakeholder comments that are in your slides seem to be relevant or correlated with the NEI letter. So I'm kind of looking forward to that discussion.

CHAIRMAN BLEY: Okay, thank you, Ron. Before we go ahead, I had something too that I need to bring up. In our last meeting, at least on my part and I think some of the other members, there was a lot of confusion about the two tiers that were introduced in Part B.

And we kind of -- I know Bill told us they were going to go back and think about that and get back to us. And I've done some of that as well. And I've talked to some of the lawyers who interceded and were involved back when this concept first developed, before it was used in the design certification process, which is a little different.

At least my impression is that it was kind

of needed under Part 50, and similarly under 52 it would have been needed. When your regulation is essentially rule-based, to be able to separate the essential rules from the important but not quite as essential rules.

It seems to me that Part 53 is moving toward a risk-informed structure, and that those concepts not only aren't needed, but don't quite make sense, at least to me. So, if you'll keep that in mind as you go ahead. And I hope you'll talk some about this. So whoever is up, please go ahead.

MR. RECKLEY: Thank you, Dennis. This is Bill Reckley, and we have a slide and I'll try to talk to that point.

If we could go to Slide 2, the agenda. As was just talked about, our primary desire today is to talk about Subpart C, the Design and Analysis subpart. And then this afternoon we get into Subpart D on the Siting Requirements.

But before we get into those discussions, we do have a bit of a summary of our past discussions on Subpart B, which lays out the safety criteria. And also the whole structure, and this will go to some degree to Dennis's last point.

So, if we could just go ahead and go to

Slide 3, this is --

MEMBER REMPE: Bill, this is Joy. I know we mentioned this a long time ago, maybe before we even had the meeting in January, the prior year or so. But when you came to us and talked to us about the, what your intent was. And one of the members, and maybe it was Dennis asked, how do interact with the folks that are doing the ongoing Part 50.52, alignment and lessons learned rulemaking?

How do you, is there still interaction with the group doing that? And how much are you guys learning from each other? Could you mention that, upfront here?

MEMBER REMPE: Hi, Joy. This is Bob Beall in the rulemaking branch. Yes, I interact with my counterpart, Jim O'Connell. He's, we're making PM for the 50.52 lessons learned rulemaking.

And so Jim and I share a lot of information and conversations, and about what he's doing and what we're doing. So that we don't have any -- I understand what he's trying to do. And if there's anything I need to incorporate in Part 53 and bring back to the Working Group.

And so we do have those interaction. And like an example, we had some of the -- basically the

questions you just asked, Jim shared that with me earlier this week and I shared that with the Working Group.

So that's an example how we're interacting and ensuring that we're in some type of lockstep so that we understand what each of the two different rulemakings are doing.

MEMBER REMPE: Great, thank you.

MR. RECKLEY: Okay, I would just weigh in, and Nan is following it at NRR as well, but so we're trying to fully, as Bob said, stay aware of what each other is doing. We're a little freer, since we're building the rule from scratch, if you will.

And so, but I won't say we'll be totally consistent with where they come out, but we're coordinating the activities. But each activity has different constraints, if you will, so.

MEMBER REMPE: So, that's an interesting response back. But we're starting to get ready to prepare for a meeting on this Part 50.52 thing. And when I think about what I've seen there, versus here, if I were to draw a diagram that shows the various steps that the applicant had to follow and what the inputs are -- like the SDA, or multiple SDAs, or do they have to have a PRA, et cetera?

And when do you have public interactions, the review? Would the steps and the inputs, and the outputs still be the same even though you might get licensing-basis events differently?

Those kind of issues are something that I'm just kind of wondering about.

MR. RECKLEY: They would probably be very similar. And we get, we'll get to that. Keep in mind, Part 52 is a licensing process rule. The technical requirements and a different licensing process is in 50. We plan, and I'll get into this in a second. We plan in Subpart H to support either of those approaches.

And so there, the similarities might be more clear because those processes are laid out in legislation, and in existing infrastructure for licensing in 52 and 50, and the related requirements in Part 2 and other places.

And so there, there probably will be a lot of similarity and Nan, did you want to weigh in since this is getting into the licensing arena primarily?

MS. VALLIERE: Yes, I think you're going to see a lot of similarity, a high degree of consistency in the licensing process area. So, as Bill said, I don't expect that, you know, they're

going to take a lot of divergence from the existing processes in that respect.

MEMBER REMPE: So, when we get to discussing that part, or if we ever discuss that part, I would really like to understand what not only the similarities are, but where are the differences?

MS. VALLIERE: Okay, thank you.

MR. RECKLEY: We'll get to that in probably, May or June, so.

MEMBER REMPE: Looking forward to it.

MR. RECKLEY: So this is the graphic reviews really from the start of this activity ever since, as John mentioned, NEIMA directed us to do this rulemaking. We started giving thought to what it might look like, and really I've been using this same basic slide since then, well over a year ago.

And we'll go through a little more detail, than we went through in a public meeting a couple weeks ago that some thought was more helpful than this slide. But just at the highest level, Subpart B that we talked about with this Subcommittee back in January, is intended to layout the basic criteria, the objectives of the overall rule.

And then the subparts follow an approach that reflects the life-cycle of the facility and how

those different aspects of the life-cycle need to address or support meeting the safety functions that are defined in Subpart B. And so Design and Analysis, that we'll be talking about today, as well as Siting we'll talk about this afternoon.

Then Subpart E would be Construction. We're getting ready to release the preliminary language on construction to support a public meeting coming up in a couple weeks. And then Subpart F on Operations, and Subpart G on Decommissioning. And then as we just mentioned, the licensing aspects will be getting dedicated subparts. We currently as a preliminary outline, have them in H and I.

And I want to talk each about, each of those subparts in a little more detail. Kind of in a "Table of Contents" format, so we can maybe discuss them a little more than we have in the past.

So, if we go to the next slide, Slide 4 this goes to kind of the process that we were kind of laying out. And how we would do interactions with ACRS. We have a similar slide for interactions with public stakeholders and internal communications and interactions.

And it basically just lays out a staircase if you will, starting with the framework, overall

framework, the safety criteria in Subpart B, and then the rest of the subparts.

I look at this however, it's kind of like writing a novel, in that we're constantly iterating, or we expect to be constantly iterating as we go forward. So, given this schedule on the interactions issue, as you might imagine, we're currently writing Subpart F on Operations.

We're still talking with stakeholders about Subpart B, and to some degree even the overall framework. Talking to you today about Design and Siting, and so our plan is to constantly support this communications and interactions and iterate.

So, one of the comments and criticisms was we haven't put out an iteration on Subpart B and C. That is in part, from our perspective, just because we have these different interactions with public stakeholders, ACRS, and our own internal communications that we have to try coordinate.

So, we have or are preparing a, you know, the next iteration even on Subparts B. And then today's meeting will help us in terms of an iteration on C and D that might come a month or two from now. So --

CHAIRMAN BLEY: Bill, Bill --

MR. RECKLEY: Yes, Dennis.

CHAIRMAN BLEY: This is Dennis. I know you're going to get to it and I knew you're eagerly awaiting it, but it seems to me Subpart B -- frankly, meeting in today's staff there was questions we had on Subpart B, so are causing me trouble.

So, it seems to me that's a really important rule to get smoothed out as soon as possible, because it effects everything else. Go ahead.

MR. RECKLEY: We fully agree with that, Dennis.

MR. CORRADINI: So Bill, this Corradini. So to follow Dennis's question. So you're going to return to B very shortly. Is that the plan? Because I'm in the same boat as Dennis, I'm still confused about that. And that leads me then to look at everything else expecting a change in the future.

MR. RECKLEY: Yes, we'll get to a summary or a review of Subpart B, where we are. And you all are right, if we make major changes to Subpart B, then what we're presenting to you today would have to be adjusted likewise in a major way. And we're cognizant of that.

MR. CORRADINI: So Bill, can I ask a

question, a general question? And then you can stick it away or choose to ignore it. As these reactors become, I'll use the word, simpler, or less complex, is the licensing approach of 53 able to handle that? Or is this one size fits all?

In other words if I go from a 3000 megawatt thermal machine to a 10 megawatt thermal machine, I wouldn't expect Part 53 would require the same complexity of information that the staff would need. Am I off base, or -- and I'm struggling to see what so far I've read, how that's accommodated?

MR. RECKLEY: And that will be a challenge. And when we get to feedback you can see that's some of the feedback we're getting. And if I can just hold until we talk about that feedback. But --

MR. CORRADINI: Okay, I'm sorry. I don't want to --

(Simultaneous speaking.)

MR. RECKLEY: Yes, but only at a high level let me take a shot at it now. Our thinking is that this rule will accommodate the whole range. And that inherent in the processes that we were calling out, there's the ability to grade those requirements to accommodate that wider, that whole range or

spectrum of reactor designs.

And our current thinking as we're laying it out to you here, is that we don't have to have different high level requirements. The grading happens within each element. So, if you have a simple design, the analysis that's required, and we'll talk about it later since today's discussion is on design and analysis, the design and analysis activities should be easier because your machine is simpler.

MR. CORRADINI: Okay. I see where you're going.

MR. RECKLEY: But we currently, but that's the challenge. And some people said we missed the mark on this. That, and they think the rule has to specifically accommodate a difference. Saying this machine is simpler, therefore a different set of rules apply. We're considering that. That's the feedback that we've gotten.

But as we've laid it out here, we say do an analysis, and the assumption was the analysis could be graded based, or almost by its nature be simpler, if the machine itself was simpler, so. But we'll get into that discussion when we get into the actual Subpart C.

MR. CORRADINI: So let me end by an

interesting way in which you've said it. The way you said it, maybe I misinterpreted is that you would start with a design and the analysis that's required of it. And as the design becomes simpler, the analysis could be simpler.

It would seem to me, the case I would make, if I were a developer, if I really have an advanced reactor of any size, I would try to do the simplest analysis possible at the beginning and only get complicated if I don't satisfy the margins I need to guarantee safety.

So simple is the way I'd start it off regardless of size. And I'm trying to struggle to see at least in the language that we've seen so far, how things are simpler here and more easy to at least accommodate?

CHAIRMAN BLEY: Bill, I want to jump in, this is Dennis and I do want to give you a chance to go ahead and then we'll see how it progresses. But at least the flavor that I got from the last meeting, wasn't usually this ability to have gradations of what you do depending on characteristics of the design.

Would it be addressed in guidance documents, is that still the intent rather than the rule itself? Let's say, you have to look at whatever

reactivity you're on, and the guidance will tell you how much you have to do depending on characteristics of your design. Go ahead, and I'll be quiet a while.

MR. RECKLEY: That's a good point. And yes, Dennis by and large we think how that gradation would work and how a simple design might differ from a more complicated machine would be reflected in the guidance.

MEMBER REMPE: So before you go on, I know we're taking too many comments now, but I, this is why I keep harping on the alignment, the 50.52 topic. Because I think the guidance, for example, what's required in a PRA could really help both your effort as well as their effort. For this guidance is going to be a very important feature. And the sooner it's done, maybe it will dissolve some of the comments we're seeing?

MR. RECKLEY: We hope that's the case. And in our March meeting, public meeting, Guidance Development is going to be one of the topics to see. The staff has a number of things under way. And the industry also has a number of things underway.

And just to coordinate who's developing what guidance? What guidance might be the most important to support the rulemaking activity and so

forth? So, all of that, it's a good point and we realize it.

And that's one of the things we'll be talking to the industry about, is what may, what might they start to develop guidance for our review and endorsement. And what guidance will the staff be developing basically on its own?

CHAIRMAN BLEY: Bill, I lied, I'm going to jump in one last time. Where on this schedule, do you have a column here for interaction with the stakeholders or with the ACRS on initial guidance?

And I think getting some preliminary idea of the structure of what these folks will believe or think about for guidance, and what kind of schedule that would be, would literally help alleviate some of the questions we're asking, if we know where it's going to fit.

So, don't respond to that now, but I hope you can during the talks today.

MR. RECKLEY: Okay. All right. So again, this kind of lays out where we think we will be in needing to interact with the ACRS on the various topics basically throughout the rest of this year, into early next year.

And the schedule aspect of this is driven

as John mentioned, in the direction that was given to the staff by the Commission in the staff requirements memorandum for our rulemaking plan. So, I think we can go then to next slide.

And I've used this slide a number of times too and it goes -- I like to come back to it because it basically reflects all the discussions we've had up to this point even, and will continue to have. In that one of the founding things or the first principles that we come back to is to try in a technology inclusive manner, address what it is we're trying to do.

And by and large, this is a simplification, but what we're trying to do is make sure that there's enough barriers in place such that the inventory of radionuclides that will be generated from a nuclear reactor, that's the one thing they all have in common, is that the process itself is making the radioactive materials and creating the hazard that we as the NRC, have as our mission to try to make sure is controlled before it reaches the public through this simple diagram, the atmospheric dispersion arrow.

And that is accomplished by looking at that inventory, and then again, the barriers that are in place to retain it, or attenuate any releases, and

how they behave in normal operations. And how they will behave when challenged by transients or accidents.

And so, somewhat to Mike's point, if you can develop a machine that -- this equation is largely based on the DOE principles for non-reactor facilities. And in that model, the inventory is called material at risk, and the first factor is called damage ratio.

If I can have a reactor such that the material at risk and the damage ratio is close to zero, meaning I don't have a way to get the radioactive materials even out of the fuel, then that's a simple design.

And should be, we should be able in the probabilistic risk analysis, the deterministic analysis, all of those analyses should be able to say, hey, in this particular design, I've achieved really the ultimate goal, which is the radionuclides never get out of the first floor. They stay in the fuel room most cases here, that we'll be talking about. So --

MEMBER BROWN: Bill, isn't that kind of pie in the -- this is Charlie. That kind of pie in the sky?

MR. RECKLEY: Um.

MEMBER BROWN: The idea that somebody --

MR. RECKLEY: That's a --

MEMBER BROWN: I mean --

MR. RECKLEY: Yes, that would give them a little challenge. I'll leave it at, it would be a real challenge.

CHAIRMAN BLEY: Bill, you've used this slide. I think it's a wonderful slide to make your point, but research reactors are essentially this. They're sited within cities, and they're essentially damaged, I can't remember the DNA terms but the real, the potential releases is minimal.

MR. RECKLEY: And we've, I mean we've looked at that. And to the degree the inventories are similar and you have things like the TRIGA fuel that can minimize any releases and address potential accidents to limit thing like temperatures that might relate to a release.

We're looking at that to see if we can control. But when -- you know, there are a number of things that are different. Most research reactors, even if they're of a similar size as some of the micro-reactors under discussion, end up with lesser inventories for example.

Because they're intermittent operation versus what would be basically continuous operation over the life of a facility, be it 10 or 20 years. And so --

MEMBER BROWN: But they're also much less power.

MR. RECKLEY: In general --

MEMBER BROWN: We're talking about power reactors that are going to generate electricity for a huge, large populations.

MR. RECKLEY: But yes, and but the discussion typically has been on the micro-reactor side, so even if it's on the megawatt, single megawatt size, the inventory will be bigger for a power production facility, than a research facility.

MEMBER BROWN: Most.

MR. RECKLEY: In most cases.

So, we are looking at all of that. And again, we would be open to an argument that says if, again back to if the damage ratio is very, very small, then that is a great thing. We wouldn't want to discourage it. And we'll take that into account in assessing how many other barriers you need. So --

CHAIRMAN BLEY: Bill.

MR. RECKLEY: -- but, so let me take it,

Dennis, or?

CHAIRMAN BLEY: Yes. Two things I wanted to jump in with. One is it seems a reasonable idea to, however damage ratio, there's a lot hidden in there, and maybe a whole PRA is one way of thinking. How do you get the damage ratio for all possible scenarios?

But for the smaller reactors, the things that approach experiments, this was brought up to me yesterday by a few people. And we just had an incident at the NIST reactor. We're going to try to get a look at that. Are you guys thinking you can learn anything from that that might be useful to you here?

MR. RECKLEY: Yes, I'm sure we will. And actually that's being, you know, our division actually has the responsibility for the oversight of NIST. There's a team there now, so yes, we'll be looking at that.

MEMBER BALLINGER: This is Ron. I'm just struggling to try to find where damage ratio is defined in a document? I'm sure it is, but can you tell me?

MR. RECKLEY: Let me get back to you on what DOE letter that is. Offhand I forget the number.

MEMBER PETTI: Hey, Bill. I just want to support your thinking. I'm involved in a micro-reactor project. And I don't think it's pie in the sky to think for some of these technologies, if we know about them in the end, what's called power reactor embodiment.

So take an HGTR something I know about, and make it a micro-reactor. In fact the safety issues just become much, much less because of some simple considerations like surface dividing ratio of a small micro-reactor compared to an MHTGR.

I think the same is probably true of an SFR, if you were to, you know, shrink them down. So, I think your thinking is right. And a lot of these technologies will, a lot of our experience might be on the larger size, but when you make them smaller, you do get some safety benefits.

And that should all come through, you know, in terms of the analysis that you do. But I think fundamentally that's not a bad way to think about it.

MR. RECKLEY: Thank you. And I guess to a couple points that's been made in that particular example even. We also don't want to mislead people on how much might have to go into determining that first

factor, right.

And then obviously, the work on TRISO fuel would support what Dave was just suggesting. But that's been extensive to actually provide the confidence that the -- and again I didn't want to really introduce it into the reactor realm, but if we're going to use the damage ratio term, the damage ratio for TRISO fuel is supported by a decades-long research activity that actually supports that discussion.

So, even if you can break it down simply, and say, yes, we're going to be able to give a lot of credit to the first barrier. But I don't want to mislead people, that that makes it easy. Because providing the confidence in the first layer will likely require proving the performance of that first layer by a lot of experiments and analysis.

So, I mean we're trying to find the balance here and I think you guys can appreciate the challenge. And to Dennis's point, that if you're going to be relying on the first layer more than we have traditionally, you do have to then look at all the events that we're challenging.

What temperatures it's going to reach. What other challenges it may have? And that gets into

having to define as we'll talk about in the next few slides, the licensing-basis events and the range of challenges. And do you do that through a PRA, or is there a simpler way? That's where we are on the discussions with the stakeholders.

So, I think the point I was trying to make on this slide has been made, hopefully. We can go onto the next slide which shows another challenge that we're trying to accommodate, and it's again another slide I've used many times.

The other thing we're trying to do in Part 53 is to integrate the whole regulatory scheme. And so in looking at Part 53 and where we want to end up, we'll be facing challenges such as how does the rule accommodate alternatives on the mitigation side of this bow-tie diagram?

We know that a desire of generation four technology plants, from the beginning, has been to reduce reliance on things like emergency planning. We have a proposed rule under way that gives some alternative approaches to determining emergency planning zone versus using the default, ten miles.

We have continued that discussion, that seems to be a continuing desire to get relief in areas such as emergency planning and siting. You need to be

cognizant of that as you're looking at the actual behavior of a plant, and the analysis and the design activities you're going to require.

Because you're building into this, the possibility that you may not rely on things like siting and emergency planning to provide additional layers of defense-in-depth as we've traditionally done. So, that puts more onus on the design and analysis, to support those possible approaches.

One of the challenges is we're trying to leave it open such that we're not -- that if any design or designer, or licensee, applicant were to choose to take credit for emergency planning, that that remains open to them.

It would have made our life simpler if we try to write this rule such that it was not needed. But a challenge again that we're facing is we're trying to leave it open for future designers, future applicants to decide the balance between prevention and mitigation.

And so that is another area when we get into Subpart C that we have a specific requirement and it'll be a point of discussion I can imagine.

MEMBER PETTI: So Bill, Bill, just a question on that prevention, mitigation and defense-

in-depth. I'm sure it's not something you put in the rule, but in the guidance the balance between those could depend a lot on the safety features and the technology and the size of the machine.

So, I could imagine that how one implements defense-in-depth at a micro-reactor might be very different than this same technology at a power plant scale. Are those things that you guys are thinking about, how you incorporate the inherent safety characteristics of some of these technologies and what that means in terms of the, let's call them the "overarching safety philosophies" that the Agency has always used, and how it might change?

MR. RECKLEY: Well, they're trying to, yes. And again, even on inherent, I have a slide later and it's a question we've posed. We have some notions but any thoughts when we get to the slide, where we basically are asking a question, not posing a position on whether additional guidance or even newer language might be appropriate to address inherent features. So, when we get to that slide a little later, please.

MEMBER PETTI: Okay.

MR. RECKLEY: If you have a thought.

So, this basically then is a challenge to

us but we're trying to keep in mind the overall structure. And what we might be getting in terms of future requests.

So, if we go down to Slide 7, what I thought I would do just to quickly provide a little more detail than that structure figure that we've used. Is to go through the subparts kind of in a "Table of Contents" format. And we can discuss a little more detail, some of them.

Subpart A is General Provisions, and I wasn't planning to talk very much about this, but we need to have a place in Part 53 where we provide the normal things that you would see in 50 or 52 in regards to how to communicate with us, and definitions, and employee protection, and so forth.

So, this list of bullets is largely the items out of Part 50 and 52. And the talk about those kind of high level provisions and requirements, responsibilities of licensees and so forth. So --

CHAIRMAN BLEY: Bill.

MR. RECKLEY: Yes.

CHAIRMAN BLEY: Yeah, I'm glad you're going this. I've gotten comments from a lot of members. So, to my favorite thing in regulations, where does it fit in the structure? It sounds like

you're kind of doing that, and I think that will help a lot for all of us. Go ahead.

MR. RECKLEY: Okay, thank you. And no apologize, we've had this, we just didn't present it. Sometimes you over think how much or how well you're communicating for example, just on that one figure. So, then we can go to Subpart B.

MEMBER KIRCHNER: Bill, before you go on, this is Walt Kirchner. On the definitions, have you tried to, we had a conversation earlier this morning on reconciling with 50 and 52, our consistency and such. One of the most important definitions in 50.52 is safety related.

Have you come to some, do you have some thinking on how you might define that for 10 CFR 53, whether it's taking the formulation that is somewhat Light-water reactor specific and make it a more generic definition that would apply?

MR. RECKLEY: Yes, we are proposing a definition in Subpart C, that we'll get to in a little bit. And it's a little different and one of the things that we're trying to come to grips with is, when we have the same term and it's defined in 50 and 52, whether we change terms, whether we use a different definition.

In terms of safety related and again we'll get to it in a little bit, but I don't think our concept fundamentally is different. And we might try to argue that ours is a more global definition in Part 53, and if you were to apply it to a Light-water reactor you'd end up with the definition that's in Part 50 and 52, but that will be a bit of a challenge, but we --

MEMBER KIRCHNER: Okay, I'll look forward to that because I've been thinking pretty hard on that particular item.

MR. RECKLEY: And that will be again, one of the, we have a running -- we're, the colliding terms that we'll need to define. And there are some terms that, and we pointed this out in, when we were working on the Licensing Modernization Project NEI 18-04, they had similar or the same terms with different definitions. So that will be a continuing issue.

CHAIRMAN BLEY: Bill and Ron, your mics are open. You going ahead -- oh, go ahead Ron.

MEMBER BALLINGER: And that's, it's open because I want to speak, and I have a cat. The term damage ratio was defined in a DOE handbook in 1994, related to airborne release fractions for non-reactor

nuclear facilities. If anybody wants to -- it actually has an ML number, so, anyway you don't need to tell me what it is, I know where it came from.

MR. RECKLEY: Okay, thank you. And again, I don't want to exaggerate its incorporation here. But it's a similar concept.

So, if we go then to Slide 8, it says Subpart B, and I'm going to talk about this in a little more detail. So this is just the format that we provided in our January meeting. And instead of dwelling here, I think we have a few slides I'd like to revisit Subpart B.

So then Subpart C, we're going to talk about today, that's Slide 9, the Design and Analysis. And this is the existing format for the iteration that we provided to you. Just in terms of timing, the iteration, the first iteration that we provided to you is for today's meeting, was actually released before our last meeting with you in January.

So, we did touch on Subpart C in our January discussions. We know the language you were looking at doesn't reflect any of those conversations. We will be looking to do future iterations and even have some notes in today's presentation where we're thinking of making some changes based not only on

stakeholder observations, but also our meeting in January. And then obviously, we'll take today's meeting and that might get incorporated into even a future iteration.

So, if we go to Slide 10. We'll also be talking about this this afternoon. So this is just the general outline of Subpart D. Some general observations on siting. And then looking at external hazards, the traditional site characteristics that one needs to define, considerations related to populations, and then the connection with Part 51 in environmental. But again, we'll talk about this this afternoon.

So Subpart E on Construction, Slide 11. We're getting ready to release an iteration on Subpart E to support public meetings in March. We've basically broken this into two halves. One is on typical construction. When I say typical, it would be a project that would look a lot like what we're used to, be it under a construction permit, or a combined license approach, Part 52 approach.

But it is a construction, if you put it in terms of housing, a stick build, if you will. This is the current approach for, underway at Vogtle for example. It would fall under this part.

And we've defined the activities as what management in control is needed, what you would have to do throughout the construction process. What kind of inspections and acceptance reviews would be needed? And a section on communications. This is, this section is dominated by quality assurance, quality control kind of requirements.

And when you see it, you'll be able to recognize right away that this is basically, again dominated by quality assurance considerations.

The second half of this subpart on construction and manufacturing, we're putting out language again, to cover the quality assurance, quality control aspects. But then also we're using it as an opportunity to really begin the discussion on, if this is going to be the approach, include it. And we're assuming when we say manufacturing that we're going to get into the realm of a manufacturing license.

So, if the distinction for us between the two is you can have modular construction, you can even build modules just like is being done for Vogtle or you would see in ship building activities and so forth.

You can build large modules, but if that's

being done as part of a, just to help in the construction process, that's still a construction activity.

Manufacturing as we're proposing it in this first iteration is the activity that would be undertaken through a manufacturing license from the NRC, which is, it's a different vehicle. And really reflects a more kind of factory fabrication of the whole reactor, or at least major parts of the reactor.

We have questions and again, we're going to use the upcoming interactions to talk about how far this might go in terms of would people envision loading fuel at the factory and then transporting a loaded reactor to a site and so forth?

So, we currently have some rough provisions for that. But if our normal goal would be to say, we're shooting for the 80-20 kind of language, when we're putting it out as preliminary, I'd say in this area, we're somewhat less than 80-20.

Because we have a lot of questions on what it is that the people foresee as kind of the business model, the manufacturing model, and what we would need to support in Part 53? So --

MEMBER KIRCHNER: Bill, this is Walt again. If I might ask for clarification. New

manufacturing licenses, by and large they usually involve special nuclear material. They usually revolve around fuel. Isn't that the case?

MR. RECKLEY: There is a current provision in Subpart F of Part 52. In ISO manufacturing, this isn't like a fuel cycle facility that would have a materials license to make fuel. So this isn't, you know, the Westinghouse facility, or the General Electric facility making fuel.

A manufacturing license is for a reactor facility, and the only exercise that we've had for manufacturing licenses is offshore power systems back in the early 80s. And it is a different reactor approach. And if you look at the history of Part 52, or at least the way I look at it, Part 52 was oriented towards standardization.

And so the design certification process was a large element of getting the design standardized. The manufacturing license was one step further. And said, not only is this the design that's standardized, but this is the process by which the machine is going to get put together.

This is going to be the welding techniques, this is going to be the, just think of whatever else might be included in that and the NRC

would review and approve not only the design, but how it would be put together and issue that in a manufacturing license.

So that was, to me that was kind of like the ultimate standardization. And why it fits into this new discussion of a factory assembled, a factory setting for reactors.

MEMBER BALLINGER: This is Ron again. With respect to say Part, transportation. How, with a small source term, for some of these small reactors, how is transportation to and from the site, even for a plant that's been operated, differ from just transporting spent nuclear fuel?

CHAIRMAN BLEY: Well, with that, as we build this out, we'll see. We think you're right, that we can handle the transportation element under the existing requirements. The difference will be that the design of the reactor itself will have to foresee its use.

Not only as a reactor, but maybe as a transportation package.

MEMBER BALLINGER: Got it.

MEMBER KIRCHNER: And also, the kind of mechanical loadings and such are, that you have to accommodate will have an impact on the design as well.

(Simultaneous speaking.)

MEMBER BALLINGER: Right, but it's pretty much the same, kind of analysis --

MEMBER KIRCHNER: You'll have to iterate on that --

MEMBER BALLINGER: -- that you have to do, right?

CHAIRMAN BLEY: No, I don't think so. Well, it is currently my understanding is that NRC's role in the transportation of the spent nuclear fuel is to certify the casks. Everything else in that process belongs to other agencies who protect that cask in various ways.

But if we're shipping a new kind of reactors with built in control systems and new fuel and all that, I think the world of NRC is a lot broader than it currently is. So, you know it, today -- you guys still remember that time?

MR. RECKLEY: Some, but not to the degree that we would need to take this concept all the way. And that's why we're wanting to engage stakeholders before we undertake it, because it -- and you're right, it would have to address various things.

You will have control systems that you'd have to make sure were either disabled, or otherwise

irrelevant. Maybe during the transport phase, but again, we really wanted to engage stakeholders to see if there's a real interest in this.

We think there is, but we wanted to confirm it before undertaking this activity, and doing more interactions, even internally with our transportation folks in NMSS.

So, that would be Subpart E on Construction and Manufacturing. Subpart F gets into Operations. And so, go to Slide 12. If you go to Construction and Manufacturing, there's two segments. Thinking on Operations, is it can somewhat be broken down into three segments.

The first one is on the equipment, and the focus would be on configuration controls, like it is now. So, for safety-related equipment, those would be addressed in Technical Specifications. And we'd have the equivalent of limiting conditions for operations and completion times.

Not really a new concept, but configuration control for the safety-related functions would be governed by Tech Specs. The configuration management for safety-significant, this is the non-safety-related, but safety-significant category that we'll talk about under Subpart C.

We would really have to define, would the -- it's envisioned, you'd have more licensing, you'd have more flexibility for those structure systems and components, but we need in the rules to define that there does need to be controls for those equipment.

So, what kind of reliability assurance program? How is maintenance performed and controlled? So, that's an area we're currently working on. This goes to, again, our goal would be that NEI 18-04, the Licensing Modernization Project, remains as one way to meet Part 53.

And that guidance includes the non-safety related with special treatment category, and talks about various forms of special treatment that might be applied to that equipment.

Our challenge here is to incorporate that concept into the rule, to make sure that that equipment is actually controlled. There's measures in place to make sure it is available, that it's reliable.

Because as it's currently constructed, there's a probabilistic element there, where the contribution of this non-safety related with special treatment equipment, might be to limit the frequency of events.

What that then means, you have to monitor the availability and reliability of this equipment to make sure that your frequency estimations in the PRA are remaining valid.

So, it's an additional element that we would be adding to support this -- and we'll get into the discussion, in these two tiers, or two layers that we're trying to carry throughout Part 53.

Then some other thoughts that we would have for the operations, the equipment aspect of operations is there would be a QA element, maybe address age and management from the beginning.

Design control, this would be the processes you need to make sure that you're maintaining the design, or if you're changing the design, that it's being assessed.

And as we'll talk about a little later this morning, that the design and the analysis stays either connected or you redo the analysis. But that's an interface, back and forth, between maintaining the design during operations in the subpart we'll be talking about today.

And we talked about briefly, well, we talked about it at the last meeting, the Facility Safety Program. And the notion of using such a

concept to look at the new information and assess whether changes to the facility would be warranted.

Then the next segment of Operations Subpart F, go to Slide 14, is Personnel. Let's see. I'm not seeing it change, I'm not sure if others are.

MEMBER KIRCHNER: No, we have it. Slide 13 is showing, Bill.

MR. RECKLEY: Okay. So, this gets into another very interesting area. And so, we're going to start the discussions, I think, in April and May with stakeholders, and this will include ACRS, on the appropriate staffing and control of staffing for Advanced Reactor Designs under Part 53.

And we have heard of proposals and possible justifications for not only reducing staffing levels, but for more dramatic change, like not having licensed personnel attending the reactor. And the possibility of going to an unmanned reactor, a totally autonomous reactor, if you will.

So, we're looking at those to see, again, over the range of activities we're hearing the possibility of autonomous, unstaffed, all the way up to facilities that would look more similar to current, or plants, or plants like NuScale that have justified reduced staffing, but keeping a structure with

licensed operators, for example.

So, we're just thinking about how to roll this out. We've prepared a paper, a White Paper to support the discussions. We'll be releasing probably in March to support more discussions in, like I say April and May.

But one very rough outline would be if we're to support that kind of flexibility that remove and require a developer or an applicant to prepare a concept of operations, which is a real systematic look at what is the level of personnel in the facility.

So, it's somewhat analogous to looking at the equipment, and doing a systematic review of what operators do to either prevent or mitigate transients or accidents and also help -- personnel might contribute to causing them.

But in any case, that concept of operations could look at the role in meeting the criteria set up for what we'll talk about a little later, the design-basis accident.

As well as the role in meeting, create more risk-informed approaches, like the NRC Safety Guide, and what might be the role of personnel. And maybe we can make a distinction between those roles, just like we do for equipment.

But then we would lay out what are the requirements for licensed personnel, and what are the requirements for non-licensed personnel. We are even looking at whether we could look at keeping the notion of licensed personnel, but trying to scale that such that it would not be as onerous as the current system we have in place, under Part 55 and the current structure.

So, this is going to be, in my view, one of the more challenging things to try to address. Not only in the rule, but in the guidance, and this might be a case where we can write a rule, but the guidance would be essential.

So, go ahead Dennis, I'm sorry.

CHAIRMAN BLEY: A few things jump at me on this. One is especially if we talk about unmanned facilities. One either has to think about concepts like your material, but risk and damage ratio, getting so small that it doesn't matter so much.

Or some kind of remote operations. If you get into remote operations, man, that's going to be a bag of worms. There's so many things that could interfere with that.

If you're unmanned, then you become like a lot of chemical facilities and you have to have

coordinated, you, the owners, have to have coordinated with local police and fire organizations so that they can deal with whatever problems might occur. Because I know we're talking about this on your next slide, so (audio interference) over there.

But it seems to me, and you guys can correct me on this, we've got a lot of regulation to protect operators, maintenance people, workers on site, from radiation.

For normal, and maybe abnormal operations, we're not so much looking at ongoing accident conditions, or at least beyond-design basis accidents, and I don't know if you thought about that at all.

And second some of the possible designs might offer greater chemical and energetic kinds of problems that are not maybe nuclide related, but are especially dangerous for workers, or maybe for nearby populations, are you thinking about that?

Or are you thinking somehow, OSHA, FEMA or somebody else has to step in and regulate that side of things, which could make regulation pretty tricky for people.

MR. RECKLEY: We have a slide in talking about other hazards coming up.

CHAIRMAN BLEY: Prepare.

MR. RECKLEY: So, on other hazards, let me just defer until we get to that. In terms of the other discussion this is again, this is another area that we're probably not going to be 80-20, when we start putting out preliminary language.

We're going to be somewhere short of that because we need to know what it is, and what is the range. And there can be a dramatic difference, as you mentioned, between totally unmanned, and just having some staffing.

And the staffing might serve multiple roles, but would it be feasible, and I don't know the answer to this, but would it be feasible to ever have a facility that didn't have anybody there? Even just to support security aspects, as well as maintenance aspects, as well as other things.

And if it's not foreseen, then we might be able to back up a step and say, okay we may not have to write this rule to go to that, to that level.

MEMBER BALLINGER: This is Ron again. Dennis and I have been having these pie in the sky discussions about autonomous and unattended, or operation. Have you guys checked out with NASA, and what they do, and how they treat autonomous and unattended operation with respect to safety and things

like that for this kind of thing?

Because they're used to that, and they developed a set of criteria for mission control if you will, for lack of a better word, but it deals with autonomous and unattended operation with respect to safety.

MR. RECKLEY: We looked at some of that. But what you're specifically mentioning I'm not familiar with, so I'm going to look that up. But we have looked at guidance in this regard, for nuclear and non-nuclear facilities.

And interacted with the national laboratories, some of which are involved with Sandia in particular, with the NASA programs, but let me make a note to look specifically at that.

(Simultaneous speaking.)

MEMBER KIRCHNER: This is Walt Kirchner. I have two comments. One, I'm struggling with whether the payoff is there for you to make the distinction in concept of operations for first tier and second tier safety.

It would seem to me, it's the same personnel. And you would want, if you get into a situation where you are beyond the design-basis events into, for lack of a better term, into a severe

accident like situation, it's the same personnel that you would want to depend on, in my opinion, and have trained for that contingency.

So, I'm struggling with the undue complication that this potentially represents. Then my second comment is that, to the extent that you reduce the requirements for licensed personnel, or in the ultimate, an unmanned, unintended plant, it seems to me then that the requirements in terms of quality, defense-in-depth go up inversely with the lack of people present, I -- to first order.

In other words, the dependence on safety-related equipment and functions, I think you call them safety functions, such as controlled reactivity and safe shutdown become even more important as you reduce the training, the requirements, the staffing.

So, that you have a robust defensive-in-depth to compensate for what you're entertaining here, going down the view graph. Does that make any sense?

MR. RECKLEY: Yes, it does. And again, this is very, very preliminary, and we have to talk internally about various things. And you're right. If you were going to try to justify, if someone were to try to justify a much less defined role for personnel, then that has to be compensated on the

design side.

One of the, and when we get to the discussions on inherent, you know, one of the definitions for inherent, when you talk to control system people, inherent means total reliable. It's a, so no question, right.

And so, if you're going to be relying on inherent features, which again we're open to discussing this, but then you're basically saying there is no question of how this machine is going to behave, and it's governed by the physics. And if that could be proved, then that can be a supporting thing for a lesser role for personnel.

The other point you made Walt, which is good, which is you can get into this error that you would have to think about. Where the role of people and the possible mitigation, which on equipment side would, tended to say, might have more flexibility if ultimately you're increasing the role of people on the severe accident side.

If you want to use that terminology. Then the logic that I laid out here, where various people would have to have lesser controls, if you will, that might not make sense.

So, all of this is stuff we need to talk

about. And so, when we get into the discussions in April and May we will have hopefully, thought this through a little bit more, and be providing some preliminary language. But all of this discussion today is stuff we can take into account.

So, if we can then support, yes, the last part of Subpart F, this segment, the third segment, we'll talk about programs. And this isn't an all-inclusive list, but it would look into the programs that a licensee has to have and maintain, radiation protection, emergency preparedness, security.

You would have, possibly, some others in here on QA, radiation protection, probably would, well it would address both on-site and off-site things. And so, this is just kind of a placeholder.

The list will grow as we go through the process, but just to define it again, Subpart F into its three parts. There would be the Equipment part, the Personnel part, and then the Programmatic part, is the way we're currently envisioning that would go.

So, Subpart H, next slide. Oh, skip G. G is Decommissioning, and that would involve laying out the requirements for the termination of operations. The transition, as we currently do from operations, that would be a possession only license.

We would include the financial assurance requirements here, most likely, and then the requirements for transition to unrestricted use.

But we haven't really, this is one that we've given less thought to how it would go, but the initial thinking is, it may not be that dramatically different then what we have now for a construction kind of project.

How this looks for a manufacturing model, we have to think through.

CHAIRMAN BLEY: Have you gotten any stakeholder comments on this slide?

MR. RECKLEY: We really have not engaged shareholders yet in the discussions on decommissioning. The one comment that we do have is maybe we could, if we had an error that we might not have for instance, the guidance developed for a particular subpart, maybe this would be one we would hold off on the guidance because it's at the end of the process.

But so, the short answer is no, we really haven't had much discussion on decommissioning. So, if we go to sixteen, that's getting into the licensing arena. This goes to Joy's point, and what Nan weighed in earlier.

We're not necessarily seeing dramatic changes to these processes. The guidance will become important, things like the content of applications might change as you change the design and analysis requirements.

There's a different project on the content to applications, not different related. A project that we have currently ongoing, and an interaction again with the, it's a DOE fund cost-shared industry-led effort, similar to licensing modernization on content of applications.

Our hope is that that can help inform us, and provide the guidance for what would be in terms of a content to applications for Subpart H. So, really all this slide does is break down existing reviews and license types into siting, where we have site suitability reviews, that's still an appendix in Part 50, limited work authorization, early site permits.

Then under the design element, the design-oriented things that we have, are standard design approvals, design certifications, and manufacturing licenses, again Subpart F, currently in Part 52.

But an area we haven't looked at in years, and probably doesn't reflect the factory setting that's currently envisioned. The first bullet under

design, we've found in the past that the stakeholders have asked to have a conceptual design review in the process of findings in the past, as we have that available.

This would be something similar that we've did in the 80s for PRISM, for the MHTGR, those pre-application reviews. That's not currently captured in a rule but we think we have available, so, but we just have a question mark there.

Whether the rule should, might accommodate something akin to a site suitability review, but less than -- in the design realm, but less than the design approval. Just a question. And then --

(Simultaneous speaking.)

MEMBER BROWN: B**ill.**

MR. RECKLEY: Yes, go ahead.

MEMBER BROWN: Is the thought process on that similar to what you did with I&C about 12 years ago, with the pre-licensing application, not application, but pre-licensing review for I&C systems, so they knew what to expect? Is that the kind of thought process? I've forgotten what ISG it is, it's ISG four, five, six, or seven.

MR. RECKLEY: In the digital I&C area?

MEMBER BROWN: Yes, and that turned out

very fruitful for the subsequently redesigns, I know they did those. And therefore, when they finally submitted their license applications, their application, it went pretty smoothly on AP1000 through the NuScale.

MR. RECKLEY: Yes, I would put that more in a guidance realm. Well, I mean again, we'll talk to stakeholders about what they may want, but this would be more the review of a specific design versus developing the guidance, which I think you're referring to. And I wasn't involved in that.

MEMBER BROWN: Well, it was pre -- before they submitted the stuff, it was just, they sat down with NRC, with the I&C folks --

MR. RECKLEY: Oh, okay.

MEMBER BROWN: -- and when through this is how we'll approach, and then they, NRC identified what they were expecting. And therefore they didn't end up with as, you know, much back and forth when they finally got the stuff submitted, so --

MR. RECKLEY: Oh, okay. Yes, then it would be more similar to that.

MEMBER BROWN: I'm just wondering what your thoughts --

MR. RECKLEY: Yes.

MEMBER BROWN: You might want to talk to them, and you'll find out how that worked, see if it's practical, that's all.

MR. RECKLEY: Yes, thank you. Yes, in my mind, the difference that we've traditionally set is that the standard design approvals, like the topical reports and other features that we have in place, or the product lines that we have in place, provide a document that you can reference in an application.

You get full credit for that interaction, and that review. Whereas, the conceptual design review, as we've traditionally described it, you don't get that safety evaluation that you can actually reference in an application.

It might be very fruitful, but you don't get a referenceable document. It's the distinction we typically make.

MEMBER KIRCHNER: Hey Bill, this is Walt again, Kirchner. I participated in those reviews of the PRISM and the MHTGR, on behalf of the NRC. And I thought, and those were fairly mature designs, for a conceptual design. I thought they were very useful.

And, I think furthermore, how should I say it, advanced concepts that have less of a technology base, that a conceptual design review is a good

starting place to flush out a lot of the potential licensing issues, concerns, matters, that whereas, jumping right into a request for a design certification or a combined operating license.

My goodness, that's a, for some of the advanced concepts, it's almost like it's too much of a leap. That's just one member's opinion. So, I think, providing for this might prove useful for the more advanced concepts with limited experimental data behind them.

MR. RECKLEY: Thanks Walt. And we don't disagree with that. We just thought we'd start, we had that existing process to pre-application reviews, and we had the ability to do it without changing any rules.

So yes, we certainly want to continue to encourage it. The question would be whether we want to build something into Part 53 to specifically address that?

Then under Site and Design, the actual facility, the processes in Subpart H on licensing would reflect current processes, either a construction permit and operating license, or combined licenses.

And then, that last bullet there, is we're just trying to think how to best describe the content

of applications for these various options and combinations, and we're thinking maybe we can do that in a table.

And if we go on to Slide 17 --

CHAIRMAN BLEY: Bill.

MR. RECKLEY: Yes, go ahead, Dennis.

CHAIRMAN BLEY: Let's go ahead with the next two slides on Subparts I and J, and then we'll take a break.

MR. RECKLEY: Okay good. Subpart A -- I, I mean, is the Maintaining-Licensing Basis. Remember this is separate from Subpart H, we'll start talking about, but you do need within the rule, to have processes for how to amend a license, that that's currently the 50.90 series of regulations in Part 50.

How to update the FSAR? Our current plan is to include a PRA. So, how do PRA's get updated? We'd have a requirement. Then the standard regulations related to NRC actions like suspension or modifying a license, when taking special nuclear material, back fitting, and requesting information as we currently do under 50.54(f).

So, that's just maintaining the licensing basis. And then ultimately, the next Slide, 18, Slide 18 --

CHAIRMAN BLEY: Well, before you leave 17.

MR. RECKLEY: Yes.

CHAIRMAN BLEY: I want to make a suggestion to you. Including the PRA, excuse me, I think it's a very good idea, but I think that's a place you should already be starting to think of what kind of guidance you want here.

Just off the top of my head, the place it has to be done thoroughly, and the same ideas would have to be done if you weren't doing a PRA is the search for damage scenarios. Scenarios that can lead to damage, initiating events, that sort of thing, has to be as thorough as possible.

However, just as we've talked in other areas, the depth of analysis that's done after that, somehow ought to scale to the hazard and the complexity of the design.

So, I think that's a place we don't currently have any guidance. People have done this, working outside of the nuclear field. But I think, it's a place you really have to start thinking early about what that guidance could look like, go ahead.

MR. RECKLEY: Okay, thanks Dennis. I agree with that, just another of many items we're going to have to address, both in the rule and in

associated guidance. So, if you'll go onto the next Slide 18. There are --

CHAIRMAN BLEY: I've lost the slides. Does everybody else have them? I've got hard copies if we need them.

MR. RECKLEY: Yes, I'm still seeing them. Is everyone else?

PARTICIPANT: I can see them.

CHAIRMAN BLEY: Okay, go ahead.

MR. RECKLEY: Okay. Then on Slide 18, there are, we're just currently kind of keeping this as the catch all. They may not all end up in Subpart J, but there will be administrative and reporting requirements that we have, that we have to track.

But this is also being, as items come up, this is kind of our parking lot. So, there are a whole host of other things to consider like financial qualifications, the insurance crime that's currently in 50.53(w). That's property insurance as well as references over to financial protection, liability regulation.

MEMBER KIRCHNER: Bill.

MR. RECKLEY: Yes.

MEMBER KIRCHNER: This is Walt Kirchner. This is a rhetorical question, I don't expect you to

answer it. I posed it to Dennis in an email. You've mentioned quality assurance now, several times, but I'm getting the impression that you're not going to make a requirement equivalent to 50.52 of Appendix B.

And it begs the following question, if you don't build an advanced reactor to the quality, and codes, and standards of the existing fleet, why should you potentially be covered under Price-Anderson?

And I'm not an expert, I'm not a lawyer in this area, but it's a rhetorical question, that has occurred to me. That somehow if we're building advanced reactors to lesser standards, or quality, then the existing fleet, it raises, in my mind, those kinds of questions.

It's a more of a policy kind of thing than --

MR. RECKLEY: Yes, and I don't think, and we'll get into this a little bit under Design and Analysis, but I don't think that -- I know, from a status point of view the intent is not to do lesser quality.

The question that's been posed is, do alternatives to NQA-1 in Appendix B provide the same quality, the same confidence in the performance of the equipment? That's the question, whether there is an

equivalency, not can we allow a lesser standard?

MEMBER KIRCHNER: Yes so, so I can see ISO 9000, for example, being pretty comparable to NQA-1.

MR. RECKLEY: So, but as we go through, the other thing, and this will be, as we put this thing together and look at it. Our first attempt here, on this iteration, was instead of having a dedicated appendix on quality assurance, was to build quality assurance into each of the subparts.

That's an area that if we look at it as we put it together and say, it's actually more confusing to do it that way, we could, at a later time for clarity, without actually changing the intent or how it would work, come up with Subpart K, Quality Assurance, and then put it all back together.

But we'll see as we put it together if that turns out to be the case. Again, we're currently are taking the approach of quality assurance has been incorporated into each subpart, versus referring to Appendix B, where all the quality assurance stuff was together, so --

CHAIRMAN BLEY: Well we're going to get to the Subpart C --

MR. RECKLEY: Right.

CHAIRMAN BLEY: -- and we'll look forward

hearing what say there. My reading, I might have missed something, you know, consensus standards show up in there at least as a one liner. I'm not sure about QA, but you'll talk about that when we get there.

MR. RECKLEY: Right.

So, I think, Dennis if you wanted to take a break, then when we get back, we'll do a recap of Subpart B, just because it's important. And then we'll get right into Subpart C on Design and Analysis.

CHAIRMAN BLEY: Okay yes, I wanted to stop here because I think your four slides on Subpart B might take us a while. We're doing pretty well, let's take a half hour break, come back at 11:40. We'll recess to 11:40.

(Whereupon, the above-entitled matter went off the record at 11:07 a.m. and resumed at 11:40 a.m.)

CHAIRMAN BLEY: At this time, we're back in session. Bill, you're back on.

MR. RECKLEY: Okay, thank you, Dennis. So, say we take a couple of slides and recap the first iteration that we prepared, and made public, on Subpart B, the Safety Criteria, and also discuss some of the feedback that we've been getting in that, and

what we're considering in providing an iteration, or an update to Subpart B.

So, that the current structure, as we provided it last time, and discussed it at the last meeting, was that the highest-level safety objectives would provide reasonable assurance of adequate protection and that's taken out of Section 182 of the Atomic Energy Act.

And that the requirements would also set out to define such additional measures, to minimize danger to life and property, that Section 161 of the Act empowers the NRC to do. And how our thoughts were, that we needed to address both of those elements in order to meet what we are taking from previous Commission direction.

That any advanced reactor has to be, at least, as safe as the reactors we've licensed to date. And we have regulations and have addressed in the licensing processes fairly concrete measures to do both of those activities.

So, under Safety Objectives, we put in Subpart B that the primary safety function is to limit the release of radioactive materials from the facility, and that applicant needs to identify such supporting functions that might be necessary.

And for many reactor designs, that would be the traditional need to control power or reactivity and the need to remove heat, the need to control chemical interactions, and so forth.

The -- then we went into the tiers, and I'm going to have a slide where we made an attempt to address some of the comments we got last time, and hopefully clarify the two tiers.

But we've identified the first tier that included normal operations and staying under the limits of Part 20, that's the 100 millirem value. And then for Licensing-Basis Events, to stay under the guidelines that are currently included in Parts 50 and Part 72.

Sometimes we'll refer to the siting criteria, that's the 25 rem over two hours at the exclusionary boundary over the course of the event, at the low populations on boundary. And laid that out as the first tier criteria for unplanned events.

And then to define the second tier that, which is associated with as low as reasonably achievable for normal operations. And then for licensing-basis events, bringing in the criteria of the NRC safety goals.

And then the rest of Subpart B, defined

the need to identify licensing-basis events, to support the assessments of the first and second tier criteria, to provide defense-in-depth, and to provide measures to protect plant workers.

So, if we go onto Slide 20, this is our attempt, it's -- I understand it's a concept that's, I think we're generally familiar with it. And we've seen its use in things like 50.69. Certainly under the Licensing Modernization Project, and NEI-00-04, we saw the attempt to make a distinction between different criteria.

I'm hearing a bit of an echo.

There we go. Thank you, Derek.

So, under the first tier -- let me back up one step. And so, in setting out the tiers, for the levels, the goal was to try to support what we've seen evolve under 50, and 52, over the years. Because this distinction between those things needed for under 50.69 safety-related.

But maybe the requirements for safety-related didn't line up with the risk significance, and in some cases, the risk significance of an SSC, didn't necessarily get captured in the regulatory treatments that 50.69 was trying to align, better align safety and risk management with the treatment of SSC's.

Again, under LMP, you had safety-related and non-safety related with special treatment that set this out in some detail. So, we're just trying to capture the motion of setting out a distinction between the treatment of equipment, and as I mentioned earlier, when we were talking about staffing, a possible distinction in the role of staffing.

So, that throughout Part 53, we could set out these different controls, different levels of NRC control, additional flexibility for licensees, for those elements in the second tier.

So, that was the goal, was to try to build it from the beginning, would enable a distinction between two levels of equipment, two levels of staffing, two levels of regulation.

So, the first tier was set out as being -- well it has generally been used over the years, as at least one of the components of adequate protection. And that's been the 25 rem criteria as it's defined in, or in both 50 and 52. And how it's applied to traditional design basis accidents.

And so, we kind of kept that, hopefully made it more clear that that's what we were using it for. And so, under the left column, under the darker blue, the first tier.

We set out the first tier, Unplanned Events, the Guidance, the criteria being 50.34, 52.79. Then we go down and say, you have to identify required Safety Functions to meet those criteria. Do you need, obviously you need to retain the radionuclides.

Do you need other things like controlling heat removal, heat generation, controlling chemical interactions, in order to keep the dose below those thresholds? To the degree you need any of those things, that shows up in the safety classification, the application of Appendix B, the inclusion in Tech Specs and so forth.

So, that class of equipment, or that grouping of equipment, that grouping of human actions, if you're relying on programmatic controls, those programmatic controls are going to get the most scrutiny.

Licensees would have the least flexibility. For instance, if they are included in Tech Specs, they couldn't change them without NRC approval. And you set out this whole grouping of requirements needed to meet the first tier.

And then, but in doing that recognizing that even for the current fleet, my view, my view is that that's not, we wouldn't be satisfied with just

saying that those have a certain boundary that's less than 25 rem. Our current requirements go beyond that.

And so, capture those things in a second tier. And really, to kind of get your head this, and my own view is that the current framework that we have for the operating fleet started off as basically binary. It's safety-related. It's regulated. It's non-safety related. It's basically unregulated.

I might exaggerate a bit, but if you go back far enough, it was somewhat close to that kind of a binary treatment. Over the years, starting especially in the 80s and carrying through now, especially with all the risks in trying to incorporate the risk-controlled insights.

You started to try to introduce the anatomy of the second tier. And so, this got you things like, blackout diesels. Important to safety, but not safety-related. In under 50.69 again, it got you controls over that class of equipment that might be important in the PRA, but not previously treated as safety-related.

So, the whole notion of the second tier was to try to set up from the outset, the new need for more than just showing you meet 25 rem. And capturing in that second tier, those things that would be

important to control in the risk from the facilities.

And so, that led to using the safety goals, because we were trying to, as much as possible, use existing standards, versus creating new things, as being the criterion for the safety goal for the second tier.

And then, if you go down, to identify the Safety Functions that would come out of considering that second tier.

It's going to be what is the equipment, in terms of both its ability to limit the consequences of unplanned events and to control the frequency of those events, in terms of the risk and safety significance, and to provide an added defense-in-depth. So, that's the way the second tier would show up under the Safety Functions' row there.

And then you go down to Design Features and Programmatic Controls, again, and our desire is to come up with a consistent treatment across all of the subparts on how we would the second tier.

That brings in for equipment, special treatment. It might bring in a special treatment on equipment. It would bring in licensee programs. It might bring in the role of, to our previous discussion, might bring in the role of unlicensed

staff.

But as we go through the subparts, we'll just try to build this out. So, that is the notion, Dennis, you had brought up earlier, the tiers, and I'll be honest, I went into a thesaurus and tried to use a word different than tier.

Just because Tier 1, Tier 2, Tier 2 is used under Part 52 and having developed the appendices in Part 52 for the various designs. And every other word had just as much confusion, or had been used in a different context.

But, the notion here is, and as we develop this through the licensing process, the hope is that this structure can hold, as we get into the licensing. And it will be pretty close to what is in currently in Tier 1 for Part 52.

It's supposed to be those things that are most important, those things that licensees can't control, can't change without prior approval. That this logic will hold, and we can use this structure, even as we go in, and it will be used throughout.

You're right, as we've used that language, and again, if we could come up with different words, maybe it would be better, but when we were developing under Part 52, this tiered structure, in order to

identify what would be certified in the design, what would require prior NRC approval of changes, what would actually, quote, "be certified".

And then, under Tier 2, Tier 2 what would be appropriate to be in the FSAR, and go beyond, and provide more detail then what would be under the Tier 1 and included in the certification?

We had to develop that, and -- Derek, are you over there? Thanks.

We had to develop that, and use it both in a legal construct, in terms of the rulemaking in Part 52, and try to align it with the technical distinctions.

Again, I think we can work, and try to make this align as we get into the development of Subpart H. Maybe we, that will be an area to see if we're successful. That's all.

I think I'll leave it there, and see -- did this help, hurt, or whatever? I think Walt, you were the one that suggested maybe we could tweak this figure to try to make it a little more clear. I tried to do that, but Dennis, or any other members?

MEMBER PETTI: Well, my concern --

PARTICIPANT: Hello?

MEMBER PETTI: -- is that by bifurcating

it, some people might comeback with the argument that well, the first tier is right, the ones I really have to meet, because they're the ones that are in the law.

And the second tier, I may not have to meet, but that's not what the intent is. I don't know how you argue against that, but whenever, you know, separate things like that, that's a risk right there.

MEMBER BLEY: Well, and that gets to, you know, that gets to be to be an interesting concept, in that one of the things that might be different, and especially when you look at the micro-designs, is there's a possibility that they would have no Tier 1, I mean the first tier.

Now I'm slipping. In other words, there may be the ability to have inherent features such that you wouldn't exceed 25 rem, which is a fairly high threshold. But then the regulation of those micro-reactors would be in the second tier, because they would have to logically have controls on other things.

But then, I shouldn't say an absolute. I'm not sure that even a micro-reactor would have nothing in the first tier, but they could have very little in the first tier.

And most of the regulation of the micro-reactors could fall to the second tier, which would be

appropriate, perhaps, in that they would have more flexibility, there would be fewer things they would need to get prior NRC approval for, there would be fewer safety-related components, and so forth.

So, it could be, one of the results of this, when you apply it to the micro-reactors, can be a shift. And the second tier becomes the dominant tier in terms of where the regulatory requirements would actually be coming from.

MR. CORRADINI: That's okay, Walt, but just a quick follow-up. So, explain to me the flexibility in the second tier. Maybe I'm missing it. It strikes me a requirement is a requirement.

So, you just explained how the first tier might not be, what should I say, controlling, but the second tier would be.

Where is the flexibility? It seems to me the way this is presented, both of these are sets of requirements that must be met. And normally the first two would be the controlling ones, the others would not be. Can you help me there?

MR. RECKLEY: Sure.

MR. CORRADINI: And then I'll come to Walt.

MR. RECKLEY: Well, the flexibility would

come in -- in what is built into the second tier for flexibility.

If it's not requiring safety-related equipment, then you have the flexibility of the whole commercial market, for example, in order to procure equipment.

In terms of programs, if it's not in tech specs and it's in the FSAR, you have the -- you have the additional flexibility of making changes without NRC approval. So, there's where you get the flexibility.

You still need to meet the rule, but the rule would have built into it that the things controlled under the second tier the licensee has more control, has more ability to make changes, has more responsibility put on them to maintain things in accordance with their licensing documents as opposed to having things defined in a structure such as technical specifications and requiring prior NRC approval.

So, at the highest level, yeah, they still are regulatory requirements, but they have the flexibility built into them, would be the goal.

So, I'm sorry, Walt. Go ahead.

MEMBER KIRCHNER: Yeah. Bill, after your

last presentation on this, I kind of thought that rather than showing -- and it's not just the optics, but kind of consistent with Mike's question, I kind of would think it would have been serial so that, as you suggested there maybe for a larger power plant the dose, you know, at the boundaries may be the controlling requirements.

I kind of thought of these serially. I'm very -- for example, safety functions. I think defense-in-depth is part of the required safety functions, in my mind, that is built into the design.

And it may prove that with a smaller reactor they can, you know, very -- excuse the choice of words -- deterministic manner address those and show that they're well below both the QHO and the dose in 50.34 or 52.79.

So -- but you would still want to see that defense-in-depth integrated into that diagram that you showed earlier today and such.

So, I kind of thought of them more serial than in parallel, or either/or, that you would go through each tier as you've shown them in a more serial manner rather than in an optional manner; but if it's a requirement, they're both going to apply.

So, maybe it's just my inability to

perceive this correctly.

MR. RECKLEY: It's probably more likely my limitations as a graphic artist, I think, and we're not as -- the previous version of this, for instance, under Safety Functions, just -- they listed the same functions.

And I tried through discussion to say that under tier -- under the first tier, if controlling heat removal was a required safety function, then that -- then at least one means of controlling heat removal was going to end up in safety-related and in tech specs, for example, and it's being set out to make sure the dose relays under 25 rem.

MEMBER KIRCHNER: Yeah.

MR. RECKLEY: I had the same list of functions under the second tier, but tried to explain that -- the functions are basically the same.

I mean, equipment is either -- it's doing something like removing heat or controlling reactivity, but the reason you would have a second system for heat removal is because of its risk significance, its importance in defense-in-depth, its contribution to the PRA, et cetera.

So, you would have an additional piece of equipment for heat removal, but I understand the

discussion, then, was having the same functions listed was confusing.

So, it's not easy to try to get this, at least for me, try to show this, but that would be the distinction.

So, if you're removing heat from a passive reactor cavity cooling system under the first tier, you might actually have some fans under the second tier which, you know, you wouldn't want to rely on as your primary means because now you have to power a fan, but it might be a very good way to reduce the overall risk by having a backup to the passive heat removal system.

MEMBER KIRCHNER: And if I might, since I've interrupted, under these required safety functions, I would take a different attack than what is listed here.

I like the first sub-bullet, of course. That's the whole idea of preventing, you know, the atmospheric release from your earlier diagram, but control of heat generation, heat removal, chemical interactions, that's going to be fairly design-specific.

At a more fundamental level, I would assert that if it's an advanced reactor, you can

maintain control reactivity and shut it down.

That, to me, is primary. It's the fundamental thing about nuclear reactors from any other power production system.

You want to control the integrity, as designed, of the plant's fuel and inventory, and don't you want to maintain the capability of those barriers to mitigate -- prevent or mitigate the consequences?

So, I would assert that the three bullets; control heat, regeneration removal, and the chemical interactions, are more design features and that there is a higher level of means to define the required safety functions that I think would apply to almost all reactors of any size and any fuel configuration, including liquid fuel.

That's just -- but I'm concerned about the absence of control of reactivity and the ability to achieve a safe shutdown as a primary safety function. That's just a member's opinion.

MR. RECKLEY: And it's good and we've heard that in stakeholders -- I think we have a bullet on that and we will get to it when we talk about the feedback.

One of the reasons that we weight it out the way we did in terms of these are examples of

safety functions that are likely to come into play, is because under the advance reactor construct that we're trying to do for Part 53, in some -- since it's technology-inclusive, in some reactors the actual inventory -- or inventories that you have to look at will vary.

And if there's a significant inventory in waste gas, then the designer and licensees for that design, where significant inventory is in waste gas, will have to define the safety functions for the retention of that inventory and reactivity may not be a safety function for that inventory.

And so, we needed the -- the thought was we needed the flexibility to have this rule address all of the source -- all the inventories, traditionally all the source terms and the safety functions would be different for different inventories. That was part of the logic.

MEMBER KIRCHNER: No, I agree with you. And I would assert that you need to maintain the control and integrity of the as-design configuration of both the plant's fuel and its radionuclide inventories, whatever they are.

So, if they're a liquid fuel system and they're off-gassing and, you know, they're

accumulating fission product gases in some kind of design vessel or something, that would, in my mind, be part of a critical safety function, but that's separate from control reactivity and shutdown.

MR. RECKLEY: Right.

MEMBER KIRCHNER: So, it may be -- in that particular design that may be the most -- and this is where the risk -- the PRA kind of analyses come in that you may find that's your most -- that may be your Achilles heel, so to speak, in terms of a contributor to risk.

MEMBER REMPE: So, along that point I really liked the approach you laid out in the prior slide, Bill, and we discussed it, I think, in the meeting we had a couple -- well, a month ago or whenever.

But I also note that even in the existing regulation the critical safety functions and guidance documents are -- slide differently in different existing literature that the staff has.

And a couple of weeks ago we had an advanced reactor code meeting and they had gone with a different layout than what you presented on the prior slide.

And I like the -- this is the NRC and

today you mentioned it tied to the Atomic Energy Act about controlling radionuclide release and then defining subsidiary goals that make sure you can control radionuclide release. The applicant would come in and the staff would agree with them.

And so, I think consistently giving that picture might be a good approach. What do you think?

MR. RECKLEY: Yeah, I think that I agree, if we can. And it is very similar -- I mean, even this construct is basically the same as the general design criteria layout from 1968, or whenever that activity was undertaken, in terms of if you look at how that is laid out, it's basically laid out in terms of reactivity fluid systems, which is really heat removal, and the retention of radionuclides through a structure. So, I think we're largely consistent.

I do agree with you to the degree we can start to always talk about it in the same terms that would be beneficial.

CHAIRMAN BLEY: You know, I appreciate your (audio interference) here. I'm hanging up on several points.

One, it seems like we're working really hard to retain something that kind of grew randomly over the years in response to those challenges.

Two, adequate protection is a legal concept for minimizing the danger, I think I can easier think of it as a scientific concept, but (audio interference).

This picture that you gave us today works better than the one you gave us a week ago, but it still -- I have trouble keeping it -- putting it all together and seeing -- even though I've read C and D, whichever one you looked at last month, and along the discussion you had with Walt, if you look at that safety functions, required safety functions there in the box, if one were to lay this out more logically I think you could get closer. Of course you wouldn't have this simpler presentation.

If you take this transcript and look at your long discussion here for the last 10 minutes, maybe that's the basis for trying to put together a white paper and that would really help. If you're laying out this logic and writing (audio interference) pictures, you know, so people could see it and talk about it, it would help.

MR. RECKLEY: Okay. Yes, it was a suggestion last time and it's a good one. We will try to do that.

I don't know what form it would be in. We

are going to have to explain this in the Statement of Considerations and other documents that we need to prepare.

And so, to a degree we start to work on that, which we need to, such a white paper could be a vehicle.

CHAIRMAN BLEY: Yeah. I think so because I, you know, this is kind of a key to at least the language and much of the rest and at least to me it's -- I know you want to be able to reflect this back and show that we're doing many of the same things, but it -- if your basis in 53, and I think it mostly is, risk-informed, then these kind of arbitrary distinctions don't work too well for me, anyway, you know. It's the extent of a particular system's impact on meeting the overall station performance of retaining the radionuclides that's the real key and they seem artificial.

We can't solve it here, so -- we can't solve it very well or help you with that, something coherent written down to work from.

MR. RECKLEY: Yeah. And one of the key things that -- it might be subtle, but one of the key things that drives this structure, which was a decision at some point to maintain, was safety-related

designation, Appendix B application, tech spec control, that kind of a structure.

If you go back and, you know, we had these discussions not recently, to be honest, because we had them a long time ago and kind of internally decided on this approach.

But if you go back -- and I know, Dennis, you are very familiar, something like NUREG-1860 basically said let the risk-informed insights that you get from the assessments determine what special treatment is needed.

And special treatment can be graded and you really may not need such things as the designation, because you can let the system drive the special treatment.

And that could include something all the way to the application of NQA1 down to some graded approach and not have these designations built in.

We did decide, for good or bad, that we were going to keep this structure with safety-related designations and application of the high level quality assurance in NQA1, Appendix B. And that is really driving, to a large degree, this structure in the tiers.

So, as we go forward, you will continually

see that and, again, that can be a point of discussion as we go through the iterations.

CHAIRMAN BLEY: I think so far some of these things aren't separable. Tech specs are in the first tier, but special treatment, which is laid out in the tech specs, is second tier.

I mean, I just -- I have trouble feeling this -- the real separability of these things.

MEMBER KIRCHNER: Dennis, if I might, I have the same problem, Bill. That's why I suggested something a little more serial.

I mean, going back to just your comments, you know, the whole idea of risk-informed and such as a top-level approach would suggest that the -- let me just -- not to rebuild your viewgraph in real-time, but give you an example in my own limited mind about how I would approach this, the control of frequency in consequences rather than being in second tier, I would have it up at the top of the first tier above normal operations. And then you go, you get normal operations, unplanned events and so on.

And likewise, to me, having defense-in-depth in the second tier just, as a former designer, is just anathema to me. I mean, defense-in-depth ought to be built into these safety functions. So,

that's what I meant be "serial."

Just as Dennis said, you would have tech specs and then special treatment and license programs would be part of the design features and programmatic controls it.

I don't want -- I'm just not convinced you need the second tier to address 182 and 161 and then trying to split them to line up with each of those raise, at least for me, some artificialities of what you really intend, which is a more holistic approach rather than an either/or kind of set of buckets to work through.

CHAIRMAN BLEY: Maybe your next slide will help us some.

MR. CORRADINI: Bill, can I ask one -- a different question, though, because, Bill, you used an example that I thought was interesting.

You said that if I had the reactor to be small enough thermal output, then perhaps what you define as "first tier" would automatically mean that, and the only thing that would be controlling is what you call "second tier." That implies that everything fits in the same -- under the same umbrella.

Could you not have a parallel path that if something -- if some design is small enough -- I don't

even know what "small" is, but is small enough that you would actually have a more restrictive categorization kind of like the NPUF rule that you have only allowable releases of 1 rem offsite.

And, therefore, with small machines, whatever "small" is, you have a more deterministic approach, but it's much simpler.

I'm -- what's troubling me is -- and, again, I said this last time, but I'll just repeat briefly, this -- as the size of the design gets smaller, this becomes a really complicated overload of regulation on something that ought to be very simple.

So, I guess I was asking -- there might be a parallel way to do this if something -- if somebody can -- and the parallel way might actually be more restrictive.

It might be -- or essentially the second tier might be the restrictive tier to do the regulation upon.

I'm using the NPUF rule as an example because -- I am not even sure if it's been approved yet by the Commission.

But when we reviewed that a few years ago, that essentially looked upon things in a manner that was more deterministic.

MR. RECKLEY: Yeah, for the decisions that were being made under that rule, but -- yeah, as we get into this next design and analysis, let's -- I think we'll revisit this again and again. So, I -- your comment, Mike, is one we're hearing from others as well.

I would caution that if you go back to the integrated slide, even the 1 rem number is for evacuation, right?

And so, you have to look at what the safety margins are being applied to to see even what the right dose number might be if it was to be used as a criterion.

And as we talk about -- and this might be today or definitely in future meetings -- what is the flexibility that people foresee if you want to focus in on micro-reactors, there is an argument to be had that the relaxations that are being sought in a whole host of areas for those -- the possible deployment of micro-reactors puts even additional onus on making sure the design is to the highest standard that a systematic approach, whether it be PRA or some other systematic approach, has made very clear that the risks are appropriate because the deployment models go beyond and we may not need to evacuate the local

population. It goes even further than those potential relaxations.

So, we get into that, I think, in the next section. Let's go on, if we can, to slide 21 and we'll talk about some of the feedback, which is similar to the feedback we're getting here.

Let's start with the first bullet. Some people say get rid of the second tier. The thing we heard last time was -- from ACRS committee members was, again, clarify the two tiers. We continually hear them on this.

Going forward we hope to clarify it. You'll see language in a few weeks when we release an iteration.

But, as I mentioned, our expectation is right now in order to make this differentiation between the regulatory treatment across all of the subparts, we continue to grasp onto this concept and maybe want to give it one more shot in the next iteration to see if we can provide additional explanation and understanding of that.

Go ahead, Dennis.

CHAIRMAN BLEY: One thing that does come together for me, but you know, see how it relates to the discussion in the proposed rule (audio

interference) today, and it eludes me a little bit, is the distinction that we see in Part 52 with Tier 1 being the fixed things that you essentially have to (audio interference) change to -- to the license to change. And Tier 2 still requires things you have to have that using your tools of this management at the plant you can change on your own, subject to the inspection looking, you know, later by the staff.

That makes sense to me, but I -- I'll leave it at that.

MR. RECKLEY: Okay. And, again, we think that would hopefully -- we're hoping, as we build this out, that that construct would stay and that what we call the "first tier" would align with Tier 1.

If there's something that is keeping the dose less than 25 rem and the licensee is proposing to make a change to it, that would require prior NRC approval. And we get into this in the Operations section.

If it is less than that, for instance, it is some of the equipment or programs that are aimed primarily, let's say, at beyond design-basis events and meeting the QHOs, then the applicant would have the ability to change those on their own and include them in an update. So, that general construct, we

think, will stay.

We have to, as we work and put all the pieces together, see if it does, but the initial thinking is that it -- that construct you've described should stay.

CHAIRMAN BLEY: Right. And this is something you can't see now. If you did follow the LMP and you came up with your licensing basis events, those high consequence, higher frequency, the things that under our current thinking might be beyond design-basis would no longer be because they would shift into the design-basis events that are covered under Tier 1.

We kind of missed that here because we're not seeing a practical application with this.

MR. RECKLEY: True. True. So, going under that third sub-bullet there under the second tier, there's some discussion of even if you keep two tiers, whether the health objectives are the appropriate metric, and some discussion about maybe the development of an alternative metric to it -- to the QHOs; or even if the QHOs are included, whether they are put into the terms of the specific numbers of the frequencies that we used in the first iteration. So, again, one of the comments that we've received.

We do -- and this is similar, I think, to the comment from Walt -- have a comment that as opposed to saying the applicant is required to identify the fundamental -- to identify safety functions, to actually include the fundamental safety functions, the ones we've been talking about, into the rule proper, again, we're reiterating on that.

One of the things that goes into our thinking, I mentioned one already, the need to address inventories or source terms within the plant that are different than the reactor core.

And then the other possible wrinkle is that we're still holding open the possibility that fusion energy systems would be also addressed within Part 53.

And they would obviously have different safety functions supporting the retention of radionuclides within that type of a facility.

So, if we go down then to slide 22, one of the big comments from our last meeting is the potential to address chemical hazards or non-radiological hazards. That was a good comment. We currently have that under review looking at fuel cycle facilities and other areas to determine how we would address non-radiological hazards.

Another comment from external stakeholders was to do away with, as well as reasonably achievable, requirements in Part 53 and our reference to them in Part 20.

Some members in our last discussion with this subcommittee actually expressed the view to keep ALARA. We're working on that iteration.

But for now, given the long history of including "as well as reasonably achievable" in our regulatory structure, our leaning is to maintain it.

MEMBER PETTI: So, Bill, I don't remember -- recall reading the industry comments on that. To me, one of the arguments for leaving it is that the greatest risk for some of these facilities may be to the workers themselves and less to the public.

And so, this allows at least a focus there, you know, to recognize that it -- that -- a distribution of risk, if you will, is different and this gives it that high-level visibility.

MR. RECKLEY: And I know it's been, you know, we summarize things here. Even the ALARA discussion varies between stakeholders and what they have proposed.

No one has proposed, as a operating philosophy, doing away with it. It's just where -- if

and where and how it's captured in the regulations.

MEMBER PETTI: So, help me understand that. Is there -- I mean, is there subtlety in the legal sense? If it's in, you know, a different part of a rule, they have to in Part 20?

I saw that later but they said, oh, they're not throwing away ALARA. They just don't want it over here. It's okay to be over there.

I mean, tactically, does that change something?

MR. RECKLEY: It has a potential, I think. When we included it in Subpart B as kind of a primary factor to consider and then something we would carry through all of the subparts, one of the areas of concern was the degree to which ALARA is then brought into the design process. And a designer would be held to showing how the design meets an ALARA concept.

So, it is tricky in that something like ALARA is accomplished by all the things we continually put together in our discussions.

It's part of the design, it's part of programmatic controls, and it's even part of the human element associated with operations.

And so, when we break out an area like design and say design in combination with programmatic

features needs to support ALARA, there is a concern about how that would be implemented.

So, I understand where the concern is coming from. I don't have a perfect solution to that concern.

But from my perspective, as you've mentioned, both in terms of occupational and public releases, as well as reasonably achievable, the design process has always been an element.

So, I -- how this would actually work, I mean, we -- when we're interacting with stakeholders, you have to -- and I would do the same if I were in their boat. They have to not only look at what the requirement is, but how might it be interpreted, how might an inspector look at them and say, show me where you meet this requirement. So, that's part of the concern.

Then the last bullet, protection of plant workers. Again, there was some concern about having it up in Subpart B as kind of a primary objective of the whole Part 53 effort.

And there was also some concern that we were cutting and pasting and potentially paraphrasing things from Part 20.

So, our preliminary thought is to keep

protection of plant workers much along the lines, Dave, as you were mentioning. It's always been important.

For some designs the -- and actually even for existing plants if you look up societal dose, protection of the workers are probably higher than the public. That will be even more so potentially for some designs.

So, we're proposing to keep it and -- but, to avoid confusion, we can refer to Part 20 as opposed to paraphrasing.

So, that is the feedback we've received on Subpart B. If you want to stay here for a second or we can jump into how this gets reflected in the design and analysis subpart.

MEMBER KIRCHNER: Just a quick, minor point, Bill. This is Walt Kirchner.

When chemical releases, there is the distinct possibility of having mixed releases with some designs, and that makes things like your earlier diagram in terms of returning the fission product barriers and overall meeting the safety objectives perhaps much more difficult.

So, it's just not chemical releases as a chemical release. There's the distinct possibility of

mixed releases and then interaction of the chemicals with the environment or -- that would be of concern, fire and other hazards.

MR. RECKLEY: Okay. Yes, thank you. Yeah. And, again, we're looking --

MEMBER KIRCHNER: I wasn't trying to make this more complicated --

MR. RECKLEY: Right. No.

MEMBER KIRCHNER: -- but if it's a chemical that's carrying a fuel, that becomes a much more difficult proposition.

MR. RECKLEY: Right. And you're looking at both the radiological toxicity and the chemical toxicity and, yeah, it's more complicated across the board.

So, we are looking at, again, using the fuel cycle facilities that face some of these challenges as well.

It might be -- or probably will be more complicated, in a reactor sense, because you have a wider set of radionuclides involved and you have at least, depending on some designs, a wider set of chemical hazards involved. And then, as Walt just brought up, the potential mixing of the two. So, as if we didn't have enough on the plate, but we agree

that it needs to be addressed.

So, any other mentions or we're starting on Subpart C?

(Pause.)

MR. RECKLEY: Let's go on, then, to slide 23. Okay. All we're setting up here is its context in the general layout of our Part 53 structure.

We go on then to 24, just a -- kind of a preview of what we'll be discussing. This is the sections as they're currently laid out, the overall design objectives, the design criteria for meeting the first tier safety criteria, meeting the second tier safety criteria, currently have a criteria for protection of plant workers and, in this version, some related design requirements. Then we get into the analysis section, the categorization and special treatment of equipment.

Going on then to slide 25. This, I think, will be an area where we can have some really meaningful discussion.

The application of analytical safety margins to operational flexibilities, and this really relates to some of the discussions we've already been having in the relationship to micro-reactors in particular, perhaps, in terms of simplifying possible

approaches and so forth in design, quality assurances related to design, and then some interface activities.

So, before we get in, I just -- it might be subtle, but the kind of language that we're using here as we go down in terms of level of detail is we're starting off with the safety criteria.

We talked about those under Subpart B. Those are currently in the iterations, the 25 rem number from 50.34 and the QHOs for the second tier. So, those are the safety criteria.

Then we say under Subpart B, you have to identify safety functions to meet those criteria. Then we say you need to identify design features, human actions and programmatic controls to meet the safety functions.

So, if the safety function is heat removal, a design feature might be the reactor cavity cooling system.

And then you would have human actions and programmatic controls to meet that to support that design feature.

The next level down and what we start to talk about under this section, Subpart C, Design and Analysis, we introduce the term "functional design criteria," which is to take the design feature that's

being used to support a safety function and actually laying out what characteristics does that design feature need to perform its job.

So, that's kind of the language we used. I know it can get lost in the discussion. So, I thought I would start off with at least trying to say this is how we're using these terms.

MEMBER BROWN: Bill, what slide are you on? I've got -- you're on 24; aren't you?

MR. RECKLEY: Actually, I was just laying that out before we go on to --

MEMBER BROWN: Oh, I'm sorry.

MR. RECKLEY: -- the next discussion.

MEMBER BROWN: Alright. Thank you.

MR. RECKLEY: So, it's just kind of background. Yeah, sorry. I should have had that on a slide, but I didn't have that structure.

But even in the table of contents you're seeing things like "functional design criteria" -- or the "functional design criteria," that's the terminology we use. So, sorry about that, Charlie.

If we go down, then I guess we can get into the first specific subpart section, which is 400, on the design objectives for this subpart.

And so, basically just kind of, in general

terms, saying the objective of this section, or subpart, is to establish the overall design objectives, tying them back to the safety criteria and the identification of safety functions from Subpart B; and to require that the design features that are identified, when combined with the associated programmatic controls, provide reasonable assurance that the safety criteria, either the tier -- first tier or second tier safety criteria are met.

And we'll talk about that as we talk about the specific sections. So, that's the overall objective of this subpart.

We go down then next to 410. This is -- maybe this would have been a better place to have the discussion I was having on the terminology, but this then -- Sections 410 and 420 are basically requiring that functional design criteria be established for those design features.

So, this is going to be things like heat removal rates and, you know, the actual things that are needed to define what a design criteria -- what a design feature needs to have in order to fulfill its function.

MEMBER BROWN: Bill?

MR. RECKLEY: Yes, Charlie.

MEMBER BROWN: 410 -- this is a question on terminology that I got lost on when I was looking at it.

410 starts the title "Functional Design Criteria for First Tier Safety Criteria." Then A is "Functional Design Criteria," virtually a repetition and you go through the rest of it.

In 420, you say "functional design criteria for second tier safety," but you start off with "design features."

Is there a distinction between first tier and second tier that you don't need "functional design criteria" down in the text?

You switched over the terminology of "design features" whereas you used in A and B of 410 "functional design criteria" within the A and B itself, and I was wondering if there is a distinction that I lost.

MR. RECKLEY: It might be an inconsistent way we've laid these out, which would be -- you know, we will take that comment and look for consistency, but 420 does require, later in the paragraph, for functional design criteria to be defined for each design feature used to meet the second tier.

It is perhaps very confusing, as you point

out, that we didn't keep the same sentence structure, but the intent is it's the same.

MEMBER BROWN: I just -- if you look at 410, Item A says, functional design criteria must be defined for each design feature.

420 doesn't start off by saying, functional design criteria must be provided for each design feature. It -- the terminology is just flipped around. That's all I -- we ought to be consistent.

I'm just hoping I didn't lose the technical understanding. That's what I was worried about.

MR. RECKLEY: Yeah. I mean, for example, under 420 B, but we don't do it until the middle of the paragraph, we do say, functional design criteria must be defined for each design feature relied on to demonstrate compliance with the second tier safety group.

MEMBER BROWN: I got it.

MR. RECKLEY: But your point is well taken. By having them in different places, it can be confusing. So, we'll look at that.

The intent was the same. We may have -- it's just the way we did the sentence structure.

MEMBER BROWN: "Design features," to me,

are things you put in place to meet functional design criteria and it seems like the first tier just reversed the way we were operating them.

So, that's all I -- I'll stop and you can deal with that.

MR. RECKLEY: Yeah. We will look at the language. Thank you.

CHAIRMAN BLEY: Can I get in a chance to --

MR. RECKLEY: No, no. That's fine.

CHAIRMAN BLEY: In Subpart B, or in any of the other subparts, do you anywhere lay out the thing you told us earlier that Tier 1 are things you have made a -- a change to the licensing basis to change, and Tier 2 are things that could be done by the licensee.

MR. RECKLEY: What you are seeing -- not yet. That will get reflected in the future subparts like on licensing and the control of licensing and even, to some degree, under operations.

CHAIRMAN BLEY: Okay.

MEMBER BROWN: Yeah, Dennis, I did not equate the second tier to the Part 52 Tier 1 and Tier 2 they way you said it.

CHAIRMAN BLEY: And the last time either,

but I think Bill's made clear that's the intent.

MEMBER BROWN: Okay. That might ought to be -- hopefully it should be reflected earlier rather than later because I thought this Tier 2 stuff here in Part 53 was like Tier 1 stuff, but just of a little lesser importance, but didn't allow the applicant to change it on his own.

That was the way I read this, so I lost that distinction.

CHAIRMAN BLEY: The other thing I was going to ask, because I think I heard this, there isn't a distinction between Tier 1 and Tier 2 that Tier 1 you have to do, Tier 2 you ought to do. These are all requirements that have a different level of, maybe, oversight.

MR. RECKLEY: That's right.

MR. CORRADINI: But the oversight is not specified here.

MR. RECKLEY: Yeah. And that's the difficulty of trying to -- in my novel analogy, trust me, we'll get to that in Chapter 8. You're looking at Chapter 2.

MEMBER BROWN: Yeah, but why shouldn't Part B make that distinction since it's the overall safety objectives?

Why shouldn't that make the distinction between first tier and second tier the way you just phrased it?

MR. RECKLEY: Again, once we put it all together, hopefully it will be -- people will be able to see it in total and understand how the pieces fit together.

But once we do that, if it makes more sense from a clarity standpoint to have some of this discussion under Subpart B, we can certainly look at that.

But, again, the thinking was that you start off at this high level and you make everything consistent with it and hopefully when we get into the licensing area, we can remain consistent, but it all derives from these higher level principles.

And so, the licensing process is -- would be driven by its relation to this higher level discussion, not the other way around, was what we were hoping.

CHAIRMAN BLEY: So, we're not doing Subpart B today, but one last comment on that.

MR. RECKLEY: Yes.

CHAIRMAN BLEY: The thing that got me started off wrong, if you will, is 53.22, the safety

functions when we read that and then immediately go into first tier safety criteria and it felt like there should be a link between the safety functions and the two tiers of safety criteria, but there are not. And that really set me astray, I think.

MR. RECKLEY: Okay. And, again, it's a challenge to put this together. To be honest, one of the things that we did do is switch around the order. So, safety functions now follow the design criteria -- the first tier/second tier safety criteria.

(Simultaneous speaking.)

MR. RECKLEY: I know. So, let me see.

MEMBER BROWN: As opposed to Dennis making the last comment in that relation, when I go back and I look at Part B, I hate to say this, when you talk about the first tier safety criteria, they all seem to be firmly rooted in limiting things to, like, the 0.1 rem for this or the 25 rem for that, et cetera, et cetera. That's in the first tier.

When you get to the second tier in Part B, it starts -- it talks about those same things. However, you throw in the "as well as reasonably achievable" and you throw in -- well, maybe the economics get thrown into this and you may not have to do anything if it costs too much.

That seemed to be a really big difference between Tier 1 and 2 -- the second tier and first tier in Part B.

And it makes -- it certainly makes the second tier safety criteria seem, well, if it costs too much, they're not important. I'll leave you with that for future --

MR. RECKLEY: And in terms of the normal operations, that is clear because the whole discussion of ALARA includes a cost element.

So, that's --

MEMBER BROWN: I got that. It's just --

MR. RECKLEY: -- and that's intentional and that is the flexibility that is provided by the two tiers. We've been talking about what's the difference. That is -- it's a large difference.

The numbers are lower, the performance goals are significantly lower than 100 millirem, but it also includes the ability to consider costs in the assessment.

And that is generally aligning with the whole concept of adequate protection, which means you have to provide it and we don't care how much it costs.

And the second tier, which goes to a

different part of the Atomic Energy Act and that part of the act that we've traditionally employed primarily for backfit analysis where a risk threshold and considering cost implications are allowed.

So, again, I think it fits not only within Part 53, but it fits with how we've generally operated over the years.

MEMBER BROWN: Well, my only thought if I had -- 53.200 talks about safety objectives. That paragraph would have been ideal at the end if you had said, within that we've established two tiers; one like this and the other one with the ALARA, et cetera, et cetera. So it -- instead of having to root it out, that's all.

MR. RECKLEY: Okay.

MEMBER BROWN: It's tough to figure it out as opposed to having a quick statement of how you've divided it up.

You divided it up by having the two separate sections and hopefully people can figure out what the difference is.

I'll quit now. I'm sorry.

MR. RECKLEY: No, no, no, you know, clarity is the goal here. And so, these kind of observations on how we might structure it -- and

discussions like this where we're not really changing what the technical requirements might be, but just trying to make them more clear are good comments.

So, we will go back and look at how we would put this together.

MEMBER BROWN: Okay. I am not objecting to the approach. This is just a matter of understanding it.

Until we had it today, I didn't quite put all that together until I went back again and reread Part B again.

MR. RECKLEY: Okay.

MEMBER BROWN: It just took me a while.

MR. RECKLEY: Okay.

MEMBER PETTI: I think the thing that I'm taking away is if -- I know it's hard. This is worse than writing a novel -- is to somehow embed succinctly a rationale in the rule without it getting, you know, overly wordy.

Because that's what people are tripping on because there's not a rationale that they can easily access to understand, you know, why the flow is the way the flow is.

MR. CORRADINI: Yeah. And, in fact, Bill, I think the way you said it in explaining to Charlie

was probably the most succinct way that I hear about it relative to there is a risk threshold and a cost threshold for the second tier requirements that don't exist for the first tier. At least that's what I heard you say.

MEMBER BROWN: That's excellent, Mike. Thank you. Bill's explanation then was very clear. Put it in Part B 53.200.

MR. RECKLEY: Okay. Thank goodness you guys take transcripts. We'll go back to see how that was said and we'll try to do better.

So, the note here was turning also to -- just to point out there are parallel activities and, at some point, your subcommittee will start to hear about these other activities like the technology-inclusive content application and advanced reactor content application, two very similar activities, that are looking to address not only the traditional content of application, but also where we might improve in terms of performance-based approaches to regulation.

And the reason that's brought up on this slide is historically one of the areas of concern is how much of the initial licensing review is associated with things like ALARA and the design aspect in

conformance with -- to Appendix I of Part 50 and so forth.

And we are thinking and developing some guidance, there's actually even been draft language put out, in terms of content of application where some of this can adopt a more performance-based approach and move some of the review from the initial design to a performance-based element.

So, it is just a note that there's other activities underway and that note is especially as it relates to ALARA in the first sub-bullet of the second tier. So, with that, I think we can go to slide 28.

MEMBER PETTI: Just a question on 27.

MR. RECKLEY: Yes.

MEMBER PETTI: I'm struggling with just the English, "design features and functional design criteria are determined through analysis."

Are you meaning that the design features are validated that they meet the functional design criteria, analysis is used to validate the design features meet the functional design criteria?

MR. RECKLEY: Oh, thanks, Dave. Actually that's a -- I was trying to make a distinction in both for the first tier and the second tier that for normal operations ultimately you can have a performance

measure actually related to the release of effluence.

And, from a regulatory perspective, we can come back and say we didn't look at your design in as much detail as we may have historically, but we can tell right away you're not meeting the performance goals set out -- apparently set out in Appendix I to Part 50, which is, you know, a couple millirem per year.

Therefore, there's a performance-based approach that can be taken for normal ops and showing that you meet the 25 rem number or the QHOs, that's done by analysis.

You can bring in performance-based elements, but that it's not, per se, a measurable parameter. It's you're showing compliance through the analysis that you do.

Is that more clear?

MEMBER PETTI: Okay. And then just the second question on the functional design criteria. In some guidance, you'd point them potentially to the advanced reactor design criteria as examples of criteria that are associated with safety functions?

MR. RECKLEY: Yeah. They could bring in Reg Guide 1.232 as an example of how they are meeting safety functions.

And the advanced reactor design criteria does go a little beyond design functions and starts to talk about design features and even functional design criteria. So, the -- but that -- so, yes, they could refer to that.

We haven't looked exactly where the ARDC -- how far they go in terms of the functional design criteria. That's a -- it's a good observation.

We'll go back and look to see if the -- at what level does the ARDC go down to.

MEMBER PETTI: Alright.

MR. RECKLEY: Okay.

CHAIRMAN BLEY: Bill?

MR. RECKLEY: Yes, Dennis.

CHAIRMAN BLEY: To me, it feels like we're just back from the break, but I expect many of you back on the east coast are ready for lunch and this is where we had it scheduled.

Although we were just really getting into Subpart C, we are (audio interference) slides at this point. So, this could be a good place.

If anybody wants to say anything about that, do it. Otherwise, I'm going to declare a lunch break now.

(Pause.)

CHAIRMAN BLEY: We're going to recess for lunch for one hour. Be back at five after 12:00 here, five after 2:00 out where those of you in the east are. We are now in recess.

(Whereupon, the above-entitled matter went off the record at 1:06 p.m. and resumed at 2:05 p.m.)

CHAIRMAN BLEY: Okay. We are now back in session. I've heard from one member, so I know we have a quorum for the subcommittee.

Bill, before I turn it back to you, two quick questions. One for now, and one for two slides from now.

The first one is Ron said you had found that old DOE paper. If you have something more recent that you folks are hanging your hat on, or something you've written, we'd be interested in seeing that.

And the other one, you know, the functional design -- I'm sorry, the design requirements of Section 440, there's a way that I think I've seen elsewhere and it seems odd to me a little, but maybe it's common, that says the system shall be designed using generally accepted consensus codes and standards wherever applicable.

Is that "wherever applicable" language common? It seems like it's just begging people to

say, well, it doesn't apply.

So, on those two things, I'll turn it back to you. Whenever it's convenient, maybe you can address them.

Bill?

MR. RECKLEY: Thank you, Dennis. Yeah, I'll get to that when we talk on the consensus codes and standards.

I'll look for the DOE handbook. It seems like that's the general time frame back in 2012, I think, or whatever edition that was.

We can talk later. Something else out of the general construct of the DOE orders handbook and standards that we had raised to stakeholders actually in the first meetings when we were talking about the design criteria, that we still are searching to see if it might have a role, is the use in the DOE terminology and approach of a new mitigated event and whether that might be a vehicle to, I think, as Mike Corradini and others have suggested, it may be as a way to greatly simplify matters in the DOE approach.

And it's been reflected in seismic design criteria and in ANS 2.26 as well that if you can do an unmitigated event and show it is below certain thresholds, then you can, in the seismic design

category, take that into account in both your design of the structure and even what seismic hazard to consider and we're still trying to toy with that.

Part of the issue and, again, this is where if there's anybody with knowledge otherwise, part of our hesitancy in exploring that further is we have not seen any literature that even micro-reacttors would show that an unmitigated event would be below the thresholds that people are interested in, whether it be the 1 rem number, or perhaps even lower, depending on what relief they're seeking.

But I'll just drop that as a bug and if anybody has insights, we'll probably come to a point in a couple slides from now where that might be brought into the discussion.

So, we've talked about this slide. Again, the requirement being to come up with the functional design criteria for any design feature for the unplanned events for both the first tier and the second tier.

So, in our first iteration that was released, we kept -- or we had a design requirement in this subpart to look at the protection of plant workers in both the Part 20 upper limits, firm limits, and then also the ALARA requirements in Part 20.

As the note says, there's been some discussion from stakeholders. We have slides at the end of this subpart.

And, I'm sorry, Dennis, one thing I did want to mention, the siting subpart is less complicated an actually has fewer exchanges. And so, the time we have allotted for that is probably more generous than it needs to be.

And so, if it's okay, I think we can extend this design and analysis discussion a little past the agenda time frame because we can make up for it in the siting subpart.

CHAIRMAN BLEY: Yeah. That's what it looked to me as well. So, okay.

MR. RECKLEY: So, as I mentioned here, there has been some stakeholder feedback on whether we include the protection of plant workers and how much it's included within the design requirements that we've defined. So, that will be a matter we can discuss as we go into future iterations.

MEMBER KIRCHNER: Bill, this is Walt Kirchner.

It would seem to me that referencing 10 CFR Part 20 is appropriate so that you don't have inconsistencies, but having functional design criteria

for protection of plant workers seems to make sense here to me at this point in terms of flushing out design criteria.

I'm tempted to ask, or just make a note, that this recent event at NIST, which I have to admit I'm not well-informed on, but where workers evidently were exposed, would suggest that this kind of criteria belongs here.

MEMBER PETTI: So, yeah, my concern -- we've struggled with this in the fusion program. Tritium control in a fusion mission, or any mission, has a lot of tritium. You could do it with bubble suits or you can put glove boxes around lots of equipment. One is an administrative sort of control, the other is an engineering design control.

And the push was obviously for the engineering design control. Yes, it costs more money, but it was a surer way to protect the LOCAs. And given the inventories involved, just the historical precedence at Savannah River and other places that dealt with tritium was that that's what we should do, but putting it here makes me think about an engineering solution instead of purely an administrative solution. So, I think it's correct there.

MR. RECKLEY: Okay. Thank you.

MEMBER KIRCHNER: It's also consistent with the past advanced reactor policy statements where, you know, less reliance on programmatic administrative controls and more reliance on, you know, design features is one of my take-aways from the advanced reactor policy statements.

MR. RECKLEY: Thank you, Walt. That's just what I was about to also observe that it is consistent with the overall agency position that it's best to do it in the design process as opposed to rely on programmatic or human actions in other areas. So, again, we're considering this both in wording and the overall resolution of public comments.

We can go on to slide 29.

CHAIRMAN BLEY: Bill?

MR. RECKLEY: Yes, Dennis.

CHAIRMAN BLEY: I agree with my colleagues on this one (audio interference) operating in a facility or (audio interference) performance (audio interference) administrative controls that are (audio interference) source of problems that (audio interference).

But we had talked with you folks and decided we didn't really have any key points at which

a letter from the Committee was necessary until we get (audio interference). But if there are any areas, this one just pops in my head, where a letter would be useful, we can always do that. So, go ahead.

MR. RECKLEY: Okay. And, you know, there will be decision points throughout the process. Like I said, we're preparing our next iteration that will include some changes to both Subparts B and C, and in some areas a conscious decision not to make changes.

And then we'll see what, you know, what the feedback is from stakeholders both external, ACRS, and then also we have to run all this through internal.

So, there may be points where a position needs to, you know, a flag needs to be planted or whatever.

I think the next iteration in the discussions right after that would be -- would probably be the point for that.

And this slide, Section 440, goes to Dennis' question about the language of design features used in generally accepted consensus codes and standards and, you're right, in the language we say "where applicable."

One of the reasons we feel it necessary to

put that in is, in some cases, there may not be consensus codes in standards or an applicant might choose not to use them.

In which case, they would have to make a -- they would have to make all of the arguments that would otherwise be resolved through the referencing of the consensus code and standard.

But the primary reason we put in "wherever applicable," at least for my first draft, was there will be plenty of places where -- for advanced reactor design to at least for some number of years there may not be consensus codes and standards available.

CHAIRMAN BLEY: I suggest we use more explicit language so it's clear what you mean.

MR. RECKLEY: Okay. We'll look at that.

MEMBER BROWN: I have another comment on that.

We talk about consensus codes and standards. Is that inclusive of current NRC Reg Guides, interim staff guidance, branch technical positions, et cetera, like that or this is in the stuff segueing in from the commercial world?

It seems to me kind of -- I mean, in my particular area, the I&C has -- you're going to need instrumentation, going to need controls, you're going

to need protection systems of some sort.

The NRC guidance and requirements that you have today, the Reg Guides are pretty -- are virtually technology neutral and even plant characteristic-type neutral. They can be whatever you want them to be, but their guidance is certainly applicable.

So, you don't even mention the NRC standard regulatory guides and other documents, NUREGs, et cetera.

MR. RECKLEY: And what we do mean here is those things that are set by standards development organizations. So, IEEE, ANS, ASME, et cetera.

We don't mention NRC guidance in the rule, but would certainly hope -- and we're looking now in a number of areas where existing guidance might be available to use to help show compliance with some of the requirements here or even one level down from what this rule language is going.

Once you were to determine, for example, in the area of I&C, once you were to determine that there will be a design feature associated with I&C and then you can set functional design criteria for what it needs to deliver in terms of timing and accuracy and so forth, then it might very well be that there's an existing Reg Guide that would support a particular

design or approach.

So, we don't refer to it, but we would certainly hope that some of that material would be relevant and usable once you get down into the design of a specific system, for example.

MEMBER BROWN: Well, the NUREG -- the new design -- DRG will be NUREG-800 Chapter 7 if it ever gets to that point. A new edition or separate. It embodies the framework from within which you would develop your design. And how you can hope that maybe somebody will decide that that's useful doesn't seem to make a whole lot of sense to me.

MR. RECKLEY: In any case, that's a good example of -- and we don't typically mention our own guidance within the real language, but that guide is developed in the same time frame as we're doing this activity.

So, that would be a good example where we certainly hope that guidance would help people meet the requirements when they are looking at the role of I&C in the design.

MEMBER BROWN: So, you're telling me the existing 50 and 52 -- Part 50 and 52, all the existing rules don't have any reference at all to NRC?

MR. RECKLEY: I'll say the number of rules

that refer to Reg Guides or any kind of guidance documents is rare.

I think maybe the ASME code case Reg Guide is mentioned in the rule, but very few Reg Guides are mentioned in rules because it usually goes the other way around. The Reg Guide is developed to show how you comport with the rule.

MEMBER BROWN: That's disturbing.

MR. RECKLEY: Okay. Going on then -- but, by the way, the reason we want to do this is it's encouraged by Congress, and also even within NEMA, they continue to encourage the maximum use of consensus codes and standards.

And so, we did this -- the reason we say "generally accepted," is here is one area and the text box is highlighting the potential issue, is that we didn't want to be really specific because one of the comments we're getting from stakeholders is -- I think somebody mentioned in the QA area, might it be possible to use ISO standards?

In other areas, if there are either ISO standards, even potentially standards from other countries or entities that are generally accepted, might this rule make it easier to apply those consensus codes and standards instead of the

traditional references to specific standards like ASME and, to some degree, IEEE.

So, that's something we'll be talking about as we go forward and exactly the language. And, Dennis, I made a note on our language there.

So, the next one is just overall design requirements in -- oh, I'm sorry. Yeah, on the next bullet, the materials must be qualified for their service conditions over the plant lifetime and have an element or code requirement embedded. Its safety and security must be considered together.

That's coming out of the advanced reactor policy statement. I'll get to that. That's an area we're getting comments on.

CHAIRMAN BLEY: I really like that, Bill. I'm glad you said that.

MR. RECKLEY: Okay. Then the last one here is -- if we're looking at the language to this, what this one was intended to do was capture the code requirement in 50.43(e) that basically says when you're bringing forth the engineering approach, it has to be proven by a combination of analysis, test programs, the potential use of a prototype plant and operating experience.

I think the way we worded it initially it

maybe lost a little of its tie with that requirement in 50.43(e), but that's the objective here.

So, any questions on that?

MEMBER PETTI: Yeah. This is Dave.

Were there concerns with the second bullet or the fourth bullet, because you, quote, qualified. I mean, there's an EQ requirement in the regs or in the guidance.

This is pretty basic stuff, right, to assure -- to come to an adequate assurance of safety finding.

MR. RECKLEY: We didn't get much reaction to the word "qualified." But the reason we ask the question when we put it out is because, like a lot of terms, it has its definition in the dictionary and then it has maybe the history of what "qualification" has met and the amount of work that goes into some qualification activities.

But, again, in terms of stakeholder feedback it did not seem to, at least preliminarily, initiate any response.

MEMBER PETTI: That's good. Okay.

MR. RECKLEY: Alright. I think we can go on to 30. This is --

CHAIRMAN BLEY: There was a fair amount

during the Gen IV project, the initial Gen IV project, focusing on security by design. It's almost a parallel to your discussion about admin versus design fixes for (audio interference) people.

But it made a lot of sense to a lot of people, that that's a preferred approach and it can very much make it easier to ensure that security is well covered (audio interference).

MR. RECKLEY: When we get to stakeholder, we'll kind of go over that, but the biggest comment or issue was not that they didn't recognize it as a good practice, but whether it should be in the rule.

And if it wasn't done by the design process, could it be compensated for on the other end? Everybody, I think, would acknowledge it's not the most efficient or desirable way to do it, but couldn't it be done by just adding guns, gates, and guards if it wasn't done at the design.

So, this is, you know, another one of those areas we have to look at and say, how much do we want to put good practice into the requirements?

As we go through the iterations and looking at comments, that's an area we'll have to kind of make a judgment on.

CHAIRMAN BLEY: Okay. And I (audio

interference) two things. I am convinced it's cheaper in the long run, by a long shot. And, two, although we do exercises, we haven't really tested the guns, guards and gates security issues and I hope we don't.

MR. RECKLEY: Well, obviously we put it in there. So, we had a similar thought when we put it in. So, I think this slide in Section 450 is one we'll end up talking a fair amount on.

In the iteration that you have that's publicly available, the analysis in Section 450 can be broken down into -- first, it starts off with the requirement that there will be a probabilistic risk assessment forum. And there's been a little reaction to that, but not black-white arguments.

The second bullet is where a lot of the discussion has focused in that we not only said that a PRA needs to be done, but then we basically said that the PRA is going to support the design and the overall analysis effort by being used to pick licensing basis events, classifying the equipment and human actions, evaluating defense-in-depth and just as a kind of central element of the design and licensing approach and the analytical approach.

MEMBER MARCH-LEUBA: So, let me break in. This is Jose. You knew I was going to break in on

this slide, right?

I just want to put on the record just a little bit, if not a little much, of a simpler logic in this approach.

It would be great if the PRA was actual systematic search of everything that can possibly go wrong in the plant, but it is not.

It is by necessity, by a scientific method, it is incomplete and this is not hypothetical. It just happened last year when the last reactor was certified. The thing is the two limiting events (unintelligible). So, it's not hypothetical. It happens. And the way people think and the way the human mind works, you ignore events. Okay?

And it's even more, because what the risk analysts do to generate a fault tree is identify all the components and ask the system engineer what happens if Valve No. 27 fails? And the guy comes back and says, eh, nothing because I have 28 that backs it up. So, then that's how you build a tree.

With fault opinions, at best an Excel calculation, and then you use those opinions, those ideas of the design engineers, to identify what events are important and you analyze those events properly afterwards. You just confirm what the system

engineers thought based on the Excel calculations.

So, and this is what -- I mean, ACRS is on the record, in a letter, saying that you should use PRA, of course, to identify the basis events, but you should also try to do more systematic and try to understand what could possibly go wrong. Because what I've seen happen is you start with the standard review plan events and start removing the ones that don't apply to your plant, but don't add any.

So, the rule should, in my opinion, be much more strict and emphasize the fact that identifying the design-basis events is crucial. That if you follow -- if you're going to spend enough time doing this and enough peer review and a lot of time on it trying to identify what could possibly go wrong, you will miss something. Every time we have a significant accident is because somebody missed something. Okay?

I put it on the record. You don't need to defend it.

CHAIRMAN BLEY: Okay. But some of us need to offer a comment. I agree with Dr. March-Leuba's final conclusion. We need a thorough process to identify these things, whether it's supporting PRA or some other approach.

There's probably been more work done in the PRA area on identifying ways to do that although it's not listed here in what you have for these -- in the rule language here or in the PRA standard or guidance document. It's necessary and there are a number of very useful approaches that have been used.

Mr. Carl Fleming was at our meeting on PRA standards a few months back and provided us a rather nice package of papers that delve into some of those methods. We've mentioned them in several of our letter reports.

So, I'm agreeing that it really ought to be emphasized, I think, in the rule, but that search has to be very thorough and creative and not just picking out previous lists especially for these new designs.

The comment about how people decide failure modes and what goes in fault trees just isn't the way it's done. So, I'll leave it at that.

But I agree it would be really good to beef up the description of how we search for these. Because even if you don't do PRA, you've got to find them and that's the place we slip up, I think.

MEMBER KIRCHNER: Bill, this is Walt Kirchner.

MR. RECKLEY: Yeah.

MEMBER KIRCHNER: You know, I had the language open at the same time as you're showing your viewgraph and my concern, to add on to Dennis' comments and indirectly also respond to my colleague Jose's comments, is this says you must do a PRA.

And, again, going back to very early this morning, Mike Corradini's comments, you know, if there's going to be a graded approach, can't we allow that someone would do -- and I'll just use some terminology probably incorrectly -- a hazard analysis for a much smaller system and start with that and use that as a basis for defining licensing basis events and then subsequently SSCs and so on in this process.

It looks like it's a mandatory requirement you will do a PRA as the -- as I read the language right now.

MR. CORRADINI: This is Corradini. I guess I agree with Walt.

The "must" part bothered me and the detail bothered me. So, I'm curious what the staff felt that required a "must."

CHAIRMAN BLEY: I'm going to jump in, too, because I disagree not in principle, but in words, with the last two comments.

I like having "must" in here. But as I said earlier, you need some pretty thorough guidance on how one implements a PRA depending on the complexity of the design and the -- I'll go back to the language we borrowed from the DOE earlier, the material at risk and the damage ratio kind of idea of it should be scalable.

I still call it a "PRA" if it's probabilistic and looking at risk.

MR. CORRADINI: So, Dennis, I think we're saying the same thing. I guess there's other tools or -- I mean, I'm not an expert. So, you're really the expert in terms of this, but it just struck me that this was very prescriptive. Almost too prescriptive.

CHAIRMAN BLEY: It does three things. It searches for and identifies the scenarios, what can go wrong; it identifies how likely those are; and it identifies what the consequences -- or the range of consequences on each one would be. And if you do those three things, that's a PRA.

Now, he has a lot of guidance on how you do one for a large, complex facility. We need some guidance on how you simplify that for smaller systems (audio interference).

So, yeah, I do think we're saying the same

thing, but in different ways.

MEMBER KIRCHNER: On the topic of -- Dennis, I'm trying to -- I'm thinking back to the existing Reg Guides which were really tailored for PRAs for the existing fleet. Very comprehensive. Very detailed.

Is there some way in this language that we can -- I agree with you, I'm just wondering what the expectation would be and -- I don't even want to raise this, but I'll mention it -- uncertainty for advanced concepts in the results of a PRA, but is there some way that one could capture what you just said, Dennis, in the language helping Bill so that -- my first reaction is they're asking for PRA like you have for the existing fleet and you really probably are going to have great difficulty doing that -- so, I mean, informing it with the kind of data that we have for the existing design.

So, is there some way in this regulatory language that it -- okay, keep the word "must," but the PRA then is defined as you very clearly defined it.

MR. RECKLEY: And this is Bill --

CHAIRMAN BLEY: They just needed the guidance to go with it.

MR. RECKLEY: Right. And what we're working on now is we got the non-light water reactor PRA standard just issued and the staff is reviewing that.

And that will be an opportunity to look and see within our guidance and what exists already within the standard for making sure, I think, what everybody is saying.

If you're going to require a PRA, make sure the PRA is simple if the machine is simple. If you have few things to break, then your trees should reflect that you have a few things to break.

The reason light water reactor PRAs are extensive and complicated is they have a lot of moving parts and the parts interplay with each other.

A break on the secondary side provides immediate feedback to the primary side. So, the interrelationships and the complexity is what drives the PRAs to be as extensive as they are, but Dennis can weigh in -- he's, again, the expert here -- or I'll ask Marty Stutzke to weigh in.

But we've come back and tried to say we think the nature of PRAs are that simple machines will or can have simple PRAs, but, Dennis or Marty, if you want to weigh in?

MEMBER MARCH-LEUBA: I want to weigh in a moment.

What I was saying, is if you are going to do a PRA, you better do a good PRA. It's not laughable, I mean, because the last PRA we saw, according to all the experts, was the best PRA ever performed for this hazard configuration, an order of magnitude, still missed the two limiting events.

That's my point, that over-relying -- just because you spend ten man-years and you fill up 700 pages of cap trees (phonetic) doesn't mean you got them all. It's the basis of the scientific method. You cannot prove a negative. Okay.

MEMBER BALLINGER: But that's the nature of any of these designs, you know? I mean, are we hung up on the -- we've got, in our mind, a definition of "PRA" that's very tied to light water reactors.

If you were to go out to the -- I don't know -- oil and gas industry and tell them what is a PRA, first they probably wouldn't -- you know, you would get a different definition. It's just a risk assessment of the system. And if you want to make the EPZ the site boundary, you got to somehow demonstrate that Part 20, you know, dose limits are met and a risk assessment is one way to do it. Call it a PRA if you

want. I don't know.

MEMBER REMPE: So, I'm curious still on why the staff said you must have a PRA. I, again, am thinking about what I've been reading about Part 50 and 52 alignment and the staff tied it to the severe accident policy statement.

And if you go back to the severe accident policy statement, it doesn't say you have to do a PRA -- well, it says you need to use risk methods.

They basically say again what everyone else is saying here today about that they realize that some designs aren't really suited for a full PRA as we think of for a large light water reactor.

They talk about that, you know, if you -- with the complexity and as you go further in the licensing process, what might be more suitable.

So, those kind of -- what drove you to decide we've got to do a PRA?

MR. RECKLEY: And I'll break it into two elements. Again, the first and the second bullet. The requirement -- our thoughts on requiring a PRA are that it seems a logical continuation and evolution of the risk-informed approach that saw a requirement for a PRA added to Part 52 and the discussion that went on at that time.

And, at that time, the PRA was required and everyone is looking at it for insights. We have an SRP Chapter 19 to look for those insights.

It also includes, as you mentioned, the -- that chapter looks at the severe accident design features and -- that were added as a result of the severe accident policy statement.

The NRC has built this -- not only the NRC. The nuclear industry and the NRC have built this infrastructure starting in the '70s that I'll acknowledge freely there are other risk assessment tools.

The one that was selected by the nuclear industry and the NRC is the PRA. And so, it just seems a logical evolution of that process to require the PRA to be performed.

And, again, the first bullet requiring a PRA is consistent with Part 52 and it's consistent with what's going to be put into Part 50. So, having a PRA doesn't seem that controversial.

The second bullet is what generated more response, was that you would actually use the PRA, which when we did this iteration, seemed again like the logical evolution.

Part 52 said, you'll have a PRA and you'll

use it for insights for a design that continued to be based largely on a deterministic approach of the general design criteria and related regulations.

And so, our initial thought was, okay, we're just going to take this step. This is an evolution in risk-informed approaches.

We will not only require the PRA to be performed, which is current requirements, we're going to actually require it to be used in the theory that it's actually a more systematic approach than the deterministic way of saying, pick some reactivity events, pick some loss of heat transfer events, some -- pick some loss of inventory events and use those. I'm sorry, I didn't mean that to come across as it probably just did.

That is a systematic approach and it's a fine approach, but, just as Jose was mentioning, it's as good as an approach as how you execute it. It can either be very good, or it can be haphazard, depending on the events you pick and the discipline that you put into it.

But our thinking at the time, and as we get into comments later on, the use of the PRA in the design process is a comment we got and it's one that the next iteration we expect will take a step back

from saying the PRA is the primary design tool in terms of picking your licensing basis events and classifying the equipment and other things.

MEMBER REMPE: So, are you closing off the option of having a worst case or maximum hypothetical event? The second bullet seems to be that you might be doing that.

I get that you need to justify the maximum hypothetical event having some sort of risk method to say you've systematically gone through possible challenges and you've picked the worst case, but I'm kind of wondering if the second bullet doesn't kind of close off that option for potential applicants.

MR. RECKLEY: And that's been the observation and why we're looking to probably change that in the next iteration.

MEMBER REMPE: Oh, again, I'd really like to tie this to what's going to be done with Part 50/52 alignment. Like, some guidance would be very helpful that emphasizes risk methods more.

MR. RECKLEY: Right.

MEMBER REMPE: But, again, I guess we'll have to see what you come up with.

MR. RECKLEY: Well, and, again -- and that will be a point of discussion. We have one way to do

this through the licensing modernization and Reg Guide 1.233, NEI 18-04. So, we have one way to do this that's been established.

Might there be additional guidance developed either by industry or staff to say here's another possible approach, that will be something we talk about as we continue through this process.

CHAIRMAN BLEY: Bill, two points. One, over the last 30 years there have been developed a number of very useful tools developed by people doing nuclear plant PRAs, some developed by the chemical industry, some from aerospace.

In any case, a large number of tools that help you be more systematic, more complete in identifying, I'll call them, "initiating events and scenarios."

There is no current guidance I'm aware of in either of the PRA standards, or in NEI 18-04, or in any of the NRC guidance documents on how to do that systematic search, you know, starting with a blank sheet of paper and not being biased by everything that's been done before.

I think you really need that guidance. This is -- we've suggested that several times already and will probably do it more thoroughly in the future.

The second point is this seems one more place that if -- that you could save yourself a lot of trouble if you'd get some white papers started that will eventually become part of the statement of consideration defining and justifying the Tier 1/Tier 2 stuff, talking about what do you mean by a PRA, what kinds of PRAs could be done, but how can this process be simplified?

I still look at it on various levels of depth and the one I think you always got to do very thoroughly is the identification of initiating events and scenarios, what can go wrong.

And then, two, how do you figure out the likelihood event and how do you figure out the consequences? Those you can scale according to things about the design.

And I think if you had white papers on those, it would help a lot. And eventually I think they ought to be part of the SSC and that same sort of thinking could be reflected over in 50/52.

MR. RECKLEY: Okay. Thank you.

Again, this might be the part or place to throw in the -- the other area, again, that we've raised and I've not gotten much traction on is when people say "maximum hypothetical," if that's

equivalent to unmitigated as it's used in the DOE standards and in the other guidance documents like ANS-2.26.

I mean, we also are looking to see where infrastructure might be in place and guidance already exists such that we could just adopt something like an ANS or a DOE standard. So, I'll just leave it there.

The issue that often arises with maximum hypothetical is if one picks hypothetical to be non-realistic and that starts to approach for me the unmitigated approach that DOE takes, one can make those arguments.

But what often creeps in is that it's not necessarily unrealistic but a probabilistic argument enters into the discussion.

And in my view, for example, maximum hypothetical or unmitigated are, by their nature, set out to be conservative to prove a point.

And if you can prove that point, then things can be greatly simplified, but that differs from a maximum credible accident where a frequency is being introduced into the argument of -- and so, maybe to Dennis' point, in such white papers we would have to make a clear distinction between maximum hypothetical or bounding or unmitigated events and

maximum credible events where frequency is being introduced based on the -- some either initiating event frequency or reliability of equipment. So -- but those are the challenges we look at.

So, again, we are considering -- we've gotten considerable feedback on this and we are looking in the next iteration to make some adjustments in recognition. Many of the comments are similar to what we're hearing here today.

MR. CORRADINI: So, Bill, just one last question because maybe you said it and I missed it, but this requirement, does the PRA have to be qualified based on some standard?

MR. RECKLEY: Yeah. It goes down to the next one that we would consider it meeting either the -- for light water reactor designs, the light water reactor standard that reflects Reg Guide 1.200 and all the related work or the recently issued non-light water reactor standard which is currently under NRC review.

Or if it didn't, then they would have to justify some other approach, but the hope and the thought was that, again, we have that infrastructure for those two major technologies, non-light water reactors and light water reactors.

MEMBER MARCH-LEUBA: What I think we were saying, or at least I was saying on this regard, is there is no logical vision to include the use of the maximum hypothetical, what you call the mitigated.

If for one of these small, super-safe reactors you can live with it, why do the rest?

MR. RECKLEY: And, again, I don't know that we would have strong disagreement. Our look at the literature is we're not sure there's such a machine exists.

MEMBER MARCH-LEUBA: Well, you just have to analyze it and see if it does.

MEMBER PETTI: Yeah. I know of one that I think meet that definition.

MR. RECKLEY: Okay. Anyway, so we're looking at that. Again, if anybody has any thoughts or experience especially for us on -- or to me, anyway, the unmitigated approach, the assessment of unmitigated events and whether that could be used in this context, the attractiveness of that is there's already a considerable infrastructure built around that that we might be able to use.

So, I guess it's --

MEMBER PETTI: Bill, just a question on the two years.

Is that something that comes from one of the standards, Y2?

MR. RECKLEY: It's another area we got comments on, but especially the word "upgraded." We were thinking to require it to be updated and assessed every two years.

Marty, weigh in. Under 50.74, I think, is that the current requirement or is the current requirement four years, but at some periodicity.

So, we pick two years. That generally goes with kind of once you enter the operational phase, that these assessments should be done periodically. I don't think there's --

MEMBER KIRCHNER: This is Walt. Just to help you a little, I thought your facility safety program was going to utilize an updated PRA at frequent intervals to kind of offset, you know, whether you had inspectors and all the rest.

MR. RECKLEY: Yeah. That would be part of it. And then there would also be on the assumed, at least in this construct that we proposed in the first iteration, the notion was especially when you get into the second tier requirements that you would be having to look at the reliability of the equipment, the actual operating history, and making sure that the

things you had set up in the PRA for meeting the QHOs in the second tier were actually being satisfied.

So, you're going to have to run that through the PRA on some periodic basis. We picked two years. That's a traditional number for updating licensing documents and so forth.

I'll have to go back and look what the existing requirement is in 50.74, I think it is.

MS. VALLIERE: It's 50.71, Bill, and it's four years in Part 50.

MR. RECKLEY: Thank you. Four years.

MS. VALLIERE: Yes.

MR. RECKLEY: Okay. So, the logic from shortening it from four to two was the increased role of the PRA and the need to really continue to validate that you're meeting the second tier.

MR. CORRADINI: So, Bill, can I ask another question? I'm sorry I'm putting you on the spot, but I'm sure you've got staff -- colleagues that can help you.

Is it fair to say the way you guys are discussing this, that the MHA is a thing of the past and everything's got to be an MCA? And, therefore, you must do some sort of risk analysis to show that you've bounded all the potential scenarios?

MR. RECKLEY: No, I don't think that's what we're trying to say. The use of an MHA, which, by the way, is not a tool we've used on the power reactor side, but the use of an MHA could still be used especially to simplify the analysis that one would do.

The logic here would be you need to do a PRA and look at all of -- systematically look at what can go wrong, as Dennis was saying.

And if you were able to show through the Image A -- or through that collection of events that you could simplify the analysis by looking at something that bounded them all -- and I'll use a simple example and don't take it too far, but let's say back on that first slide where you had a damage ratio, that you had a fuel farm that basically could say there will be no relief below temperature X. Okay?

And I go through all of the events and look at what can go wrong with this plant and then say of all of those events, I can bound it by saying I'll take away, you know, everything but radiation to the air -- and that's a maximum hypothetical -- and I still show I'm under the temperature at which damage ratio is basically zero.

Then I could argue I've looked systematically at what can go wrong, I took a conservative approach to assessing the consequences of a maximum hypothetical accident and I've assessed it and there are no consequences.

CHAIRMAN BLEY: And you have taken a conservative approach to the likelihood. You've assumed it's going to happen.

MR. RECKLEY: Right.

CHAIRMAN BLEY: So, really those three pieces kind of work. My hang-up -- it's not a hang-up. My claim is that you always got to do a detailed search for the scenarios.

Maximum hypothetical or maximum credible can't be proved if you've got the worst one unless you can show that you've really thought through those things.

MR. CORRADINI: But then, Dennis, I think you're kind of saying, in essence, what I said, which is the concept of an MHA can only be identified once you've essentially gone through some sort of search of what could happen, what is the likelihood of it happening, and what are potential consequences in bounding those consequences with a -- I won't call it "simple," but with a bounding analysis.

CHAIRMAN BLEY: With a bounding analysis. And if you don't do that first part, you might be missing something very energetic that happens right next to this thing that sets it all in motion and would create much broader consequences than you would normally get to that thing you thought was maximum hypothetical.

That's why you have to look to what can go wrong.

MR. RECKLEY: Yeah. And the other, you know, the other part from a practical standpoint as we look at this, is, you know, maximum hypothetical is a good -- I mean, it's a plausible approach to show that there's no consequences to the public health and safety, but --

CHAIRMAN BLEY: In use for research reactors, too, though.

MR. RECKLEY: Right. And it has some history in the research arena. The -- but the notion that you're going to thereby greatly simplify the analysis done for the machine overall, I would ask people to really think if that's true.

In this day and age if you won't be looking at failure modes in effect of every component to support the commercial aspect of the deployment of

these machines, it's kind of easy for the NRC, perhaps, to say, well, the MHA bounds and therefore it's okay.

But if you don't think that any customer is going to say, whether there's a health effect or not, how often are components going to fail that kicks this thing offline, I -- my personal think is that's going to happen in any case.

And so, for all of the work to say you don't need to do a PRA, are you just taking it out of the regulatory arena but it's going to have to be done anyway?

And so, the conservatism you piled onto the licensing side, in theory, to save doing the PRA, you don't save at all anyway because you're going to have to do the PRA to show that this thing is going to have a reliability greater than the 40 or 50 percent that the light water reactor capacity factors showed for the first 10 or 15 years.

So, you know what I mean? I think you need to take a realistic view of the whole landscape and be kind of realistic about are you really saving by arguing that you don't need to do a more complete assessment of not only failure modes, in effect, but the actual probabilities that will go ultimately into

giving some kind of estimate on the reliability of the reactor as a whole.

But anyway, now I'm starting to preach. So, I better shut up because I'm going beyond my realm here.

MEMBER REMPE: Bill, I agree. I used to work for a company many, many years ago and they did economic risk as well as safety risk assessments.

I think the answer that might come back is that the regulators should only be concerned about safety and let the buyer beware and look at the economic risk assessment.

Again, there's a lot of cost with the QA required for the regulator, right? So, perhaps, you know, you may be right, but I just kind of wonder. I can see why it would --

MR. RECKLEY: And I do -- and that's why I say I was going off the rails there, but -- because I see the difference between a regulatory responsibility and what the -- but I just -- the argument that a lot of money gets saved one way or another is my point.

I'm not sure that argument really is all that compelling, but that's not for us to decide in the end. You're exactly right, Joy.

So, anyway, all that said, we're likely to get some relief in this area, when we get down a couple slides, to show the feedback and what we expect to do in the next iteration.

Someone brought up that we use for the analytical conforms to analytical generally accepted methods and standards. That would include the PRA standards.

The next bullet, the codes, you'd have to go through an appropriate validation and verification to qualify the codes. I don't think that's very much in argument.

The next to the last bullet we did throw in some things. We did not -- weren't sure got captured and we just wanted to have a placeholder.

Fire protection obviously very important. Aircraft impact assessments under the Part 50 and 52 regulations.

And the specific events that were addressed most recently, the Fukushima-related mitigation of selected beyond design-basis events.

And then I wanted to get into another important element because I'm not sure it's been clear that the analysis, the licensing basis events as we've talked about them above and then the rest of 53.450,

we would say the analysis of those events one acceptable way to do that would be, as we've endorsed in Reg Guide 1.233 on licensing modernization, which is those assessments of events are using out of NEI 18-04 kind of best estimate approaches and then assessing the uncertainties of frequencies and consequences. That would be one way to do it.

But the other thing that's in NEI 18-04 methodology and we were proposing to require also in Part 53 was the specific assessment of a design-basis accident, which is done using only safety-related -- crediting only safety-related equipment, using perhaps more traditional analytical approaches, a bit more conservative than codes might be to do the thermal hydraulic assessments under the PRA.

And here's where we tie this kind of back to Subpart B that it's the design-basis accident that's really being used to judge the first tier safety criteria.

This is the assessment from which you're getting the confirmation that there's no conservatively assessed using only safety-related equipment even that would trip the 25 rem at the exclusionary boundary threshold.

MEMBER MARCH-LEUBA: And how do you choose

the DVAs?

MR. RECKLEY: Well, the DVAs would come out of the overall assessment licensing basis event that under -- and I'll give you two answers.

NEI 18-04 describes one way to do that, which is you derive them out of the design-basis event category as well as looking at potential high consequence beyond design-basis events, but the primary element is to pick them out of the design-basis event category at NEI 18-04.

Or especially as we get into the alternative we'll be building in, they could be picked by some other systematic approach and that might be picked up in some kind of other standard.

Going back to the way it was done for light water reactors, you could pick it out of ANS 51.1 and 52.1, for example, for PWRs and BWRs, would tell you what your design-basis accident is.

So, if there is some other methodology that's developed that has included a kind of systematic approach to it, when we get down to the next iteration, I think we would say that we'd be open to such an approach.

MEMBER MARCH-LEUBA: Yeah, but shouldn't the rule -- I mean, a specific variable of the

licensing basis events, which don't mean anything because the DVAs are the ones under control, and then the DVAs we don't specify how to do it?

MR. RECKLEY: Well, the current language used is the 10 to the minus 4 frequency of the underlying event frequencies, again, consistent with what we endorsed in Reg Guide 1.233.

One of the discussions as we go forward is if you want to separate the approach of selecting events from such a frequency oriented approach, a PRA approach, then we'll have to perhaps come up with other approaches.

Although, even 51.1 and 52.1 for the current structure basically tied those -- or had any relationship between the DVAs and frequencies.

But as the current language that we have for 53.450(e) talks about picking the design-basis accidents from the event sequences with a frequency on the order of 10 to the minus 4.

MR. CORRADINI: That's an upper bound. That one piece of language you just quoted confused me in Subpart E.

MR. RECKLEY: Yeah. I mean, under -- and I should have had it open, but under LMP, for example, they're selected from the event sequences ranging from

10 to the minus 2 to 10 to the minus 4, plus accounting for the uncertainty.

So, a 95th percentile event down to 10 to the minus 4.

MR. CORRADINI: Okay. Because -- alright. So, the way you just said it here isn't the way I read the English in Subpart E.

MR. RECKLEY: Okay.

MR. CORRADINI: Because in there it says, with an upper bound frequency less than 1 in 10 to the minus 4.

So, the way you just said it in explaining it to me makes perfect sense. It's just the way it's worded in the subpart confused me. Sorry.

MR. RECKLEY: Yeah. No, no. And I find it very difficult to write and we adopted -- later on we adopted using the frequencies and then saying accounting for uncertainties as opposed to trying to -- I think the reason I put in "less than 10 to the minus 4" was the assumption that you'd have to account for uncertainties, but that --

MR. CORRADINI: Okay.

MR. RECKLEY: It might be more clear and I think we've tried to adopt it later on where we just are more clear and then say, plus accounting for

uncertainties.

MR. CORRADINI: Okay. No, that helps, Bill. Sorry to butt in there.

MR. RECKLEY: No, no.

MEMBER REMPE: Before you leave this slide, when I was studying up for this meeting with respect to this thing about enhancing the guidance, I think that Section 2.3.1 of Reg Guide 1.174 might be a good place to add some additional words because there they already talk about the fact that although you need to look at all the plant operating modes and hazards groups, that it's also not necessary to have a PRA of such scope. A qualitative treatment could be sufficient for some applications and designs.

And so, that's a good starting place that you might want to consider for beefing up the guidance.

MR. RECKLEY: Okay. Thank you.

Alright. If we can go to slide 31, so a couple notes. So, as we develop the next alteration, as I had mentioned a couple times, I got allowing an alternative risk-informed systematic approach to PRA for the determination of licensing basis event, safety classification, and evaluating defense-in-depth.

That is a comment we've received from some

of the members today. It's also something we got from public stakeholders. So, that's something we'll address in the next iteration.

There was some discussion in the next iteration I'll try to clarify a little bit. The lower -- or the higher frequency events, the anticipated operational occurrences, I'd have to agree the existing language that we have in the first iteration is probably a little light on the anticipated operational occurrence end. So, we've tried to clarify that.

And then something out of our meeting with this subcommittee in January is the discussion in your lessons learned letter about end states.

And so, we will look -- the PRA -- non-light water reactor PRA standards talks about analyzing events to define end state. So, we can capitalize on that discussion within the PRA standard.

And then for the design-basis accidents, the one we were just talking about within 53.450 on analysis, at that point we can't even talk about a safe, stable end state for the design-basis accident.

So, per the discussion we had in January and in looking at that discussion, I think we can address that in the next iteration.

So, any discussion with that? If not, we can go to slide 32 and the safety categorization.

(Pause.)

MR. RECKLEY: So, the definitions that we would propose, and somebody had brought up earlier the definition, so we would look, and we have in 53.460, the need to categorize equipment and human actions.

And the first one is what equipment -- what human actions are relied upon to address the design-basis accidents and meet the first tier safety criteria? And those would be termed "safety-related."

Then the non-safety-related, but safety-significant, would capture those things that are needed to provide or fulfill the second tier safety criteria of meeting the QHOs.

And -- or are considered risk significant within the probabilistic risk assessment using the value from the PRA standard.

And it's actually consistent with NEI 18-04 that it be one percent of the cumulative plant risk.

As we look at revising, in the next iteration, the role of the PRA and categorizing the events and categorizing the equipment, this is an area that we'll have to look into because the non-safety-

related, but safety significant, would not necessarily -- it wouldn't work to quote the PRA if you weren't requiring the PRA to be used for this purpose. And so, we'll look, in the next iteration, to maybe modify that language.

CHAIRMAN BLEY: But have you thought about how deep you go on some of these? Let's say you have a design -- we'll make up something that might be a little silly, but it's happened in some other cases -- you have a design for which one of your design-basis accidents relies on this particular system.

This particular system from your -- from a hydraulics analysis and other things shows that you need one train to operate, but you've built four trains in.

Are all the components in all four trains safety-related? Is it one train? Is it one plus one? And if you do something like that, then it gets really confusing going on to the other cases or if you stayed with -- if you went with risk-significant, it would be clear.

MR. RECKLEY: Yeah, that -- that would have to be developed as people look at a possible alternative.

The guidance that's available for at least

one approach, which is that described in NEI 18-04, would basically say your single train can be safety-related and then -- depending on the nature of the designs.

It was more clear when you talk about passive. If you talk -- even under LMP if you talk about having an active system, whether you could get by with an assessment that one of -- one train of a two-train active system would be differentiated in safety classification gets a little fuzzy because you would have to look at -- you'd really look at the actual reliability of the system to make that determination.

But the basic structure of the -- of NEI 18-04 that enabled us to address things like single failure criteria and -- if you're not using the PRA and you are proposing an alternate approach, then that question of things like single failure criterion would have to be answered within that approach. Maybe I'll just leave it with that.

So, I can't give you a definitive answer because it would depend on a number of things, whether it was passive or active and so forth, but -- and we have a slide later on even if we introduce the term "inherent," that may be one additional complication,

but the -- one of the reasons we were writing the first iteration the way we did is because we had an available guidance document that answered questions like single failure criteria.

So, I probably didn't answer your question, Dennis, but --

MEMBER KIRCHNER: Bill, this is Walt Kirchner. I'm -- just a little clarification on that I would ask for.

I thought the traditional definition of "safety-related" was those SSCs. It did not include human actions.

And certainly the advanced policy -- advanced reactor policy statements have always pointed to less reliance on human actions.

So, one would expect, you know, longer time constants, inherent feedback, passive mechanisms.

I'm a little concerned about what you mean by "human actions" other than pushing the scram button or activating TFAS (phonetic) and so on.

MR. RECKLEY: And what you're seeing is a bit of a trailer for what's yet to come. The reason we included human actions in this discussion is because we're looking ahead to that segment of the operation subpart that I mentioned earlier where we

start to really look at what are the role of the human actions and where there will be distinctions between what's done by a licensed operator, what might be allowed by a non-licensed staff, and the possibility that you'd have no staff at all.

And so, the fact that we're kind of looking at this as an integrated approach requires us, we thought, and why we included it in here, to bring this forward even into the analysis to say that when you're doing the analysis under this subpart, the analysis under 53.450, is also likely to be supporting your staffing discussions under Subpart H and it has to be reinforced that whatever analysis you've done under 450 in this construct is showing that the -- whatever the role of the people might be is going to carry forward.

So, for light water reactors the operators have roles that they have to take during the course of a design-basis accident. It might be in the later stages, but most designs have a role for operators.

That would get reflected in Subpart H on staffing to say, oh, a human being is being relied upon to meet that 25 rem criterion in the first year.

Therefore -- and the "therefore" we have yet to write, but in traditional, therefore, that's

going to be a licensed operator. That action is going to have to be modeled and simulated and trained and, et cetera, et cetera.

If, on the other hand, 53.450 analyses can show that people serve no role, then that might support the concept of operations that would be required in Subpart H on the role of personnel.

So, the reason that it includes human actions, you're right, we don't traditionally call human action a safety-related thing, but we're looking forward to how this will translate into Subpart H.

MEMBER KIRCHNER: Yeah, I get that. I just wonder if that -- this introduces -- lowers the expectations.

I mean, traditionally what we've done in Chapter 15 analyses is you rely on the SSCs, they're classified as safety-related and it's pretty much hands off and you do the accident analysis to demonstrate that you can meet the regulatory -- I mean, sooner or later it ties to the dose offsite, but basically there are a lot of surrogate regulations for the LWRs.

And I'm just -- I'm -- I see where you're going with it. I just would expect of an advanced reactor that, at least for the design-basis accidents,

human intervention would not be a requirement. That's old-fashioned thinking, I'm sure.

MR. RECKLEY: It's an element of the advanced reactor policy statement to try to minimize human actions.

The question to us is always how to build that into the requirements and whether it's -- whether that is something that all designers will choose to do.

We're trying to leave open to the designer throughout this subpart that they have choices to make.

Do they want the operational cost of licensed operators? And is that more economic in the long-term than putting in design features to try to show you don't need them?

That is something we're not trying to decide. We're trying to support either decision. So, that's where we are in developing the --

MEMBER KIRCHNER: Yeah. But I guess, for me, this would be something that would be more second tier, the human factor.

In your first tier, I guess, I would see the definition of "safety-related" restricted to the SSCs needed to form your -- what you call your primary

safety functions.

MR. RECKLEY: Right. I guess that may be saying the same thing, but from the other direction. Do I think it's likely that most advanced reactor developers can show they don't need a human to meet the 25 rem first tier criteria? I would hope so.

But we'll put it in there and then it will be up to them to show that they don't actually need human intervention.

MEMBER REMPE: So, I thought Walt was going to go a different direction with his questions because we were involved in an activity not too long ago where it appears that an operator was required for recovery to put the reactor in a safe, stable state and the -- there was not really any documentation to support it or what would happen if an operator didn't act as expected.

And so, it sounds to me like you're actually going to require some more documentation about operator actions if they're needed, which I was wondering if some of the stakeholders were concerned about that.

MR. RECKLEY: We didn't hear too much. But after you pointed it out, then we might hear next round.

(Laughter.)

MEMBER DIMITRIJEVIC: I have a question about your third category, non-safety-significant.

Can safety-related things be in that category?

MR. RECKLEY: No. That's the -- that's really the remaining category for which the only expectation for non-safety-significant SSCs would be commercial-grade equipment and whatever restrictions a designer or licensee wanted to put on it for their own reasons not really -- nothing beyond commercial-grade being built into the safety assessment.

MEMBER DIMITRIJEVIC: So, my question is here you're not using any risk insights, right, to classify your conformance?

MR. RECKLEY: It depends on what the approach would be. Under one acceptable method, which is the NEI 18-04 method, risk insights are integral to the determination especially of the non-safety-related, but safety-significant category.

That is going to be those events that are coming out of the PRA as being needed to support findings related to the NRC safety goal, as an example.

MEMBER DIMITRIJEVIC: I think it's a very

small category in the current PRAs. It's a much bigger category is safety-related, non-safety-significant components. And this is what the most of, you know, 50.69 is about, but you don't have this category here.

So, you know, this category of non-safety-related or safety-significant is a very small category. So I'm just surprised that you have actually -- the biggest category, which this NEI guide and 50.69 devotes a lot of things deserves special treatment, reduction is a category where you have safety-related but not risk-significant component.

MR. RECKLEY: The logic there is that that process in 50.69, in general, comes out of a historically very deterministic approach to the classification and then overlaying a risk assessment and finding that there were many safety-related SSCs that, from the PRA's point of view, weren't really contributing as much as expected to the risk argument.

And so, there was a category basically created to address that and lower the expectation on that set -- or subset of safety-related equipment.

Going into a new design the thought is that a reactor designer will not over-classify equipment such that you then have a category of

safety-related but not safety-significant.

So, that was the reason that we even omit this because it can be avoided from the initiation of the design.

MEMBER DIMITRIJEVIC: So, it's a different safety classification than we are to use now. That's what will take care about this category. That's what you are saying.

MR. RECKLEY: Yeah. The definition -- the definition of "safety-related" should limit the amount of equipment going into that category.

So, there should not be -- in our view, there should not be as much over-classification as might had been done in the earlier days of the operating fleet.

MEMBER DIMITRIJEVIC: Alright. Thank you.

MEMBER KIRCHNER: Just an observation, Bill. Are you going to reconcile this set of definitions, these three bullets, with your colleagues who are doing 10 CFR 50 and 52?

I think it would help immensely because then when it comes to Reg Guides, we won't have the four boxes that we often see as the -- kind of the framework in the Reg Guides. So, getting this simplified across the board would be certainly useful.

But I wanted to go back to Dennis and say, Dennis, did you say non-safety-related but risk-significant would be preferred?

CHAIRMAN BLEY: Preferred to what? I'm not sure -- you're going way back in whatever I said.

My own thoughts in this area are that safety-related is a holdover from the time of kind of guessing what was going to be important and slapping a classification on it.

Now that we have a risk assessment to pin that down, the things that are risk-significant are the things that ought to be treated as we always treated safety-related and we shouldn't arbitrarily declare anything safety-related, from where I stand.

Now, what they're doing because they're going to have a PRA up front, they're going to know what's important and they're going to develop their own design-basis accident, the things that go into that category are, you know, kind of meets what Bill was saying before.

It's going to be self-regulated such that almost anything that meets their label of "safety-related" will also be risk significant or is likely to be risk significant.

So, I'm kind of okay with where they're

going. It's just I would have done it differently.

MR. RECKLEY: Okay. If we go, then, to 33 we've had this discussion somewhat, special treatment. And this will be established that, you know, it has to provide appropriate confidence.

The safety-related stuff we've already talked about, it will fall under Appendix B. It would fall under the existing PRA requirements defined under Appendix B.

It would fall under technical specifications and so forth. So, special treatment as it's applied to safety-related will look much the way it currently is described for the operating fleet.

The big change really will be the kind of expansion of the discussion of special treatment for non-safety-related but safety-significant SSCs and making sure that they will perform as they're assumed to perform under the right service conditions, under the appropriate environmental conditions, and that they're available and reliable as it's been modeled in showing that they meet the second tier safety criteria, which is currently proposed to be the QHO.

So, it's really the expansion of those requirements in order to allow us to take more credit for those, that category of equipment and the

performance of those functions to meet the QHOs that then supports going forward in some of the other areas that we'll talk about.

And then as Walt brought up human actions, we thought even here to start to bring in the discussion of human actions more so than what you'll see in current regulations under Part 50, for example, to start to build the argument that would be possibly used in the later subparts on staffing levels, on the development of concept of operations, which would actually be more definitive in terms of this is the role of people in meeting the safety objectives.

If we go to 34, this is an area I thought we would probably have a fair amount of discussion on. And I think we're okay still on time, but I will try to speed it up a little bit.

But the -- this is where the flexibility for advanced reactors starts to be introduced and this was our attempt to say how you can capture that.

And it's through the analysis that would show you're meeting some threshold, some target that's been established by the designer that's more restrictive than what would otherwise be required.

And the margin you gain from showing you meet a lower threshold is the avenue to get relief in

some other area.

So, the easiest one to explain, because we're all familiar with it, is you run through your licensing basis events. The expectation is most advanced reactor designers will try to show that, at the fence, they don't exceed the 1 rem in a month or 1 rem in 96 hours and, therefore, they can justify an emergency planning zone that collapses to the site fence or at least much closer to the site fence.

So, how is that arrived at? That's arrived at picking 1 rem, which is more restrictive than showing you meet either the -- than you would show by the -- through meeting the QHOs and establishing a more restrictive criteria.

And then the requirement, as it's written in 470, is once you do that -- the goal of the requirement in 470 is once you do that, that becomes your new design standard that you have to show you continue to meet because this has been one of the questions of how once I set that and now I set things in motion for the next 20 years and I do system changes, I do power uprates, I do whatever, how do I maintain the fact that I justify that I don't exceed 1 rem at the site and, therefore, don't need emergency planning that has to be maintained throughout the life

of the facility or I have to have an option of bringing emergency planning back into the possible overall framework for that facility.

So, 53.470 is the avenue by which we're trying to do that. And I know it's only a paragraph, but it's a critical paragraph within Part 53 because it's, again, saying I can establish more restrictive goals.

And with the margin that I get from that, I can trade it off against requirements that are most likely going to be in Subpart H under Operations.

This is how I'm going to do siting, maybe more flexibility in siting, more flexibility in emergency planning, perhaps more siting -- more flexibility in security, more flexibility in staffing.

And so, with that, I'll just kind of open it up for discussion again because, from my perspective, this is -- we've talked about advanced reactors and how you can get some of the flexibility that's been expected and this was our vehicle to try to do that.

Dennis?

CHAIRMAN BLEY: Yeah. I was waiting to see if somebody had discussion. And this is probably a good place for a break.

Do you think so, Bill?

MR. RECKLEY: Yeah, that's fine. And, again, maybe during the break people will think about this because this -- it goes to some of the earlier discussions as well.

I mean, this idea that -- and this is built on the fact that you do the analysis and from the analysis you get the relief.

There's been, even today, some discussion of isn't there a shortcut to even do less analysis? So, we would have to work such an approach into this construct.

I'll admit it's not currently there, but whatever people wanted to do through the shortcut, you also have to show, through that simplified assessment, that you're confident that you're going to be justifying all the relief that is being expected in these other areas.

So, I'll kind of leave that as a thought for people to consider during the break.

CHAIRMAN BLEY: Okay. That sounds good. It's about 10 minutes till. Let's take a 20-minute break. Come back at 10 after -- what is this back east? Anyway, come back in 20 minutes.

(Whereupon, the above-entitled matter went

off the record at 3:48 p.m. and resumed at 4:10 p.m.)

CHAIRMAN BLEY: The question and 53.470 appears to be linked to the Tier 2 stuff and in the -- pardon?

MR. RECKLEY: Take us back to where you were, if you would. This seems a little hard to parse I guess for me.

MEMBER REMPE: Bill, if you're talking, you're on mute.

MR. RECKLEY: Oh, there we go. Sorry about that. It is difficult because it's the attempt at trying to make this flexible and yet integrated so in the bowtie figure of how you might capitalize on the assessments that are done under 53.450. And to use them to justify operating flexibility and so, as Dennis mentioned, basically you're the, an applicant would be setting up an alternative threshold that's more restrictive than the regulations.

And then the goal of 53.470 is to just maintain those. Once that decision is made to make sure that all of the analysis and then all of the subsequent programmatic controls are in place, to maintain it.

The actual trading off of the margin will be reflected in the later Subparts and again, the

example would be emergency planning where it can be shown that the doses are less than one rem over the time period.

You can use that to justify an alternate emergency planning zone in siting, you could do the dose calculation and if you meet the revised threshold you could revise the population density guidance from 500 people per square mile out to 20 miles to some lesser distance.

And we're looking to how that might actually then also go into the concept of operations and the possible justification of reduced staffing and other areas, security and other areas.

We might be able to use that same logic and so, again, it's a short paragraph but the intent of it is to explicitly allow the tradeoff and then set the requirements in place to maintain them after that tradeoff is made.

MEMBER CORRADINI: So Bill, this is Corradini, can I ask the question a little differently? If this weren't explicitly written, that still would be allowed it just wouldn't be explicit.

If they were to follow the, your discussion about one rem at the boundary, that allowed, that could allow them to do this. This just

makes it an explicit opportunity. That's where I'm confused. I thought this flexibility always existed.

MR. RECKLEY: It does both. It highlights the opportunity and then it puts in place the requirements to maintain it.

MEMBER CORRADINI: I got it now. I got it.

CHAIRMAN BLEY: So if I design my plant to be more robust then I can cut some of my margins in other areas but this requires me to keep, maintain that robustness?

MR. RECKLEY: Right. Or to revisit how you were trading off the margins.

CHAIRMAN BLEY: Sure. So, if I do that because this is Tier 2, if I'm beginning to get where you're headed with that, this is Tier 2 so, if I decide to rebalance those margins, I have the freedom to do that. Now you might come in and audit me on it but it's something I can do on my own?

MR. RECKLEY: As we develop the Subparts, yeah. Keeping in compliance, yes. You'll have the inherent flexibility. The notion of not including Tier 1 is that those things are not intended to have flexibility.

CHAIRMAN BLEY: Right.

MR. RECKLEY: You will always meet Tier 1

and you'll always meet it basically the same way. There is no tradeoff of emergency planning in Tier 1 for example or any other criterion.

It's also based on an individual dose number versus, well I won't get into that. So --

CHAIRMAN BLEY: Another thing that would be very helpful to have explained then in the SOCs or early in some kind of whitepaper.

MR. RECKLEY: Okay. Seeing no other activity at the moment, we'll finish out the design section in the next 10 or 15 minutes and then get into siting. The, yeah, if we go to the next slide.

The quality assurance for design was basically just Criterion III from Appendix B, which is the Criterion related design activity.

And again, we brought in that it would comply with generally accepted consensus codes and standards of which we've already identified in QA one as being one of those.

One of the discussions that we will have going forward is if other consensus codes and standards like the ISO standards might also fulfill that expectations.

MEMBER PETTI: So, Bill, do you see a gap analysis or something in the future with when we

compare Appendix B to these other quality standards and see if they really do cover all the bases?

Because I've heard different, I've heard people steeped in this stuff tell me that ISO in no way comes up to the level of NQA-1 Appendix B.

MR. RECKLEY: And the NRC did its study and it varies by which criterion and activity you're looking at but other places have taken, this is stretching my memory here, which is not a good thing.

But there's been a nuclear component added on to some of the ISO standards to kind of fulfill --

MEMBER PETTI: Ah, okay.

MR. RECKLEY: -- where some of those gaps exist. So, it's not clear you could take the most general of the ISO standards and simply say, I will follow that but there has been activity to supplement them to make them more amenable to the nuclear community if you will.

Is my understanding. But yes, somebody would have to show that the consensus codes and standards that they're referencing actually fulfills the underlying desire and provides the confidence that's provided.

One thought in breaking Appendix B up into its associated areas was that might be a little easier

to show for a particular activity like design versus showing some collection of ISO standards meets the equivalent of NQA-1 in its totality.

But we'll see as we get into additional interactions. But --

MEMBER KIRCHNER: Bill, this is Walt. Having looked at this a while back and I have to admit it's a while back, I would say something along the lines that David just suggested that the simple ISO 9000 would not come quite up to measure with the totality of NQA-1.

I would also even suggest that of the DOE's QA standard, which is derivative from NQA-1 and after a fashion. The danger I see in breaking down things like this is that yes, you'd have section in NQA-1 that's design controlled.

But there are many other aspects to NQA-1 that support your ability to maintain that design control. It's things as simple as records. So, it's a little, if you pick and choose from Appendix B, be careful because it's the integrated, all 18 sections of NQA-1 that as a whole that really, you know, give you the total effect.

Whereas, just picking and choosing criteria from Appendix B may not, maybe necessary but

not complete. You see where I'm going with this?

MR. RECKLEY: I do and it is something we're looking at and as we take the concept as I mentioned earlier, we're not exactly wedded to this breaking apart. It was a notion.

But when you see Appendix E on construction, which is primarily quality assurance, we really ran into something exactly what you're saying because what do you do with the requirements for audits and things that go beyond that particular activity and are really aimed at the QA program overall.

And so, it's a point well taken and we're looking at it. We'll see kind of, taking this attitude of wait and see once we get it all together and if it makes sense that's fine or if it makes more sense to put it back together.

The way we're doing it, it's easy to also put back together if that's decided that's the best way.

MEMBER BALLINGER: This is Ron, the ISO standard that you're talking about is 19443, which I have and it's pretty extensive.

MR. RECKLEY: And again, for certain activities the comparison is probably easier. I'm not

versed in the ISO numbering scheme and even the content. So, but today's point yeah, somebody would have to do that assessment. The last time the NRC did it, it was, I think 10 or 15 years ago.

MEMBER BALLINGER: Yeah, this standard was issued in, around 2018.

MR. RECKLEY: Okay. So, that's really all I had on that one. If we can go to 36.

MEMBER PETTI: Just one more question.

MR. RECKLEY: Sure, Dave.

MEMBER PETTI: That's come up. In terms of the ASME code to use, would an ASME accept a Section 8 vessel instead of a Section 3 vessel if for some reason the material was unique or the inability to get an N stamp.

It is a code in standard, it is accepted in many places but it's not, you know, it's not the nuclear part of the code. Is that a hard rule on that?

MR. RECKLEY: I'm not going to give you a straight yes, no answer. We'll look into that and it would depend on really the technology and what was being derived from the reference to that code.

MEMBER PETTI: Okay.

MR. RECKLEY: I can say I don't think

we'll necessary rule it out but we would have to look and see what was in that division and make a judgement on what was being provided.

MEMBER PETTI: Okay.

MR. RECKLEY: Okay. If we can --

MEMBER DIMITRIJEVIC: How -- sorry, this is Vesna. How about the PRA code? The PRA now, they been using design. Is it going to be applicant's -- up in addition to PRA standard.

MR. RECKLEY: The PRA itself, our thinking is would be governed the PRA standard. So, either the light water or non-light water reactor standard and then the assessments that are built into that standard, the independent reviews and so forth.

MEMBER DIMITRIJEVIC: All right.

MR. RECKLEY: So, if we can go then to Slide 36. There's a section on interfaces that we'll probably build in to all the Subparts just to try to reinforce that they all have to fit together.

If we go on into 37, this is one of the things we put out to stakeholders when we released this Subpart as a question and that is, the treatment of inherent features, basically those things that are governed by physics without either a need to activate or have an active or a passive engineered system to

provide and whether it would be useful to have additional discussion and guidance.

And it might help to go on then to 38, which is Slide 38. This is Idaho National Lab, kind of figure that basically goes through that for any design you have basically the same concept we were talking about before.

You have an inventory, you have a number of barriers and traditionally you have originally for large light water reactors, for the most part you had active engineered features to do things like maintain cooling of the cladding.

Then pressure relief to maintain the pressure boundary and containment cooling systems to maintain the reactor building in the final barrier. As you move forward in time you started to have passive systems to perform those roles.

And then at the bottom is just the concept that it is possible to have for some designs and some technologies and some power levels the ability to perform those functions using inherent features.

Like reactivity feedback or heat removal that might depend only on conduction and radiation and not need a circulation path perhaps and so, as most of you are aware, as we moved from active to passive

there were was a lot of guidance written.

A lot of thought that went into moving from active to passive and just the question is if we are to be moving from passive to inherent, what additional guidance, what other discussions would be needed to support to moving in that direction? You --

MEMBER MARCH-LEUBA: What's the difference between passive and inherent? And haven't we been taking credit for all this reactivity for bad, we take credit for it all the time?

MR. RECKLEY: No, not exactly, Jose. What they're proposing here, I believe, is that the negative temperature coefficient of a solid moderator is a shutdown mechanism. And so, I don't need --

MEMBER MARCH-LEUBA: If you're over --

MEMBER KIRCHNER: Yes, but not if you cool down.

MEMBER PETTI: Well, if you cool down super low but I'm just talking about it turns it around so, do I have to have, you know, two --

MEMBER MARCH-LEUBA: So, does void fraction in a boiler, I mean, if you overheat a boiling water reactor it will produce voids and it will shut down. It will maintain k-effective one eventually, is what everyone of this is going to do.

This is part of the analysis. It's part of your effected margins.

(Simultaneous speaking.)

MEMBER KIRCHNER: Bill, to the extent that people take credit for these inherent or passive features, it would seem to me the logic that would be applied would be similar to what you discussed a few slides earlier about trading off analytical safety margin.

So that you would have to demonstrate that this is maintained over the lifetime of the plant. In other words, you know, as you go through a burnup cycle the negative temperature of coefficients may change.

As you go through leaving a plant operate for 40 years we may have, I'll make something up, you may have CRUD deposition on a boundary that is passably cooled and that reduces the cooling rate.

So, you know, it erodes the, over time the performance that you had been credited for in the initial analysis. So, it seems to me, these things should be encouraged but they would have to be, how should I say it, maintained over the lifetime of the plant.

You would have to have, I don't know if

tech specs is the right vehicle for doing that you would have to be able to demonstrate that those credited features over the lifetime of the plant would still, you know, provide the desired performance.

MEMBER MARCH-LEUBA: Yeah, I don't think the reactivity from that is going to degrade with what lies instead. The problem I have actually, I have an aversion to this, the first year replaces General Design Criterion-27, thou shall have a shutoff mechanism, that keeps the reactor shutdown, meaning k-effective less than one.

By controlling the heat rate. Meaning that as long as you increase the heat rate a little bit you will get a reactivity feedback and you will maintain k-effective of one no matter what happens under any conditions.

That's not the same thing as GDC-27. I only think that you need to consider having a GDC-27 to the Tier 1 safety criteria. Shutdown of a reactor must be a fundamental principle.

Being able to shut it down and not letting it run out, run off when the temperatures was high because you got activity feedback, it's not the same as shutting down.

MEMBER PETTI: So, Jose, just to give you

a comparison, I don't know if you know this, the pebble bed reactor in China, the small one, HTR-10, they shut it down by shutting the circulator off, letting the temperature rise, very tiny rise. And then the temperature coefficient brings it down and then xenon builds in.

MEMBER MARCH-LEUBA: That's correct. All of the gas cool reactors do that.

MEMBER PETTI: Well all, lots a solid moderator and I think we're going to see a lot of different in innovative solid moderators come out in the micro-reactor space beyond a graphite.

And they all tend to have this behavior and it's just something that we haven't looked at, you know, in the U.S., solid moderators besides graphite haven't been plenty since the 70s.

MEMBER MARCH-LEUBA: But this is a backup for the shutdown system.

MEMBER PETTI: No. This is where, this is the key issue is that some designers I know want to say that is their primary, that it's a safety function. It's how they're going to implement the safety function and then they'll use the LMP in the second system, the rods in essence become that middle category of the three in the characterization.

MEMBER KIRCHNER: Yeah. But, Dave, you know, sooner or later that system cools down and you need the rods to effect a, as Jose is saying, a positive shutdown.

MEMBER PETTI: For sure --

(Simultaneous speaking.)

MEMBER PETTI: -- function of the five in terms of what power level it backs to, all that stuff.

MEMBER MARCH-LEUBA: And then our lessons been learned that you have to analyze the transient to its logical completion. In one reactor like this it might be three months.

But you're leaving the reactor hot for a while, eventually it's going to cool down and you're going to return to power. You're not taking it to a safe and a stable condition.

It might be acceptable. It's really great that they have it but you are in a degrading, a continuously degrading condition. You're --

(Simultaneously speaking.)

MEMBER PETTI: Yeah, but what if --

MEMBER MARCH-LEUBA: -- the rods.

MEMBER PETTI: But we just allowed a design because they didn't violate SAFDLs to go through a very similar approach.

MEMBER MARCH-LEUBA: Yeah. No, it's okay but we consider that, that's a defense-in-depth. I don't know, so --

(Simultaneous speaking)

MEMBER PETTI: All I'm saying is that they could --

MR. RECKLEY: So anyway --

MEMBER BROWN: Not all of us agreed with.

MR. RECKLEY: So again, I'll leave this maybe, because we posed it as a question, we're not proposing an answer. Yes, such features to some degree have been built in before.

But as Dave is suggesting, the question is, as they become the front defense mechanisms, what additional guidance would we need and what, you mentioned some of the concerns.

What we're posing to stakeholders is, to what degree are proposing this that such that we need to develop guidance to make sure that if you're crediting an inherent feature, you're staying within the boundary conditions in which you're confident that that behavior is guaranteed.

Both within things like physical conditions, temperatures and so forth, then over the life of the facility, all of the questions that you

raised.

So again, this question we're posing and based on the feedback it might be another area where guidance might be developed.

If we also need to look at the rule language to support it, that might be another thing that we talk about in a future iteration.

So, just so we can do design, I think we'll go on to the public comments. Most of these I've already talked about --

MEMBER MARCH-LEUBA: Before you go there on that line, the problem I'm having, I put myself with my hat as reactor designer with this rule is that you having so much flexibility that I don't know what you're approving and you're not approving.

I'm going to either be very concerned about it and not believe you want to approve or yes, think you want to approve and go see, bring it around and see if you approve it.

The guidance doesn't tell me if I can do this or not and this is not the only, I mean, there are many where you say well, bring us a proposal and we'll look it.

In other words, the rule does not forbid you from bringing a proposal but doesn't tell you what

to proposal needs to satisfy, which leaves me with a lot of licensing uncertainty.

Yes, put it on the record. I know you don't want to prescript it but there is a perfectly good alternative, which is using exemptions when you want to get out of the rule. As it is, I don't know what you want me to do.

MR. RECKLEY: Okay, thank you. So, let's, so again, I've talked about most of these in terms of the comments and even given the hint at the direction we're going.

The discussion of occupational dose, we talked about the need to continue the discussion on generally accepted in terms of Consensus Codes and Standards.

I mentioned there was a suggestion that security could be put off and be addressed by the overall security program and not included within the design activities, within this Subpart. Going on to Slide 40.

A lot of discussion and we had it here today, very similar discussions of not using the PRA for the purpose of selecting your licensing basis events and safety classifications.

That the PRA should complement the safety

review, allow more, allow other approaches. Some discussion that even the PRA itself should be optional.

One issue that's come up kind of as a continuing theme is our discussion all along in the rulemaking plan, and even before the rulemaking plan, was that we would use the guidance in Reg Guide 1.233, the NEI 1804 methodology as one acceptable way for this rule to be, to meet this rule.

And one of the comments, again a recurring a theme has been, the rule may lean too much in that direction. That it might actually end up requiring or not allowing any other approach or requiring the use of LMP.

And so, that's one of the areas where we're looking trying to strike the balance to maybe provide alternative but as we've said all along to maintain that methodology is one acceptable way to meet this rule.

That was, you know, from our perspective that's why we undertook that initiative back when we were doing LMP. We said we foresaw it being used for what is now Part 53, so, you know, it was part of the rationale for everything we've done in the last three or four years.

So, we want to maintain that. At the same time, we're hearing those that are complaining or observing that maybe we're precluding other methods. So, as we prepare the next iteration, we'll look at alternate approaches. Maybe more deterministic approaches.

Then another discussion about consistency with IAEA or other regulator's approaches that look at PRAs somewhat differently and build them into the regulatory structure somewhat different than what we had proposed here. So --

CHAIRMAN BLEY: Bill?

MR. RECKLEY: Yes?

CHAIRMAN BLEY: As I read information from various sources, a lot of this emphasis on developers seems to be that they really are hoping for consistency in regulation internationally so that they can sell these things in many different places without doing a full, you know, review everyplace they go. Does that seem what they're after to you?

MR. RECKLEY: Yeah, that's the comment on the international frameworks. That, to the degree we can try to either be consistent with or at least that whatever we put into this rule doesn't require starting all the way over from scratch to go to

another approach.

It is the desire. So, again, it's something we're looking at and trying to do. We're aware of this kind of issue and desire even before.

I think we've talked to you before about having agreements with CNSC, the Canadian Nuclear Safety Commission and kind of looking at our approaches.

Because there are a number of potential applicants that would look at both countries and then obviously were involved in IAEA and some other activities. So, yes. We're trying to do that.

Going on to 41. Some other observations has been that defense-in-depth, while it's a good philosophy should be addressed somewhere other than incorporating it into the regulations.

Or, maybe and/or the guidance we could clarify, what would be a defense-in-depth analysis when either you're using an approach other than licensing modernization that includes a methodology for a defense-in-depth.

Or reflecting the decision, the discussion we just had when there's a reliance on inherent features, what additional measures might be taken for defense-in-depth above those provided by the IAEA.

What would be considered an inherent feature?

So, those are the, kind of discussion points. Think we have one more slide, 42. So, that's really the discussion and a summary of the feedback we've gotten on Subpart C.

I think I can get through Subpart D deciding one in the allotted time here. Largely because Subpart D will look very familiar. We are largely, we're not proposing dramatic changes to what goes into the siting considerations.

But any last-minute discussion on Subpart C, the design and analysis Subpart?

CHAIRMAN BLEY: No. But just a quick note from me. We wrote a letter a year and a half ago on your draft SECY paper on siting considerations for advanced reactors, went with you toward option three. Do you, in your opinion, is what you have in here pretty well consistent with that?

MR. RECKLEY: Yes. In so, and the language is the same. Actually, in our proposed Subpart D the language is pretty much the same as the existing language in part 100 and therefore the methodology and flexibility that would come with the options that we describe in SECY-20-45 would be available under this.

But we didn't mention it specifically but it would be available because it was written to this language that comes out of Part 100. I'll talk about that as we, when we talk on the population slide.

CHAIRMAN BLEY: Okay, good.

MEMBER BROWN: This is Charlie. I did have one comment or maybe it's a question, I'm not sure which. This is on Slide 41, about the defense-in-depth required when you've got physics or inherent features.

That it always disturbs me a little bit when we think maybe DID is not required when some unknown accident progression that nobody envisions all of sudden rearranges, disturbs the inherent and/or the physics-based feature.

A lot of stuff we don't know that we found out later when we're doing designs, we're not familiar with. So, I hope NRC is not compromising and leaving -- I thought incorporating DID into the overall thought process was the right way to do it. I hope you don't throw that out. It's just my observation.

MR. RECKLEY: Yeah, this comes into play specifically under our defense-in-depth proposal. We had a requirement that no single element be credited, I mean not -- be relied upon.

And so, this question kind of comes in the context of, well what if you have some inherent feature, do you really need to back it up and again?

The comment was coming in the context of the DID requirement that we included in the first iteration that included the sentence, no single feature shall be totally relied upon, words to that effects.

MEMBER BROWN: Did you eliminate that in your, did we not see the original version?

MR. RECKLEY: You saw the original version. We're working on evaluating comments to see if we might change anything in that regard.

MEMBER BROWN: If you decide to throw out defense-in-depth you ought to explicitly address it with us.

MR. RECKLEY: Oh, we will. When we come in a future meeting, probably the March meeting if we have one set up in March. We'll be bringing any revisions we made to B and C in light of ongoing discussion.

And then, as I said, these are going to be continually iterated because we continue to get comments, we continue to learn as we develop future Subparts that something needs to be changed to make it

work.

And so, this will be dynamic all the way, well, logically, I mean, it'll probably be dynamic all the way through the process. But at least until we start to get the package together in the Fall.

We'll be constantly iterating. Hopefully, converging so that each iteration is making less and less changes, just tweaks. But yes, we would probably come to you at the next meeting with any changes we're thinking about for B and C, Subparts B and C.

MEMBER BROWN: Okay, thank you.

MR. RECKLEY: And then as Dennis has pointed out, anytime you see us going in the wrong direction, you can, you have an option then of saying hey, maybe this is something that needs to come before the full Committee.

(Simultaneous speaking.)

CHAIRMAN BLEY: I would say it happened years ago, as recently as maybe 10 years ago is everybody knew what defense-in-depth meant but you didn't find in the rules and it essentially meant something different to everybody.

I think the work that was done by the staff on putting together the NUREG --

MR. RECKLEY: Yeah, the knowledge

management.

MEMBER KIRCHNER: Yeah, KM009.

CHAIRMAN BLEY: -- was really useful and I'd hate to see it disappear. I mean, what we got here is, when, it's essentially a fill the gap, as Charlie was in saying in another set of words.

It takes care of, it helps cover our uncertainty in identifying the areas where we have uncertainty and making sure we have sufficient defense-in-depth to support those areas is really important.

It was one place I thought NEI, 19-04, 20-04 on the LMP did a really, the best job I've seen of explaining how you bring all of the quantitative and qualitative ideas together to really decide how much defense-in-depth you need.

Twenty years ago, we'd gone so far anything anybody wanted they just said defense-in-depth and we had no control of it. Pushing it aside doesn't make much sense to me. I think refining it a little bit here is important. But, you know, again, it's one member.

MR. RECKLEY: Yeah, and I want to -- go ahead. I'm sorry, Walt.

MEMBER KIRCHNER: Yeah, I was going to

jump in, Dennis, and say that or suggest that, and Mary Drouin's work has a short list of considerations and this second bullet is bothersome to me as it probably is to Charlie.

I mean, I can't, I'm an advocate of these advanced designs with inherent safety features and so on but maintaining multiple fission product barriers is just, you know, you can't, you have to have a reasonable balance.

And you can't overly depend on one design attribute. So, some, I, like Dennis said, I would hope you do not drop this.

I think there's a way in your rulemaking to very concisely in a paragraph outline what you mean by defense-in-depth. So that would-be applicants have at least a conceptual idea of what you are, what you mean by DID as pertains to 10CFR 53.

MR. RECKLEY: Okay, thank you. And I don't want exaggerate that stakeholders are not, are wanting to do away with defense-in-depth or even in some of the previous discussions as low as reasonably achievable.

Or even the safety code policy statement for those commenting about that, the question comes down what do we incorporate into the regulation, what

stays as policy and philosophy and what gets incorporated.

So, we saw this largely as an opportunity to look at the policy statements that were done over the last 30 or 40 years and there was a reason they were adopted as policy statements as opposed to trying to incorporate some of that into Part 50.

But given we're starting from scratch our thought was this is an opportunity to take what the Commission has said is important and important enough to write down in a policy statement and actually incorporate it into the, kind of the infrastructure of the rule.

But again, that'll be something that as we go through the iterations, we'll work out what actually gets incorporated into the rule and what might be addressed by guidance documents or remain as Commission policy.

MEMBER KIRCHNER: Well, didn't you state that defense-in-depth is policy or a philosophy, would it not fit in, Bill, in your Part B?

MR. RECKLEY: Oh --

MEMBER KIRCHNER: Or you would make a, let me use the word policy statement about defense-in-depth and describe what you mean by it and then, you

know, then you can look for either in the design section, Part C or you can look at it in the, I forget which letter is operations, where you do defense-in-depth through tech specs or administrative and programmatic controls.

MR. RECKLEY: Right. So again, I think we're all-in agreement. We put it in there in the first place. Maybe I should just cut to the chase, expect it to stay there.

But we are listening to the nuances as well, so there's, you know, the big question of whether to keep it or not and then there's the secondary questions of if it's kept, exactly how it reads and what, is there opportunities to maybe improve how it's written.

So, we're leaning at this point, in terms of the next iteration, we're leaning towards the latter, changing the wording a little bit but keeping the overall thought as you read it the first time.

So, getting into siting, again, I'm hoping I can get through this relatively quickly. Because it's largely not introducing major changes. The way it fits into the analysis and so forth, changes a little bit.

But we've talked about that in the past

so, going on to 44, there's a 53.500, just a -- you can go onto the next one if you will, 45. There's a general requirement mentioning why, in the biggest picture why we have siting considerations.

And it's basically to identify the threat or the hazards that the site introduces to the plant and then vice versa, the threats that the site introduces to the environment.

So, looking at in both directions, that's always been the general approach to the siting requirements. The one thing that does get introduced here, although it's not a dramatic change, I don't believe, is the introduction and the tying of the siting to the Subpart B first and second tier safety criterion.

And we'll talk about that in large part on the next Slide 46. So, the first part of that discussion is what threat does the environment pose to the plant. That's generally referred to as external hazards.

The approach is that SSCs needed to meet the first tier need to be designed to withstand natural phenomena and manmade hazards up to the design-basis external hazard level. And that's a phrase that's taken out LMP NEI 18-04.

And basically, it's the same thing we do now, safety-related equipment needs to be designed to withstand an external hazard level up to the design-basis earthquake, the design-basis flood, design-basis wind loading.

That is basically comparable to what we're doing now. We did add the second sub-bullet, which is a bit of a change but I don't think it's a dramatic change in that we adopted the seismic numbers of 1 in 100,000 years.

With added margin to address uncertainties to be a standard that would be used for all external hazards. The guidance now, there's a bit of a range from hazard to hazard that's been introduced in terms of the frequency and the probability of exceedance and so forth from hazard to hazard.

So that's basically again, is what we do now for safety-related SSCs and it reflects, again, the approach in NEI 18-04 in terms of applying the design-basis external hazard level.

We did maintain a specific requirement for the safe shutdown earthquake ground motion and that again, reflects the current requirement including the establishment of the minimum .1g value.

So again, nothing really being introduced

in Part 53 that's a departure from where we are now or have been recently anyway. If we go onto 47. This is a new requirement and it actually goes beyond current requirements.

And that is, given you have a PRA that one needs to do, the analysis required under 53.450, which is the PRA, needs to address external hazard frequencies and related SSC fragilities related to those hazards within the PRA to the degree that's possible.

And so, we're just trying to build in looking forward that the external event PRAs would be done. At the same time, we recognize the state of the art might not be there for all hazards quite yet. Any thoughts or questions on that?

MEMBER BROWN: Yeah, just I had forgotten something so, I need you to refresh me. One of the statements in 53.10, if I can make my picture big enough to read it, was that they need to design or address a range of estimated external hazard frequencies to once in 100,000 years.

Is that standard on number? 100,000 sounds, how can anybody ever believe what you're talking about?

MR. RECKLEY: That's the current number in

--

MEMBER BROWN: Okay.

MR. RECKLEY: -- the seismic approach.

MEMBER BROWN: Okay. I'm not as familiar with the overall seismic stuff. That's why I asked the question. All right. Sounds ridiculous to me, but.

MR. RECKLEY: Well actually is the seismic arena, given the ability to look at historical data, that's why they've been able to do that and I'll ask Dennis or somebody or Marty to please jump in, I'm not a PRA expert.

But at least in geologic history you can track things like that and so, you do have some ability to look at earthquakes. There are other hazards where you may not have the ability to construct such an approach and that's why the ability to do probabilistic hazard analysis in some other areas is more challenging.

(Simultaneous speaking.)

MEMBER BROWN: The Mineral Springs earthquake was kind of a surprise up here into the North Anna, near North Anna so, I don't know, I never saw an analysis of that but --

MEMBER KIRCHNER: Charlie, actually you

can do a good job on the seismic, as Bill said. The thing, surprisingly, it's things like meteorology where we have only a 100-year history.

So, there it becomes more difficult to construct the 1 in 100,000 event but certainly in the seismic area, there's good geologic basis for what they've been able to extract there.

MEMBER BROWN: Well, I'd like to see somebody show that the one that occurred, that the North Anna and Mineral Springs area in Virginia was outside the 100, once in 100,000 years.

CHAIRMAN BLEY: It was not, Charlie. It wasn't --

MEMBER KIRCHNER: It was not, yeah. It was within it.

MEMBER BROWN: So it, so they didn't meet the metric then? It shouldn't have happened in other words?

MR. RECKLEY: Well no, actually the opposite. The North Anna plant was designed for that, it exceeded a little bit but in some frequency ranges, I think. But again, Marty can weigh in.

But by and large the plant was already designed for that or very nearly that level of a seismic event.

MEMBER BROWN: Okay, thank you. I learn something all the time.

MR. RECKLEY: Okay. So, then we can go on to 48, I think. This is again just the need to characterize the site and to gather data on meteorology, the geology, seismology, all of the -ologies in order to understand the site.

What would happen if radioactive material were to escape in terms of how would it be transported in air, how would it be transported in water. Again, nothing, this was largely just taken from the existing requirement in Part 100.

And it makes a certain amount of sense. I don't think we got any significant feedback that you don't need to characterize the site.

You can go on to 49, I guess before we leave site characterization, the potential model and this is, when you get into the micro-reactor realm and if the thought is these are being fabricated in factories and being deployed, whether the degree to which they would take bounding approaches to these external hazards and then be able to also in this area basically say they're compatible with this, you know, this range of sites such that you could minimize some of these evaluations.

Along with the general discussion of manufacturing licenses, something we want to understand from the industry and other stakeholders on exactly what is the model and what would Part 53 need to address in terms of this kind of a deployment if that's being contemplated, so --

CHAIRMAN BLEY: Bill?

MR. RECKLEY: Yes, Dennis.

CHAIRMAN BLEY: This jumped off the page at me because we've been looking at something that came up because of concerns about where micro-reactors in particular might get sited as the NRC has now developed the Reg Guide on volcanology, in case it's too close to volcanos.

And you don't mention that one in your list here and it came up particularly for some of the new reactors. Seems like you ought to have it in there.

MR. RECKLEY: Yeah, it would be addressed in the external hazards that needs to be identified. You're probably right. We can certainly add that. I don't, again, we lifted this largely out of Part 100, one could say geology includes volcanology but maybe we'll add specifically. It's definitely --

CHAIRMAN BLEY: You've actually done a Reg

Guide on it recently.

MR. RECKLEY: Yeah, no, and its, volcanology, volcanos have always been included in the list of external hazards one needs to assess. It's, the NUREG Guide or Draft Reg Guide is just going into more detail on how to do that assessment. But yeah, okay. Good point.

If we can go to 49, yeah, 49. This gets into, Dennis, what you were saying and it's also an area where we got some feedback in this area on the population-related siting considerations.

We were looking at it as we developed SECY 20-0045 on alternatives to population density and so, we're awaiting the Commission to make a decision on that SECY paper.

And so, we didn't go much further than that paper. What we've included here would allow that flexibility but we didn't go much further than that.

So, what 53.530 talks about is the definition of both the exclusion area boundary and the low population zone using the existing criteria, 25 rem for two hours for the EAB or over the course of the event for the low population zone.

Some of the comments were to replace those with the site boundary. This goes again, to whether

Part 53 should continue to allow a future advanced reactor to meet the same criteria that existing plants have or should we, for example, prohibit any plant that would exceed 25 rem dose at the site boundary.

Our current approach is to try to support the flexibility that advanced reactors can have an exclusionary boundary and low population zone defined as the site boundary if that's where, if they can show that the dose does not exceed 25 rem.

So, it's setting up the equivalency, the site boundary is the site boundary, it's the exclusionary boundary, it's the low population zone boundary.

But if there are advanced reactors that, for whatever reason would be designed and have the potential for the 25 rem offsite, thereby they're also going to set up that they're going to need emergency planning offsite, that that flexibility be provided.

So, it comes down to trying to allow flexibility. So, the current language that we used here allows the exclusionary boundary and low population zone to collapse.

It also allows, if anyone were so to choose, to keep with the existing system. So that was the logic of using the existing language. The --

MEMBER BROWN: Bill.

MR. RECKLEY: Yes?

MEMBER BROWN: Go ahead, I'll wait until you're done.

MR. RECKLEY: No, no. Well, I was going on to the next slide.

MEMBER BROWN: Oh, okay. I just want to make sure I understand it. Effectively there's a fence around the site most of the time of some sort. A physical barrier around the site.

MR. RECKLEY: Right.

MEMBER BROWN: So, this would, if they took advantage of this because they meet the 25 rem that means somebody could have their backyard up against the site boundary? Is that correct?

MR. RECKLEY: Yes. That the, usually the way it is set up is you have a site boundary then beyond the site boundary out to, typically about a half a mile you have the exclusionary boundary where the licensee has the ability contractually to control people within that boundary.

MEMBER BROWN: Yeah, but you said you're waiving that.

MR. RECKLEY: It could collapse if they can show that the 25 rem won't exceed the 25 then

you're right, you would not need an additional half a mile distance or even any distance --

MEMBER BROWN: Somebody could build a house right next door to the boundary if they meet this requirement?

MR. RECKLEY: That's right.

MEMBER BROWN: So, wouldn't there be some other physical safety concerns relative to people that do that that have ulterior motives?

MR. RECKLEY: Yeah. As we get, then there's another --

MEMBER BROWN: Safety, you know, physical safety issues, you know what I'm talking about.

MR. RECKLEY: Yes. And actually, as we get into the security arena there's another zone, the owner-controlled area that is set up for security reasons.

Sometimes, traditionally they might overlap with some of these radiological areas just because it made sense for an owner-controlled area and an exclusionary boundary to line up.

But there is another consideration of where people live and that is in the security realm under the owner-controlled area.

And if were to be, if it were to make

sense from a security standpoint to have people not having their backyard at the fence, then that would be another way but for reasons other than radiological to have them be at a distance.

MEMBER BROWN: Yeah, I just wanted to make sure there was still, is the safety or the owner-controlled boundary part of these Part 53 considerations or not?

MR. RECKLEY: It may be when we get to the security program, which would be under Subpart H.

MEMBER BALLINGER: So then, in order to avoid having to have evacuation plans and all that stuff, you just simply build the plant where the fence is out to the point where you don't exceed the 25 rem?

MR. RECKLEY: You could do that.

MEMBER KIRCHNER: But the PAGs, Ron, are one rem.

MR. RECKLEY: Yeah, that's different than emergency planning and having evacuation plans, which as Walt said, is one rem.

MEMBER BALLINGER: Okay, well then that just makes it a little further out. 1 over R-squared.

MR. RECKLEY: In theory, one could do that.

MEMBER BALLINGER: Well, the Seabrook

Plant up here just simply sold a lot of their land right up to the boundary and now there's a giant shopping center and the access road to the plant goes through the parking lot for the shopping center. You don't even know it's there.

MR. RECKLEY: So, again, I would just weigh in, this is basically the current requirement. And the EAB and the LPZ, the low population zone, exclusionary, have always been defined in terms of these dose values. So, this is the existing requirement.

MEMBER REMPE: Bill, before you leave this slide or if you, I'm not sure if you're done with your sentence. Did you have another comment?

MR. RECKLEY: No, I did not.

MEMBER REMPE: Okay. So, on this last item, it sounds like, again, I've seen this before, that you're assuming a single release from an event and as I recall the gas reactor has circulated, if it had a LOCA, there's a circulating activity release.

And then you might later heat up and you'd have additional releases coming out that might be more substantial. So, is a release the word you want to use in the second bullet?

MR. RECKLEY: The actual language is, I

think, refers to the worst case. The worst two hours, and in the low population zone if over the period, the whole period of the release, which would be including the PUF and the subsequent release.

MEMBER REMPE: Okay. So, what if there's a design that's, because again you've got this, it's the release associated with an event is basically what I'm trying to be clear about and I hope the language is clear.

Because I thought when I looked at it, in an earlier section they talked about a single plume. We want to make sure that it's recognized you could have more than one release associated with an event.

MR. RECKLEY: Right. And keep in mind also that, for Part 53, when we talk about a plant it includes multi-units and so, not only could you have different timing of different releases from a unit, you could have different timing from different units and you could have different timing in the case of an external event from different inventories associated with different units, so.

MEMBER REMPE: And I thought that was the response you gave me back but I thought the language I saw here still kind of talks like it's a single release.

MR. RECKLEY: Okay, that, we'll look at that language and make sure it's clear that this is looking in total and reinforces, again, one difference for Part 53 is, it's multi sources, multi units.

And as you're saying, potential different time frames. So, we'll look at that language and make sure that in our copying it over from Part 100 we didn't inadvertently lose the continuity of that requirement.

Anything else on EABs and low population zones? If not, we can go to Slide 50, which is talking about the population center distance. This is an existing requirement as well.

And it does start to get into the relevance of SECY 20-0045 on population densities. And just as a remainder, the low population, I mean, the population center distance is currently defined as the, you take the low population zone boundary.

So, traditionally that's been a number of a couple miles and it's one and a third so, just one way to think about it easily, if the low population zone is three miles, the population center distance, which is the distance between the plant and the nearest population center of 25,000 people could not be any smaller than four miles.

And that was just developed in the, you know, all of this was developed in the, kind of early days. The NUREG-0396, the whole setting up of the emergency planning programs and so the multiplying by one and a third was just a way to add some conservatism, make sure things like emergency plans could be effectively done and to site them away from somewhere where that might become an issue in the value of 25,000 where the population center was selected way back in the, it was probably in the 1960s, I guess.

So, we actually maintained that but as we talked about in SECY 20-0045, if you're collapsing the low population zone to the fence then you basically have a low population zone distance of zero and one and a third.

You don't, this doesn't come into play unless you have a dose of 25 rem at some distance from the plant. The last bullet on the slide, reactor sites should be located away from very densely populated centers.

And this is more or less the way the rule is worded. It's one of the more general-worded rules that you'll find, even including that sentence where population, low population densities are generally

preferred.

This is where we addressed in SECY 20-0045 that instead of 500 people per square mile as the population density out to a distance of 20 miles, we would introduce a, or potentially introduce if the Commission approves it, a consequence-oriented formula where our recommendation, as Dennis mentioned, was that the distance would be out to twice the distance at which you get one rem dose to an individual over a period of a month.

And so, it's roughly twice the emergency planning zone distance, I mean, the, yeah, the emergency planning zone. But that is what we recommended. So instead of 20 miles, it could be a smaller number.

But there still would be a limit on population density. If there was a dose off site exceeding one rem and if there were no doses off site that exceeded one rem, then the only population-related requirement that comes into play is that reactor sites should be relocated away from densely populated centers, which is defined as 25,000.

And so, the interpretation in SECY 20-0045 is, if you have no dose exceeding one rem off site, you could be located almost anywhere except for in a

population center of greater than 25,000 people.

And so, that is the way this carries out and this is what we brought into Part 53. As we'll talk about, some stakeholders want that even further relaxed but our current language in this iteration is as I described it. So, questions on the population-related?

MEMBER BALLINGER: This is Ron. It looks to me that most of this rule is assuming as a practical matter that the plant that you're going to install is going to generate electricity.

What about a plant that you want to install that's just going to generate heat for use in processing?

MR. RECKLEY: There's nothing in the rule that we foresee that is totally dependent on the end product. For example, whether it be electricity or process heat. The --

MEMBER BALLINGER: But if you plunk this thing down in the middle of a site where they're doing mining and there's a lot of workers and things like that, does that make a difference?

MR. RECKLEY: Well, the way we have currently constructed it, as it's described in SECY 20-0045, is that a reactor could support those

activities because those areas are usually population centers of less than 25,000 people.

If you start to talk about process heat being district heating or process heat in an industrial facility that is also in a densely populated center, this could become a restriction.

So, one of the things again we would be interested to hear from stakeholders is, if the 25,000 is going to become -- if they see 25,000 as an obstacle to actually deploying these reactors as they envision, might we need to look again to see if that is a needed limitation?

Right now, we didn't do the assessment because we didn't, we're not changing current requirements. But if the thought was to put advanced reactors into more densely populated centers, what would need to be considered?

And what limitations would come with that? That's a question. Since we didn't propose it, we didn't need to come up with a justification. But if it is going to be proposed, what would be the argument?

So, I'll leave it there if there are people with thoughts or concerns on that aspect of whether we should go further in terms of flexibility

in siting.

MEMBER PETTI: So, Bill, this is all depending on that document that you presented to us that's not yet approved, right?

MR. RECKLEY: Yes. I mean --

MEMBER PETTI: Is that just, you know, a time constant for the bureaucracy and the gears to move or there is a chance that somehow higher up the chain people that don't like and you have to, might have to and rewrite this?

MR. RECKLEY: I mean, where it is right now is for the Commission to consider. It's made it through the process and it's with the Commission, so.

MEMBER BALLINGER: What document is that? Excuse me, I'm sorry.

MR. RECKLEY: This is SECY 20-0045.

MEMBER BALLINGER: Oh, okay. I have it. Thanks.

MR. RECKLEY: So, I don't know the answer, David, as to what the Commission might decide. I mean, if they, if the Commission were to decide just to deny that SECY paper altogether and just stick with the current requirement, the guidance, the key part is, everything we've adopted up to this point is in accordance with the existing guidance, existing rules.

It's just the guidance that we were proposing to provide additional flexibility by shrinking the 20 miles. If the Commission were to decide to maintain 20 miles at 500 people per square mile, that would, you know, that would have an impact on the deployment models.

CHAIRMAN BLEY: I'll just mention that we wrote a letter on this in late 2019 and briefed the Commission on this sometime after that so, we've gotten our input to the Commission.

MR. RECKLEY: Yeah. I mean, from the staff's point of view in writing Part 53, the question is really at this point, whether to go beyond the flexibility that's afforded by both the existing rules and the guidance documents including the potential for additional flexibility in SECY 20-0045.

Again, some stakeholders are saying it should be opened up more than this. We will see what arguments are brought forth to possibly support that argument.

You know, it's always brought up so, I might as well, you know, just pose it as a question to the Committee, you know, it's always brought up, do we want to revisit Ravenswood, right?

Ravenswood was the boiling water reactor

proposed, I'll get my rivers wrong. Anyway, it was in the middle of New York City, East River or Hudson River. So, in a very populated place.

Would we want to go as far as to say there are no requirements related to siting and population and a reactor can make a case based on its consequence assessments and be placed anywhere.

You know, that would be the question. The long-standing policy of the Commission has been as it's stated here, areas of low population away from very densely populated centers.

If there's an argument that should no longer be the position based on an analysis of advanced reactors or potentially micro-reactors in particular, should we, in Part 53, ask the Commission to change that policy I guess, would be the question.

We're not proposing to do that. You guys can think about it. You'll see this again as we go through the iterations and as you see the total package. I'll leave it then as a question because we're at the end of the time. But I only have like a couple more slides.

So, if we could do 51, we talked about the interfaces. Basically, every subpart will have a reminder of its interfaces with others.

Obviously, external hazards goes back to things like 53.540 on, I mean, I'm sorry, 450 on the analysis and safety classification and so forth.

And applicants would have to also address all the environmental requirements in Part 51. So, if we go to 52, Slide 52. Some of the public comments I already mentioned.

Specifically use of the site boundary as the EAB and low population zone specifically as opposed to, I suppose allowing the EAB and LPZ of being outside the site boundary.

The comment I just made, that there's some observation by some stakeholders that the safety criteria does away with the need to worry about population centers, population densities and so forth.

And sort of the last bullet there is a notion that, and this goes to some of the other discussion of maximum hypothetical accident and so forth, it is impossible to just show that a particular design is impervious to external hazards or some subset of external hazards and therefore, not need to do any additional analysis, any additional characterizations of a site and so forth. And with that, I go to the last slide, which is just questions.

CHAIRMAN BLEY: No, but you brought up

something I'd mentioned to my colleagues on the Committee. If anybody is entertaining this idea that, forgetting about what happened at Ravenswood is a good idea, I'd suggest reading the chapter on Ravenswood in Dave Oklin's book that all of you have access to. But it might be something to talk about at a later time, not now.

Any comments from the Committee? If not, I'd like to get the public line open, so we could entertain public comments and then I'll come back to the Committee. While we're waiting for the line to open --

MR. DASHIELL: Public line is open for comments.

CHAIRMAN BLEY: I see he's still signed in. Thank you, Thomas. If there's anybody in the public that would like to make a comment, please identify yourself and make your comment. Any public comments?

MR. DRAFFIN: Yes, this is Cyril Draffin from the U.S. Nuclear Industry Council. We appreciate the effort that you've done today in terms of raising issues.

We spend a lot of time thinking about the topics and thinking about how these technologies can

be developed and used and I think it's healthy to have a dialogue.

And we look forward to the iteration as people think about what makes sense, provide safety and also enables this to be a transformative part that the industry and others can rely upon. So, we --

(Simultaneous speaking.)

CHAIRMAN BLEY: Thank you very much. I'm sorry, I thought --

MR. DRAFFIN: -- coming fast and we will continue to try to be supportive of the NRC.

CHAIRMAN BLEY: Okay. Thank you very much for your comment. We appreciate it. Anyone else? All right, hearing none, Thomas, can we close the outside line?

MR. DASHIELL: Outside line is closing.

CHAIRMAN BLEY: And now I'd ask members, I'd first state that I don't see a reason yet to go to the full Committee and consider writing a letter. But if anyone disagrees, bring it up. Anyone like to add something to your questioning today? Of the members of the Committee? Well, thank you.

I have a couple things I wanted to mention right here at the end. Bill, I don't know if when you see it might be possible. So, let me start at a

different point.

It's becoming clear to me from the discussions today that the emphasis on flexibility and what that does to the brevity of the language and the rule, to me makes the Statement of Considerations or whitepapers that would precede the development of Statements of Considerations.

And the associated guidance documents, really essential integral elements with the rule and I don't see how we can evaluate the rule language absent the SOC and key guidance documents.

Bill, when you talked about some of these things, the story was really pretty good. I don't know if you were talking from draft white papers yourself or speaking extemporaneously, if it's the latter, I suggest you get the transcript and see what you said.

And I again, say that would be a good starting point. Part 100.23 does mention volcanos so, I say you need to do that here too.

I'd also ask, whenever it's possible, it would be really good to schedule a discussion with us on the development and structure of guidance. What's going to be in the guidance documents, what kind of documents do you envision, what things beyond what we

currently have.

And likewise, as you begin to develop any white papers that would support the SOC, bringing those to us and letting us see it would be very helpful. I guess that's all I wanted to say.

So, thanks to everyone. Bill, it was a heroic day for you. You should be tired, have a good weekend. Thank you very much for the presentation and all of the discussion. And at this point, I think the meeting comes to a close. We are adjourned.

(Whereupon, the above-entitled matter went off the record at 5:38 p.m.)

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ACRS Future Plant Designs Subcommittee

10 CFR Part 53
"Licensing and Regulation of Advanced Nuclear Reactors"

Subparts C and D Preliminary Proposed Rule Language

February 18, 2021

U.S.NRC
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Agenda

9:30 AM – 9:35 AM	Opening Remarks
9:35 AM – 9:40 AM	Staff Introduction
9:40 AM – 1:00 PM	10 CFR Part 53 Subpart C – Design and Analysis Requirements
1:00 PM – 2:00 PM	Lunch
2:00 PM – 3:00 PM	10 CFR Part 53 Subpart C – Design and Analysis Requirements (continued)
3:00 PM – 5:30 PM	10 CFR Part 53 Subpart D – Siting Requirements
5:30 PM – 6:00 PM	Discussion

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NRC Staff Plan to Develop Part 53

Subpart B | **Subpart C** | **Subpart D** | **Subpart E** | **Subpart F** | **Subpart G**

Project Life Cycle

Requirements Definition
- Fundamental Safety Functions
- Prevention, Mitigation, Performance Criteria (e.g., F-C Targets)
- Normal Operations (e.g., effluents)
- Other

Design and Analysis	Siting	Construction	Operation	Retirement
System & Component Design	*External Hazards*	*Construction/ Manufacturing*	*Facility Safety Program*	
Analysis Requirements	*Site Characteristics*	*Ensuring Capabilities/ Reliabilities*	*Surveillance Maintenance*	
Safety Categorization & Special Treatment	*Environmental Considerations*	*Change Control*	*Configuration Control*	
		Environmental Considerations	*Design Changes*	
			Staffing & Programs	

Clarify Controls and Distinctions Between

- Plant/Site (Design, Construction, Configuration Control) →
- Analyses (Prevention, Mitigation, Compare to Criteria) →
- Plant Documents (Systems, Procedures, etc.) →
- LB Documents (Applications, SAR, TS, etc.) **Subparts H & I** →

NRC Staff Engagement Plan

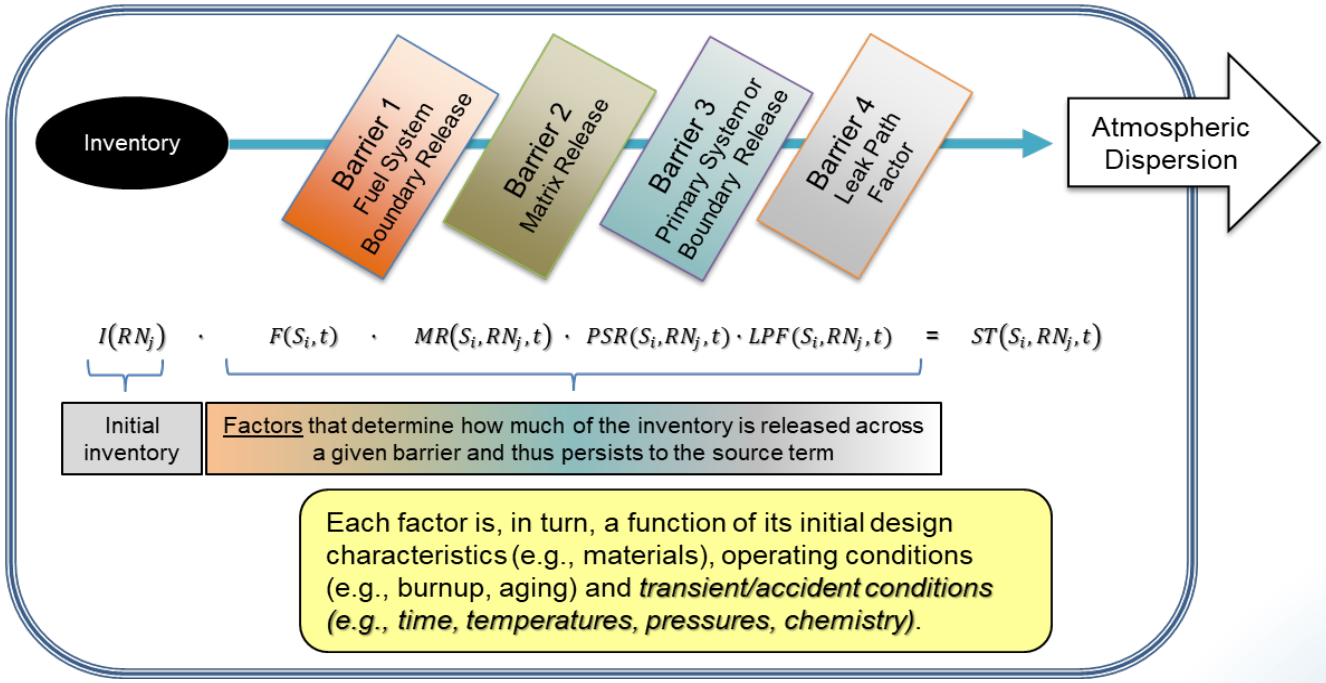
ACRS Interactions

Stakeholder Interactions									
	Framework	Safety Criteria	Design	Siting	Construction	Operations	Decommissioning	Licensing	General/Admin
Sept 20									
Nov 20									
Dec 20									
Jan 21									
Feb 21									
Mar 21									
Apr 21									
May 21									
Jun 21									
Jul 21	Consolidated Technical Sections								
Aug 21	Consolidated Technical Sections								
Sept 21									
Oct 21									
Nov 21	Consolidated Rulemaking Package								
Dec 21									
Jan 22	ACRS Full Committee								
Feb 22									
Mar 22									
Apr 22									
May 22	**Draft Proposed Rulemaking Package to the Commission**								
Jun 22									
Jul 22									
Aug 22									
Sept 22									
Oct 22									

	Concept/Introduction
	Discussion
	Interim Staff Resolution

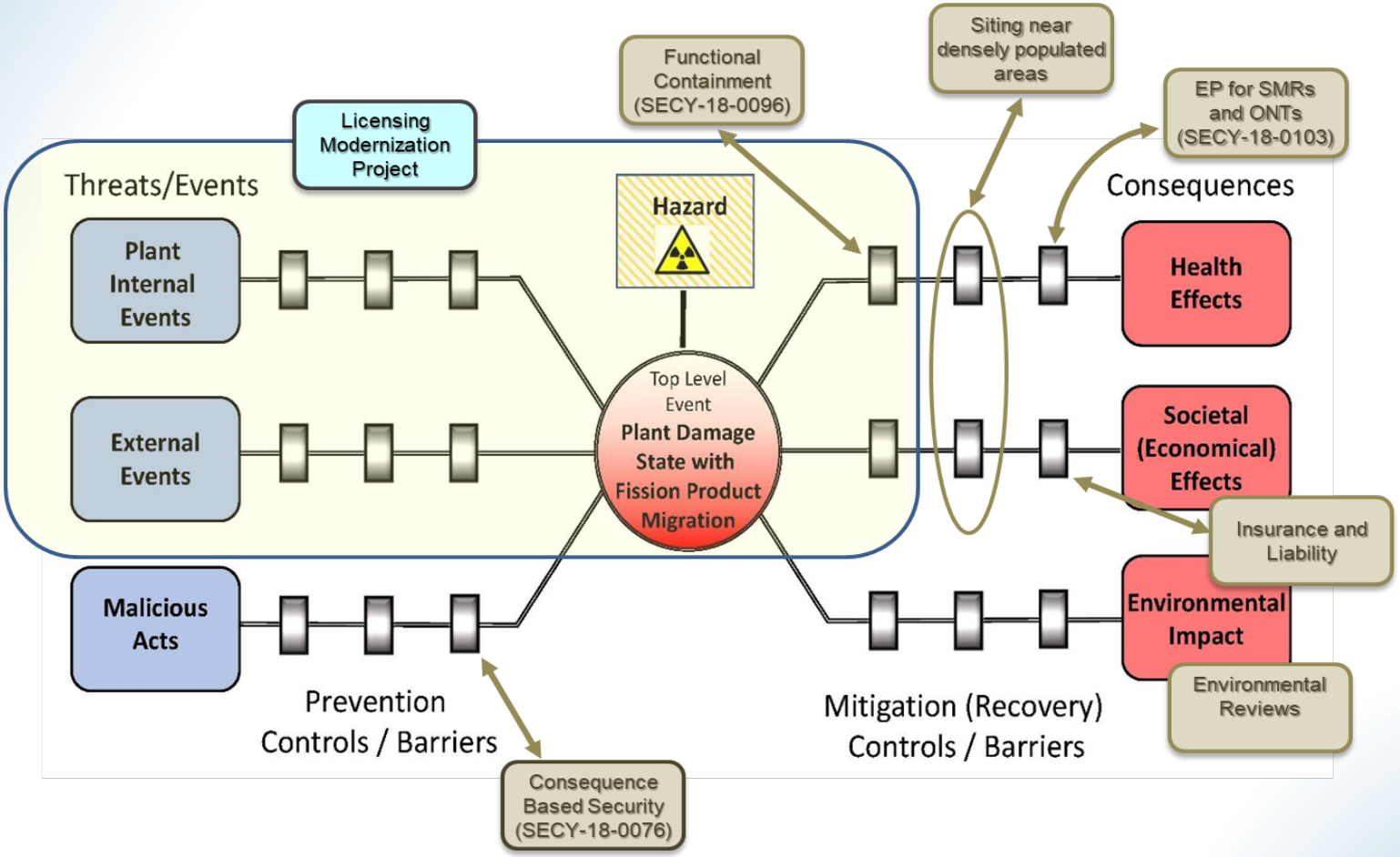
First Principles

Recent NRC activities related to advanced reactors (e.g., functional containment performance criteria, possible changes to emergency planning & security, and DG-1353) recognize the limitations of existing LWR-related guidance, which requires a return to first principles such as fundamental safety functions supporting the retention of radionuclides



See: SECY-18-0096, "Functional Containment Performance Criteria for Non-Light-Water-Reactors," and INL/EXT-20-58717, "Technology-Inclusive Determination of Mechanistic Source Terms for Offsite Dose-Related Assessments for Advanced Nuclear Reactor Facilities"

Integrated Approach (NRC Activities)



Note that a goal of the current effort is to build from the Licensing Modernization Project and have that guidance (NEI 18-04, RG 1.233) be one acceptable way of meeting the requirements to be developed and incorporated into Part 53

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Subpart A – General Provisions

- Scope
- Definitions
- Interpretations
- Written Communications
- Employee Protection
- Completeness and Accuracy of Information
- Specific Exemptions
- Deliberate Misconduct
- Combining licenses; elimination of repetition
- Jurisdictional Limits
- Attacks and Destructive Acts
- Information Collection Requirements: OMB Approval

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Subpart B – Safety Criteria

- Safety Objectives
- Safety Functions
- First Tier Safety Criteria
- Second Tier Safety Criteria
- Licensing Basis Events
- Defense in Depth
- Protection of Plant Workers

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Subpart C – Design and Analysis

- Design Objectives and Design Features
- Functional Design Criteria for First Tier Safety Criteria
- Functional Design Criteria for Second Tier Safety Criteria
- Functional Design Criteria for Protection of Plant Workers
- Design Requirements
- Analysis Requirements
- Safety Criteria and Special Treatment
- Application of Analytical Safety Margins to Operational Flexibilities
- Design Control Quality Assurance
- Design and Analyses Interfaces

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Subpart D – Siting

- General Siting
- External Hazards
- Site Characteristics
- Population-Related Considerations
- Siting Interfaces
- Environmental Considerations

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Subpart E – Construction and Manufacturing

- Scope and Purpose
- Part 1 – Construction
  - (a) Management and Control
  - (b) Construction Activities
  - (c) Inspection and Acceptance
  - (d) Communication
- Part 2 – Manufacturing
  - (a) Management and Control
  - (b) Manufacturing Activities
  - (c) Fuel Loading
  - (d) Communication
  - (e) Transportation
  - (f) Acceptance and Installation at the Site

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Subpart F – Operations

- Transition from Construction/Manufacturing to Operations
- Part 1 – Maintaining Capabilities and Reliabilities of Safety Related and Safety Significant Equipment
  - Design Features and Programs for Normal Operations (53.220(a) Criteria)
  - Design Features and Programs for Normal Operations (53.220(b) ALARA Criteria
  - Configuration Management for Safety-Related Design Functions
    - Technical Specifications
  - Configuration Management for Safety-Significant Design Functions
    - Special Treatment (e.g., Reliability Assurance)
    - Maintenance, Repair and Inspection Programs
  - Quality Assurance
  - Aging Management Programs
  - Design Control
  - Facility Safety Program

Subpart F – Operations, Cont'd.

- Part 2 – Establishing and Maintaining Appropriate Staffing
  - Concept for Operations
    - Identifying Role of Personnel in Meeting First Tier Safety Criteria
    - Identifying Role of Personnel in Meeting Second Tier Safety Criteria
  - Requirements for Licensed Personnel
    - Staffing
    - Training
    - Medical Requirements
    - Licensing (Applications, Examinations, Licenses)
  - Requirements for Non-Licensed Personnel (Graded based on roles)
    - Staffing
    - Training
    - Other Requirements

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Subpart F – Operations, Cont'd.

- Part 3 – Radiation Protection
- Part 4 – Emergency Preparedness
- Part 5 – Security Programs
- Part 6 – Preparing for and Transitioning to Decommissioning

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Subpart G – Decommissioning

- Termination of power reactor licenses (transition from operation to possession-only license)
- Financial assurance for decommissioning
- Transition to unrestricted use…

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Subpart H – Licensing

- General
- Siting
  - Site Suitability Reviews
  - Limited Work Authorizations
  - Early Site Permits
- Design
  - Conceptual Design Reviews?
  - Standard Design Approvals
  - Design Certifications
  - Manufacturing Licenses
    - Manufacturing, Transportation, Deployment
- Site & Design
  - Construction Permit
  - Operating License
  - Combined Licenses
- Appendix A (Content Table)

Subpart I – Maintaining Licensing Basis

- Amendments to a license
  - Application (review?)
  - Public notice and consultations
  - Issuance
- Updating FSAR
  - Including PRA
- Revocation, suspension, modification of license for cause
- Retaking SNM
- Commission order for operation after revocation
- Suspension and operation in war or national emergency, (50.54(d))
- Backfitting and Issue Finality
- Information requests (50.54(f))

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Subpart J – Administrative and Reporting

- Common standards
- Selective implementation (relationship to Parts 50, 52)
- Reporting
- Notifications (50.72, 50.73)
- Financial Qualifications
- Creditor Regulations
- Enforcement
- US/IAEA
- Bankruptcy (50.54(cc))
- Property insurance (50.54(w))
- Liability / Price Anderson
- Water pollution control act (50.54(aa))
- National emergency, can deviate from TS (50.54(dd))
- Share SNM and byproduct material between units (50.54(ee))
- Need to address FEMA deficiencies (50.54(gg))
- Receipt of aircraft threat (50.54(hh))
- ASME (50.55(a)) & quality standards (50.54(jj))
- SNM (50.54(b)-(d))
- Antitrust (50.54(g))
- Subject to laws & regulations – (50.54(h))

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Recap of Subpart B Safety Criteria

- Safety Objectives
  - Reasonable assurance of adequate protection
  - Additional measures to minimize danger to life and property
- Safety Functions
  - Primary safety function is to limit the release of radioactive materials from the facility
  - Additional supporting functions must be defined
- First Tier Safety Criteria
  - Normal operations (§ 20.1301)
  - Licensing basis events (§§ 50.34(a)(1)(ii)(D) & 52.79(a)(1)(vi))
- Second Tier Safety Criteria
  - Normal operations (Performance objectives for liquid and gaseous effluents (10 CFR Part 50, Appendix I))
  - Licensing basis events (Safety Goals)
- Licensing Basis Events
- Defense in Depth
- Protection of Plant Workers

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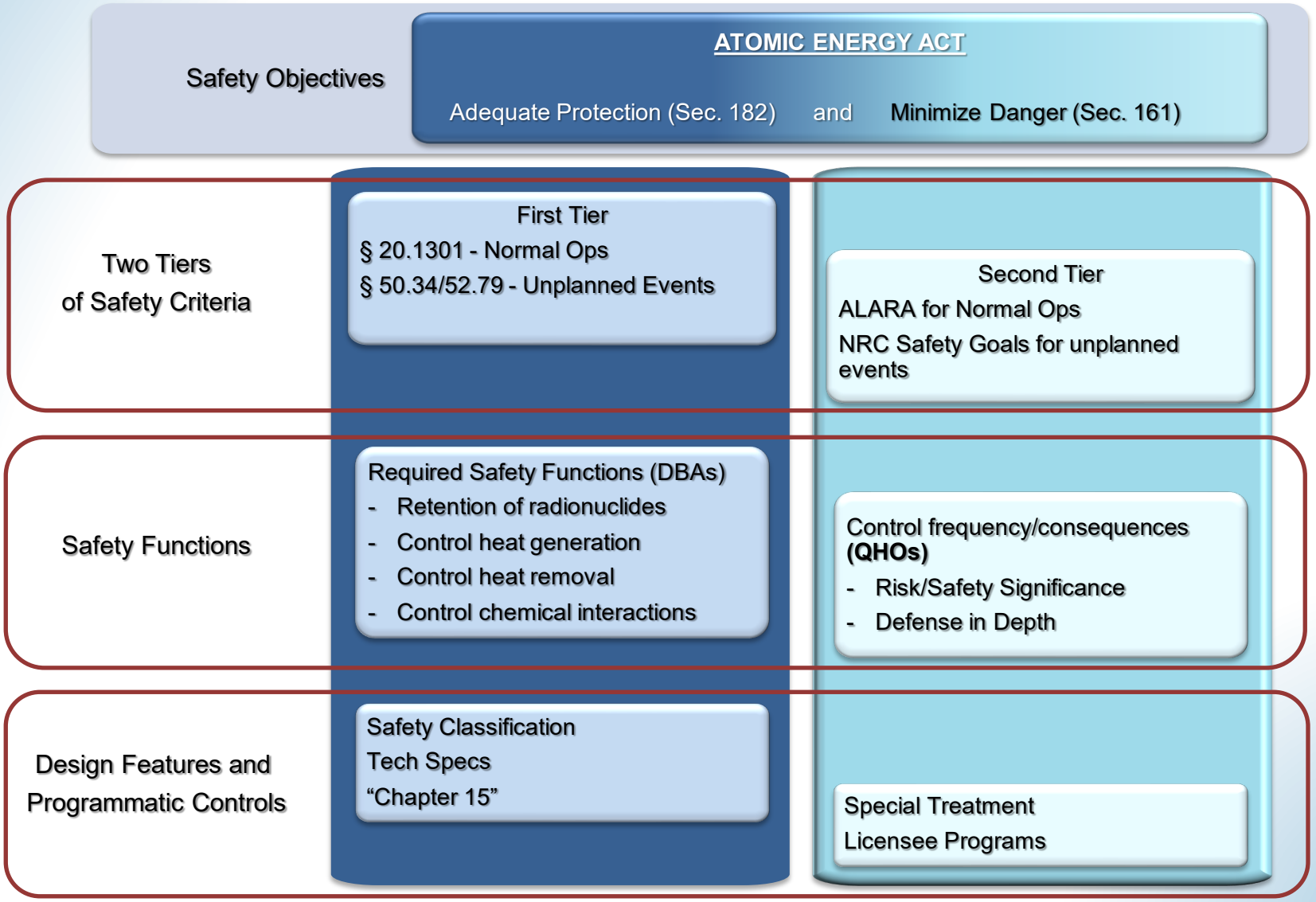
Subpart B Flowchart



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Part 53 Subpart B Stakeholder Feedback

- Second Tier Safety Objectives
  - Proposal by some stakeholders to eliminate second tier
  - Some ACRS Subcommittee members supported revisiting the two tier framework to clarify requirements
    - Staff Proposed Iteration: Maintain second tier to provide clarity on regulatory treatment (e.g., special treatment for safety significant SSCs)
  - Proposal by some stakeholders to not use QHOs as second tier
    - Staff Proposed Iteration: Maintain use of QHOs as logical risk-informed criteria. Industry may develop guidance for analysis section to support other risk-informed (but perhaps more deterministic) approaches to support finding that QHOs are satisfied.

- Safety Functions
  - Proposal by some stakeholders to explicitly cite fundamental safety functions
    - Staff Proposed Iteration: Maintain mention of fundamental safety functions as examples to maintain technology-inclusive framework (with potential use for technologies such as fusion energy systems and multiple source terms within plants)

Part 53 Subpart B Stakeholder Feedback Cont'd

- Non-Radiological Hazards
  - Some ACRS Subcommittee members noted inclusion of non-radiological hazards should be considered, such as chemical releases
    - Staff Proposed Iteration: Under consideration by the Working Group
- As Low as Reasonably Achievable (ALARA)
  - Proposal by some stakeholders to exclude ALARA requirements for normal effluents or occupational exposures
  - Some ACRS Subcommittee members favored retaining ALARA requirements in subpart B
    - Staff Proposed Iteration: Maintained requirements for normal operations and occupational exposures to be ALARA
- Protection of Plant Workers
  - Proposal by some stakeholders to exclude occupational dose from Part 53 or to confine to reference to Part 20
  - Some ACRS Subcommittee members favored retaining occupational dose limits.
    - Staff Proposed Iteration: Revised to reference Part 20

Part 53 General Layout

- Subpart A, General Provisions
- Subpart B, Technology-Inclusive Safety Objectives
- Subpart C, Design and Analysis
- Subpart D, Siting
- Subpart E, Construction and Manufacturing Requirements
- Subpart F, Requirements for Operation
  - Facility Safety Program
- Subpart G, Decommissioning Requirements
- Subpart H, Applications for Licenses, Certifications and Approvals
- Subpart I, Maintaining and Revising Licensing Basis Information
- Subpart J, Reporting and Administrative Requirements

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10 CFR Part 53 Subpart C Layout

- **§ 53.400** – Design Objectives and Design Features
- **§ 53.410** – Functional Design Criteria for First Tier Safety Criteria
- **§ 53.420** – Functional Design Criteria for Second Tier Safety Criteria
- **§ 53.430** – Functional Design Criteria for Protection of Plant Workers
- **§ 53.440** – Design Requirements
- **§ 53.450** – Analysis Requirements
- **§ 53.460** – Safety Categorization and Special Treatment

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10 CFR Part 53 Subpart C Layout

- **§ 53.470** – Application of Analytical Safety Margins to Operational Flexibilities
- **§ 53.480** – Design Control Quality Assurance
- **§ 53.490** – Design and Analysis Interfaces

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§ 53.400 – Design Objectives and Design Features

- Design Objectives and Design Features
  - Establishes the overall design objectives by referring to the underlying safety criteria and the identification of safety functions.
  - Design features must be provided such that, when combined with associated programmatic controls and human actions, there is reasonable assurance the safety criteria will be met.

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§§ 53.410 & 53.420 – Functional Design Criteria

- First Tier Safety Criteria
  - Effluents during normal operation do not result in a dose to an individual member of the public exceeding 100 millirem.
  - Design features and functional design criteria for unplanned events are determined through analyses.
- Second Tier Safety Criteria
  - Doses from effluents during normal operation are as low as reasonably achievable (ALARA).
  - Design features and functional design criteria for unplanned events are determined through analyses.

Note that performance-based approaches for Part 53 safety criteria for normal operations are being discussed as part of the advanced reactor content of applications project (ARCAP). Performance-based approaches for licensing basis events are being incorporated into sections on analyses and programmatic controls within Subpart F (Operations).

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§ 53.430 – Protection of Plant Workers

- Functional Design Criteria for Protection of Plant Workers
  - Functional design criteria must be defined for each design feature relied upon to demonstrate compliance with occupational dose limits provided in Subpart C to 10 CFR Part 20.
  - Functional design criteria must be defined for each design feature to ensure that plant SSCs achieve occupational doses as low as is reasonably achievable.

Note that inclusion of requirements for protection of plant workers within Part 53 is a topic of ongoing discussions related to Subpart B (Technology-Inclusive Safety Objectives)

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§ 53.440 – Design Requirements

- Design features must use generally accepted consensus codes and standards
- Materials must be qualified for their service conditions over plant lifetime
- Safety and security must be considered together
- Design features must be demonstrated capable of accomplishing safety functions without adverse effects to other safety features
  - Analysis
  - Test programs
  - Prototype testing
  - Experience

Note that preliminary rule language refers to “generally accepted consensus codes and standards” and materials being “qualified” for their service conditions. These terms are topics for discussion. Resolution may include rule language, discussions within rulemaking package, and/or developing guidance documents.

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§ 53.450 – Analysis Requirements

- Probabilistic risk assessment (PRA)
  - Performed to identify potential failures, degradation mechanisms, susceptibility to hazards, other risks to safety functions
  - Used to determine licensing basis events (LBEs), classify safety significance and human actions, evaluate defense in depth, assess other challenges to plant safety
  - Conforms with generally accepted methods, standards, and practices
  - Maintained and upgraded every two years
- Analytical codes must be qualified for range of conditions for which they are used
- Analyses must assess fire protection, aircraft impacts, and mitigation of select beyond design basis events (BDBEs)
- Analyses must include design basis accidents (DBAs)

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§ 53.450 – Analysis Requirements

- Note that possible changes being considered for next iteration as a result of interactions with public stakeholders and ACRS
  - Allowing alternative risk-informed, systematic approaches to the PRA for activities such as determining licensing basis events, safety classification, and evaluating defense in depth
  - Clarifying that licensing basis events range from anticipated operation occurrences to very unlikely event sequences.
  - Addressing that analyses must be performed from event initiation to defined end state (e.g., safe stable end state for design basis accidents)

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§ 53.460 – Safety Categorization and Special Treatment

- Safety Related (SR)
  - SSCs and human actions relied upon to function in response to design basis accidents
- Non-Safety Related but Safety Significant (NSRSS)
  - SSCs and human actions that perform a function that is necessary to achieve adequate defense-in-depth or are classified as risk significant
    - Failure contributes 1% or more to cumulative plant risk
    - Would cause a licensing basis event to exceed safety criteria
- Non-Safety Significant (NSS)
  - SSCs not warranting special treatment

Note that criteria for NSRSS my change to address an iteration that supports alternatives to a PRA categorizing SSCs

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§ 53.460 – Safety Categorization and Special Treatment

- Special treatment
  - Must be established to provide appropriate confidence that the SR and NSRSS SSCs will perform under the service conditions and with the reliability assumed in the required analysis to provide reasonable assurance of meeting the safety criteria
- Human actions
  - Must be capable of being reliably performed under the postulated environmental conditions present and be addressed by programs to provide confidence that those actions will be performed as assumed in the required analysis

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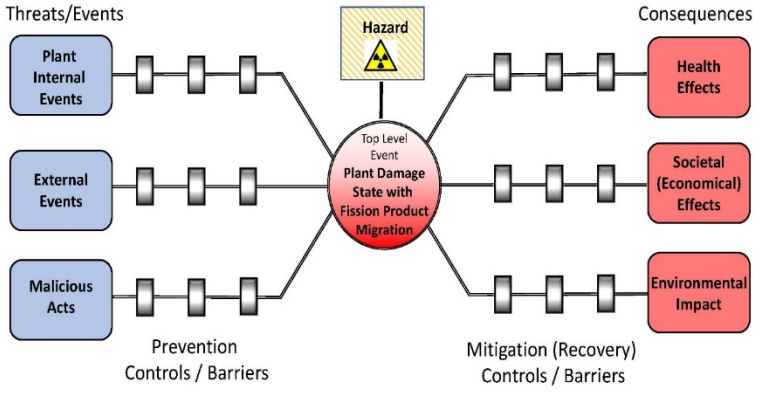
§ 53.470 – Application of Analytical Safety Margins to Operational Flexibilities

- Allows adoption of more restrictive criteria to obtain safety margin for application to other areas
- Requires use of a design goal to ensure analysis, design features, and programmatic controls are established to support analytical margins

Note that this provision would support integrated approach historically discussed for use in justifying alternatives in areas such as emergency preparedness and population-related siting considerations



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§ 53.480 – Design Control Quality Assurance

- Establishes quality assurance requirements for design and analysis activities
- Derived from Criterion III in Appendix B to 10 CFR Part 50
- QA program must conform with generally accepted consensus codes and standards

Note that preliminary rule language refers to “generally accepted consensus codes and standards”. This term is a topic for discussion. Resolution may include rule language, discussions within rulemaking package, and/or developing guidance documents.

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§ 53.490 – Design and Analysis Interfaces

- Requires applicants and licensees to identify, control, and maintain interfaces between design and analyses activities and other activities
  - For example, configuration controls in Subpart F and the proposed facility safety program

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Other Possible Topics for Discussion

A topic for possible discussion is the consideration and treatment of inherent design features. An inherent design feature is one where the safety function is achieved through natural processes governed by the physical laws without reliance on the activation or operation of supporting active or passive systems. It may be helpful to develop guidance on how inherent design features are credited in analyses, verified and validated, and considered under safety classification and special treatment provisions of this Subpart.

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Other Possible Topics for Discussion (Cont'd)

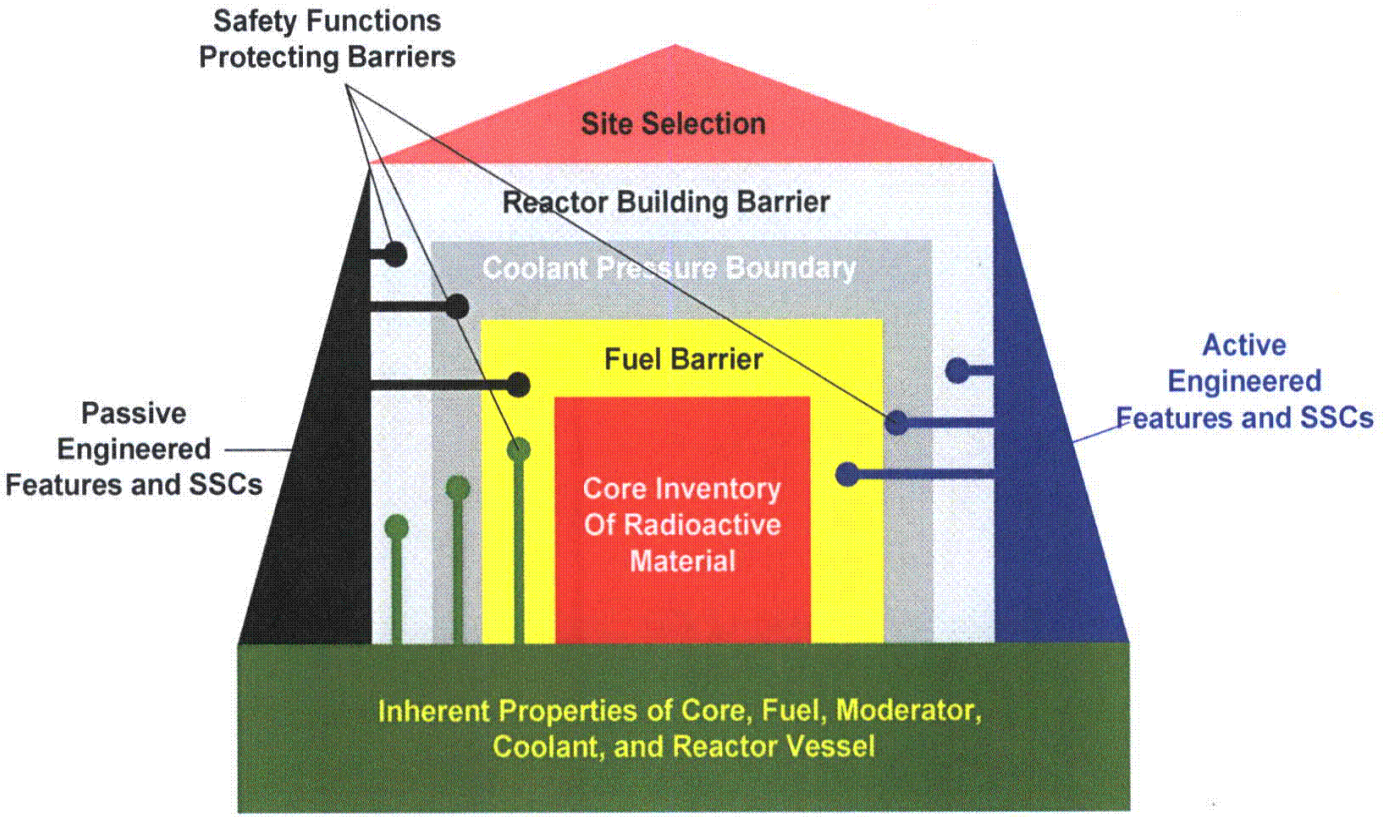

Figure 3-6. Elements of safety design approach incorporated into ***Plant Capability Defense-in-Depth***.

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Key Public Comments on Subpart C Design and Analyses

- Occupational dose should not be included in Part 53.
- Need additional discussion on the term "generally accepted" as applied to consensus codes and standards
- Security should be assessed against NRC performance requirements, not required to be assessed within design processes.

Key Public Comments on Subpart C Design and Analyses

- Do not make PRA an implicit requirement for LBE selection, SSC classification, DID determinations
  - PRA insights should complement the safety review
  - Use of PRA should be optional if other risk-informed analyses are appropriate to use
  - Preliminary rule text for is supported by RG 1.233 implementation, but not supported by an applicant using a deterministic approach to classify SSCs
  - Deterministic approaches for some aspects may be appropriate and should not be excluded (allow combination of risk-informed and deterministic analyses)
- International regulatory frameworks have risk-informed approaches that certain vendors may choose to pursue
  - Part 53 should accommodate such approaches (i.e., IAEA SSR-2/1 and markets with dual-DSA/PSA requirements)

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Key Public Comments on Subpart C Design and Analyses

- DID is important in supporting an adequate safety case for both LMP and non-LMP applications, but is best addressed in guidance rather than regulations.
- In guidance, NRC should clarify what DID analysis is required when physics or inherent features of a design have already resolved or removed the potential for releases of large amounts of radioactivity

Subpart C, Design and Analysis

Discussion

Part 53 General Layout

- Subpart A, General Provisions
- Subpart B, Technology-Inclusive Safety Objectives
- Subpart C, Design and Analysis
- Subpart D, Siting Requirements
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10 CFR Part 53 Subpart D Layout

- **§ 53.500** – General Siting
- **§ 53.510** – External Hazards
- **§ 53.520** – Site Characteristics
- **§ 53.530** – Population-related Considerations
- **§ 53.540** – Siting Interfaces
- **§ 53.550** – Environmental Considerations

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§ 53.500 – General Siting

- Overall siting considerations
  - Consider site in combination with design features and programmatic controls to satisfy first and second tier safety criteria.
  - Identify and assess external hazards and site characteristics that could contribute to initiation, progression, or consequences of licensing basis events.
  - Address potential adverse impacts on nearby environs as a result of normal operations or potential accidents.

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§ 53.510 – External Hazards

- Structures, systems, and components (SSCs) needed to meet first tier safety criteria must be designed to withstand natural phenomena and man-made hazards.
  - SSCs designed to withstand hazards up to design basis levels.
  - Design basis external hazard levels must address hazards occurring with both routine frequency and up to 1 in 100,000 years, with added margin.
- Geologic and seismic factors must be considered to determine Safe Shutdown Earthquake Ground Motion (SSEGM).
  - SSEGM is level of seismic activity at which SSCs must remain functional.
  - The SSEGM for the site is determined considering the results of the geological, seismological, and engineering characteristics of a site and its environs.

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§ 53.510 – External Hazards (cont.)

- Analyses required by § 53.450 must address external hazard frequencies and related SSC fragilities.
  - Analyses (including beyond design basis events) must assess external hazards in order to meet second tier safety criteria.
  - Functional design criteria and programmatic controls must be established to maintain performance of SSCs relied upon to meet safety criteria.

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§ 53.520 – Site Characteristics

- Meteorological, geological, seismological, topographical, hydrological, and other characteristics of the site and surrounding area that could affect radioactive material escape should be identified, estimated, and considered in the analyses required by Subpart C (Design and Analysis).

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§ 53.530 – Population-related considerations

- Every site must have an exclusion area, low population zone, and provide a population center distance as defined in § 53.120. Offsite radiological consequences estimated by analyses required by § 53.450 are used to define:
  - Exclusion area such that any individual on the boundary for any two hour period following a release would not receive more than 25 rem total effective dose equivalent (TEDE).
  - Low-population zone such that any individual on the boundary following a release would not receive more than 25 rem TEDE.

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§ 53.530 – Population-related considerations (cont.)

- Offsite radiological consequences estimated by analyses required by § 53.450 are used to define:
  - Population center distance that must be at least one and one-third times the distance from the reactor to the outer boundary of the low population zone.
  - Reactor sites should be located away from very densely populated centers. Areas of low population density are, generally, preferred.

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§§ 53.540 & 53.550 – Siting Interfaces and Environmental Considerations

- External hazards and site characteristics must be addressed by design features, programmatic controls, and supporting analyses to demonstrate compliance with first and second tier safety criteria.
- Applicants must demonstrate compliance with environmental protection regulations in accordance with 10 CFR Part 51.

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Key Public Comments on Subpart D Siting Requirements

- Scope of required site characteristics and associated analyses should be first informed by risk/safety profile of the facility, and then the specific site, as necessary.
- Use of site boundary to replace EAB and LPZ
- Performance-based focus of safety criteria obviates need for considering distance to population center (i.e., prescriptive Section 53.530 not necessary)
- Consider higher level requirements to allow flexibility
  - Characteristics of the site that have a significant impact on the ability to meet the safety criteria (examples, e.g., seismology, rather than prescriptive)
  - Locate detailed expectations in guidance (e.g., seismic hazard)

Part 53 Rulemaking

QUESTIONS?

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Acronyms and Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
ALARA	As low as reasonably achievable
ARCAP	Advanced Reactor Content of Applications Project
BDBE	Beyond design-basis event
CFR	Code of Federal Regulations
DBA	Design-basis accident
DID	Defense-in-Depth
DSA	Deterministic Safety Analysis
EAB	Exclusionary Area Boundary
EP	Emergency preparedness
F-C	Frequency – Consequence
FEMA	Federal Emergency Management Agency

FSAR	Final Safety Analysis Report
IAEA	International Atomic Energy Agency
LBE	Licensing Basis Event
LMP	Licensing Modernization Project
LPZ	Low Population Zone
LWR	Light-water Reactor
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
NSRSS	Non-Safety Related but Safety Significant
NSS	Non-Safety Significant
OMB	Office of Management and Budget
ONT	Other New Technologies
PRA	Probabilistic Risk Assessment

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Acronyms and Abbreviations

PSA	Probabilistic Safety Assessment
QA	Quality assurance
QHO	Quantitative health objective
SAR	Safety Analysis Report
SMR	Small Modular Reactor
SR	Safety-related
SSCs	Structures, systems, and components
SSEGM	Safe Shutdown Earthquake Ground Motion
TEDE	Total Effective Dose Equivalent
TS	Technical Specifications